Goulburn-Murray Water Connections Project: Expert Review Panel

To: Ross Plunkett and Chris Solum
Re: Kerang lakes Bypass Investigation Project: Technical Reports

From: Jane Roberts and Terry Hillman (ERP)

Date: 7th October 2014

Thank you for the opportunity to read the six Technical Reports dealing with developments in the Kerang Lakes Bypass Investigation Project (KLBIP). This long letter is intended to provide a clear statement of support by the ERP for this project - its philosophical basis, the methods used and the preliminary outcomes – and a brief outline of the ecological considerations underlying ERP's opinions drawing on its assessment of the six Investigation Reports.

In line with the ERP's role, our opinions are based on the potential ecological outcomes of the KLBIP, particularly the opportunities afforded by decoupling the lakes from the irrigation system. This allows (presumably within engineering and financial constraints) the opportunity to design and provide alternative watering regimes that, other considerations aside, should enhance the ecosystems of the lakes.

1. Overview

Stage 2 of the Goulburn-Murray Water Connections Project seeks to develop changes to the current management of GMW water resources resulting in water-savings that are cost-effective in terms of three criteria:

a. The cost of infrastructure and on-going management versus the value of water recovered,
b. The continued reliable provision of water for human use including consumptive use, recreation, and amenity.
c. Support and enhancement (particularly where further degradation is expected if current management is not changed) of local and regional ecological values associated with the water resource.

In this context, the KLBIP considers five wetlands ("lakes") that are hydrologically connected in series. All five have been part of the Torrumbarry irrigation scheme since the 1920s. Large storages and carriers within an irrigation system generally indicate opportunities for water savings, but in this instance there are particular bounds to criteria ***b*** and ***c***. Not only must the lakes continue their irrigation function of supply, but the water must continue to be of appropriate water quality (freshness) and the lakes must be considered in terms of being part of the Kerang Wetlands Ramsar site, a complex of 23 wetlands, a listing that carries certain obligations.

Complexes require special consideration, as their values, particularly their ecological values, are more than the sum of their parts, so go beyond those of the constituent wetlands. For the Kerang Lakes, its Ramsar values are expressed for the complex of 23 wetlands. Thus whilst management actions generally apply to individual wetlands, their effects or outcomes need to be assessed both at the individual (subject) scale and at the scale of the total complex. In other words, the benefit/cost assessment of criterion ***a*** needs to be positive at the landscape scale.

In general, wetlands that have been entrained into an irrigation system have very different water regimes relative to their regional and/or their undeveloped conditions, and function quite differently from wetlands that have not been entrained. For example, seasonal inversion favours certain types of plants; the lack of a dry phase allows biota such as the introduced fish Common carp *Cyprinus carpi*o and the native Australian emergent macrophyte Cumbungi *Typha spp* to become abundant and usually dominant; the patterns of nutrient cycling and productivity became stabilised and the *boom and bust* pattern that is typical of inland wetlands is lost; woody perennials dependent on periodic flooding such as River Red Gum die under continuous flooding; a different array of wetland habitats is available; and there is a loss of biotic diversity.

These general points broadly apply to the five lakes being considered in the KLBIP. The water levels of these lakes are very stable with minimal fluctuations and no marked seasonal pattern; there is no dry phase, and hence no ecological re-setting; and through being kept surcharged relative to their natural sill level, they have quite a different array of wetland plant habitats. The challenge facing the KLBIP is to identify water regimes that result in water savings that can redress some of the ecological issues whilst not negating the ecological values of Kerang Lakes as a Ramsar site. This is a complex issue, involving questions of scale: short-term and long-term, and local and landscape.

2. Overall approach

The ERP believes that, overall, the two-step approach used in this investigation is a sensible way to tackle these complex questions. This two-step approach is a separation of what is appropriate and feasible for each wetland individually (the five individual reports) from the considerations of the wetlands as part of a Ramsar site (the landscape scale report). The advantage of this two-step approach is that it reveals how some feasibility and ecological considerations are best applied at the site scale and some at the broader scale.

For the five Kerang Lakes, detailed assessment was carried out on a one-by-one basis for five lakes ,viz for First, Middle, and Third Reedy Lakes, Little Lake Charm and Racecourse, that, through constructing by-pass channels and other infrastructure, could have the potential to satisfy the three criteria above. e. A landscape-scale study also evaluated the criteria at the regional scale. All six studies aimed at providing scientific support with which to address the third criterion, criterion ***c*** (see above), and to recommend a future watering regime as a contribution to addressing the other two criteria.

3. Wetlands individually

The Reedy Lake Complex, is composed of three lakes in series. They are of similar area (around 200ha) and originally would have been filled (sequentially) from high flows in the Loddon River. The three lakes are closely connected and producing different water regimes in them would probably require the construction of regulators.

First Reedy Lake is the most upstream of this 3-lake complex and since its incorporation into the Torrumbarry irrigation system in the 1920s has remained a permanent freshwater lake. As such it now supports a thin annulus of emergent plants and is considered to have low vegetation diversity (which, however, includes traces of Tangled Lignum). By-passing First Reedy will result in water savings. It will be possible to provide a variable, though still permanent, water regime which is expected to stimulate plant diversity in the littoral zone, promote growth of submerged vegetation, and enhance shelter and feeding for native fish and colonial waterbirds. Current water levels are above the surrounding groundwater levels but there is a risk of 'moderate' salinity fluxes under the proposed regime.

Apart from possible increases in Common carp densities (already the dominant fish species) there is no indication that the ecosystem of First Reedy Lake will deteriorate further if management remains unchanged.

The Technical Report recommends maintaining First Reedy as a permanently inundated water body with some seasonal pattern introduced. The ERP agrees that such a water regime would enhance the extent and diversity of the vegetation in the littoral area, and thereby improve the range and quality of native fish and waterbird habitat.

Middle Reedy Lake is similar in size and ecological condition to First Reedy Lake , but does have an active ibis rookery, substantial stands of Tangled Lignum and a single sighting of a Murray Hardyhead, consequently its goals and recommended hydrological regimes are similar. It is not clear from the available information if First and Middle Reedy Lakes can be managed as one unit or (as is more likely) infrastructure will be needed to treat them separately. However the recommended watering regime is designed to extend and enhance vegetation communities through more variable depth with resultant benefits to waterbirds and fish.

Third Reedy Lake. Being the furtherest downstream in the Reedy Lakes series, Third Reedy Lake would have been the driest of the three, and is thought to have had an intermittent wetland before the 1920s. The management objective favoured in the Investigation report is to provide a water regime that will return Third Reedy Lake to being a living River Red Gum woodland, as opposed to its current state of Open Water with

dead timber.. The proposal does not seek to reinstate the supposed pre-European water regime of Deep Freshwater Marsh but to provide a water regime that is episodic and is considerably drier than it has been over the last 90 years. This is expected to reverse at least two of the current symptoms of a stable permanent water regime: the development of a live River Red Gum woodland, and conditions unfavourable to building up numbers of Common carp.

A 2-stage watering regime is proposed, first establishing then maintaining a red gum based ecosystem. . The report acknowledges that periods of complete dryness may incur a risk of salinity increase due to groundwater incursion. There are indications that this can be adaptively managed so as to not incur ecological risk or affect downstream consumptive users but more precise scenario-based modelling is needed to quantify this, and the potential for long-term accumulation, clarify this, with a better network of piezometers. .

Unlike the other two Reedy lakes, the recommended water regime for Third Reedy is expected to result in a change in "ecological character". This can be expected to trigger an obligation to notify under the Ramsar convention on the grounds that the wetland is being changed from its registered description at the time of listing through "human-induced alteration" (i.e. exceeds the limits of acceptable change). However, the fact that the change is likely to increase overall diversity, and that it aims to provide a pre-settlement ecosystem (as opposed to a modified or novel one) is thought to make it acceptable.

Little Lake Charm. As with the Reedy Lakes complex, Little Lake Charm forms part of the Torrumbarry Irrigation System and has been a permanent lake with a fairly constant water level for about 90 years. As a result, and like the other lakes, it supports a narrow band of fringing vegetation with a large area of open water and restricted diversity of aquatic plants. However the lake provides habitat for a number of listed bird species and supports the most diverse frog population of all KLBIP wetlands surveyed. The report indicates that the lake ecosystem is stabilised under the current hydrological regime and that further decline in ecological values is not expected. Further, surrounding groundwater levels are high and saline, and represent a threat of significant salinisation during extended dry periods. For these reasons the investigation does not recommend a drying phase but instead recommends a water regime similar to the current hydrology be maintained with (perhaps opportunistic) fluctuations in water level to support vegetation diversity.

The ERP agrees that the risks posed by saline groundwater, and possibly ASS mean that full advantage of bypassing Little Lake Charm cannot be taken at this time and agrees that endorses the minor proposed changes may improve the lake ecosystem's resilience.

Racecourse Lake is a relatively large (239 ha) freshwater lake that receives water from Little Lake Charm and other sources (including Kangaroo Lake) and is integrated into the Torrumbarry Irrigation System. Its current hydrology is similar to that of the other KLBIP lakes and, like them, it supports a narrow fringe of aquatic vegetation. However it supports populations of a number of flora and fauna species listed under international, national, and State legislation, as well as diverse fish and frog communities.

The investigation indicated that, as well as representing significant water savings, a watering regime that included enhanced water level variability with periodic, short, dry periods would encourage aquatic plant diversity and extent and, with extensive drawdown zones, diversity and biomass of fish frogs and birds. Preliminary assessment indicated that by-passing the entire lake would require expensive infrastructure (threatening criterion ***a*** above) and an alternative is proposed, of dividing the lake in two using an existing natural levee, leaving the eastern section operating as part of the irrigation system and applying the recommended watering regime to the by-passed western section. This alternative would significantly reduce by-passing costs whilst still producing water savings and ecological benefits. Details of this option including management of connectivity between the two sections of Racecourse Lake are currently being investigated. However the recommended water regime and associated objectives remain valid either for the whole lake or for one part of it.

The ERP agrees that the proposed water management changes are ecologically sensible, and commends the imaginative work that produced a choice of management options in Racecourse Lake.

Conclusions. All five lakes are in a similar condition, showing parallel responses to some ninety years of permanent and relatively stable water levels. Despite their slightly differing starting points, the lakes share

characteristics such as suppressed extent and diversity amongst plant communities, prevalence of competitive species whether native or exotic, , and substantial areas of open water. The recommended water management regimes differ significantly amongst the lakes, from minimal change (Little Lake Charm), through permanent or near permanent inundation with substantially increased fluctuations (First and Middle Reedy) to regimes that include fluctuations and periods of complete dryness (Third Reedy Lake and Racecourse Lake). These different recommendations to similar sets of (human-induced) hydrological circumstances were driven by differences in the value of potential ecological gains, and threats associated with changing water regimes (e.g. saline groundwater intrusion). The imaginative approach to these technical studies and the 'customised' responses to the ecological conditions surrounding five apparently similar lakes is to be highly commended.

The degree of resolution in investigating the five lakes demonstrates the value of this program undertaken by GMW and indicates that Stage 2 of the Connections Project provides a means of basing benefit/cost evaluations on the best available scientific knowledge. As well as supporting the optimisation of water saving actions the studies on the five KLBIP lakes have provided guidance in avoiding serious risk of failure in the future.

The ecological value of being able to reintroduce fluctuating water regimes in the future is set out in the Technical Reports. There are other benefits. Isolating a lake is an opportunity for future innovations in ecological management, and new knowledge will certainly be gained. Particularly in lakes that experience a dry phase, there will be opportunity to 'engineer' the fish community at the time of refilling. Removal of medium to large fish would substantially benefit frog recruitment in the first years of filling; and significant reduction of Common carp numbers would increase submerged plant establishment and reduce competition for native fish species. These are all additional reasons to support the effort being expended by GMW Connections Project on the KLBIP.

4. *Wetlands in the landscape context* [JR1]

The report on the landscape scale assessment examines three risks that could follow as a result of introducing a drawdown or drying phase: the risk of salinisation as a result of groundwater intrusion; the risk of acidification resulting from exposure of acid sulphate soils; and the likelihood of exceeding the presumed natural range of conditions, called Limits of Acceptable Change (LAC) as quantified in the ECD report (KBR 2011). The implementation is systematic, and done at the local (or site) scale: all five wetlands in the KLBIP are evaluated, even though drawdowns are proposed for only Third Reedy and Racecourse Lakes. For these two, the salinity risks are deemed to be low, and low to moderate, respectively (Table E1); the risk of ASS could not be resolved for either lake without additional sampling (Table E1); and although the proposed water regime exceeds the LAC for hydrology, this is not considered detrimental overall, as the introduction of a dry phase is expected to increase the productivity of Third Reedy Lake and increase habitat for migratory birds at Racecourse Lake.

These three risks are indeed important, and address some serious questions. The issue of potential salinisation is central to criterion ***b***; ASS at their extreme have resulted in near-sterile conditions in wetlands along the Murray; and LAC if triggered would require a bureaucratic response.

5. *Additional Points*

Although the ERP agrees with the findings of this risk-based landscape appraisal, and believes this has been done responsibly, it feels strongly that it is equally important to present the ecological gains. As outlined in the Overview, periodic drawdowns should result in productivity pulses and types of within-wetland diversity likely to suit an array of waterbirds other than those suited to permanent water regime, and without penalising them.

The ERP considers that changing the water regime to include drawdowns as at Third Reedy lakes is an unparalleled ecological opportunity for this wetland complex, for two reasons. First, there is the chance to have a wetland where the negative effects of Common carp dominance can be ameliorated, and serve as a public and high profile demonstration site, possibly becoming a special feature of the Kerang Lakes. Second,

this should add considerably to the diversity of the wetland complex at the landscape-scale, by providing environmental conditions that are currently under-represented.

The Kerang wetlands are renowned for the waterbirds, abundance and richness, and this was the principal motive driving the original 1982 nomination. Since then, the Ramsar criteria have been somewhat broadened, to encompass other aspects of aquatic biodiversity. The projects commissioned in support of the KLBIP have taken this broader view of wetland ecology, and the ERP was particularly pleased to see frogs and turtles included, and wetland vegetation mapping brought up to date. The value of doing this is evident in Table 1 of the Landscape Report, which gives specific details for these five wetlands which were previously reported across the whole wetland complex.

6. Further Investigations

Further to our point above (Overview) about the special characteristics of complexes, the ERP considers that certain aspects of the landscape-scale ecological effects of changing the water regimes, and of changing ecological character remain outstanding.

An appraisal at the whole-of-Kerang Lakes complex scale needs to be done, if the Business Case proceeds. This should focus on spatial (and temporal) characteristics of this 23-wetland complex and its principal sub-catchments in terms that are relevant to wetland biota, by considering passive dispersal, movements, availability of resource patches, refuges. For reasons given above (under 3: Wetlands individually), the ERP does not anticipate that such an appraisal would be negative, but it needs to be done for completeness, and in recognition of obligations.

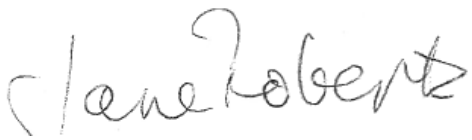
7. Concluding Remarks

The assessments provided in the Technical Reports at individual-lake and landscape scale demonstrate a high-level use of scientific information and ecological appreciation in developing potential management strategies that simultaneously result in water-savings and substantial ecological benefits in a highly modified wetland complex. They also deal with external risks and their amelioration. It is expected that this use of applied ecology in managing natural resources as part of the Connections Project will be of significant benefit to the regional ecosystem. as well as avoiding or at least significantly reducing the unintended disbenefits that have often attended resource management of this scale in the past.

The ERP considers that these five Environmental Watering Investigations are fit-for-purpose. They have lead to informed benefit/cost assessment in the Business Case, and can be a solid platform for developing sound Environmental Watering Plans in the future. The process of incorporating applied ecology in assessment of future management actions as developed within the KLBIP is a blueprint for similar work in the Connections Project and indeed elsewhere. It also provides a foundation for further refinement in the future, including the incorporation of new ecological knowledge.

The ERP is pleased to have had the opportunity to comment on this substantial and important work. This is a significant contribution to the KLBIP, and to the effective operation of the modernised irrigation for which the GCP has responsibility.

Yours sincerely,



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