Impacts of Rural Drainage on Nature Conservation Values -Cost-effectiveness of the Environmental Impact Assessment

Process for Evaluating Drainage Proposals.

Project for Department of Conservation and Land Management

RFQ 46510/99

Prepared by

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Introduction

Project Background

This document is a component of a broader study commissioned by CALM to develop an evaluation method for assessing the impact of rural drainage on the nature conservation values of downstream wetlands. The project involved a revision of evaluation criteria produced by *actis* Environmental and Regeneration Technology (1998), a revision of draft guidelines for drainage proponents produced by Regeneration Technology Pty Ltd (1998), and a case study using the Nyabing drainage proposal.

Results of these components are contained in the following separate documents:

1. Coleman, M and Meney, K (2000). Impact of Rural Drainage on Nature Conservation Values - Proposed Evaluation Guidelines. Report to Department of Conservation and Land Management. *actis* Environmental and Regeneration Technology.;
2. Coleman, M and Meney, K (2000). Impacts of Rural Drainage on Nature Conservation Values - Nyabing Case Study: 1. Self-Assessment. Report to Department of Conservation and Land Management. *actis* Environmental and Regeneration Technology.
3. Coleman, M and Meney, K (2000). Impacts of Rural Drainage on Nature Conservation Values - Nyabing Case Study: 2. Technical Assessment. Report to Department of Conservation and Land Management. *actis* Environmental and Regeneration Technology.

Scope

The third component of the study, presented in this document, addresses the cost-effectiveness and practicality of using environmental impact assessment as a mechanism for assessing drainage proposals. This work expands on a literature search previously produced by Regeneration Technology Pty Ltd (1999), which examined the use of environmental impact assessment and the use of tradeable quotas or cross-compliance in drainage management.

In addition, this document presents comments arising from all components of the project arising from:

a) Consultation with relevant research personnel from a range of organisations to establish salt and nutrient tolerances for native fauna, particularly invertebrates and waterbirds.

b) Consultation with representatives of Agriculture Western Australia (AGWEST), Department of Conservation and Land Management (CALM), Department of Environmental Protection (DEP), and Water and Rivers Commission (WRC) regarding guidelines for drainage planners;

c) Consultation with the landholders and drainage contractors in re-working the current Nyabing Drainage Proposal including costs of the work, problems encountered and recommendations for future use of the guidelines;

Evaluation Impact Assessment

Cost Effectiveness – Self Assessment Process

The Self-Assessment guidelines are intended to be a rapid assessment process based on limited available data that provides a rough quantitative assessment of the changes likely to be caused by any given drainage project. It is not intended to be a formal EIA process, although it could be used in this manner with collation of sufficient data. The use of the process as intended is to 'flag the issues' to those intending to drain, those making decisions about drainage approval, and those interested in monitoring the scale of drainage.

The integrity of the numbers generated for salt load, hydroperiod change etc. will directly reflect the accuracy or otherwise of the data set. The cost of completing a Self-Assessment will in turn be determined by the available data set.

We think that the cost of completing a Self-Assessment is within the vicinity of costs currently being expended by drainage proponents to complete the current NOI requirements.

An advantage of the Self-Assessment process is that it focuses the discussion on the important issues related to any given drainage project. For example, in most cases drainage is unlikely to affect hydroperiod, but possibly will affect salt load; on the other hand, groundwater-pumping schemes are likely to cause significant changes to hydroperiod.

If a proponent exceeds 'acceptable limits' for a given parameter, it may not be necessary to proceed to a comprehensive technical study. It may be sufficient to examine a single parameter in more detail to provide more realistic data, or to evaluate the proposal in terms of tradable quotas.

Table 1 Cost of Self-Assessment

Section	Task	**Cost**
A. GUIDELINES FOR PROPONENTS	1. Area of subcatchment to be drained (ha)	
Consultation with Proponents	2. Area of subcatchment under proponents control (ha)	1000
STEP 1: Drainage System Checklist (tasks 1-6)	3. Type of drains	2300
2 days @ $50/hr[1] (including design drawings)	4. Length of drains in clay, loam and sand	
Cartography	5. Estimated time of construction (yrs)	
	6. Estimated drain discharge (L/sec)	
STEP 2: Receiving Wetlands Checklist (tasks 7-13)	7. Primary receiving wetland name & type (basin, channel, flat)	400
1 day @ $50/hr	8. Width, depth & slope or fall of primary receiving wetland at discharge point	
	9. Catchment size above point of discharge	
	10. Final receiving wetland name & type (basin, channel, flat)	
	11. Subcatchment name & size (ha)	
	12. Width, length, depth, area, volume of final receiving wetland when full	
	13. Turn-over factor	
STEP 3: Conservation Risk Assessment		150
3 hrs @ $50/hr		
STEP 4: Project Details		200
4 hrs @ $50/hr		
TOTAL COST: GUIDELINES FOR PROPONENTS		**$4050**

B. SELF-EVALUATION WORKSHEET		
1. Vegetation Condition		**600**
1 day field assessment @ $400/day Travel ~ $200		
2. Spreadsheet		
STEP 1: General Information (repeat tasks 1-6)		**4700**
2 hrs @ $50/hr		
STEP 2: Receiving Wetland (repeat tasks 7-13, plus tasks 14-20	Average monthly rainfall for a year	
Data collation (includes accessing climate data from Bureau of Meteorology).	Average daily evaporation	
Field sampling of groundwater & wetland, 3 visits, 2 days each @ $400/day	Expected salt concentration of drain water	
Analysis of samples	Pre-drainage salt concentration of receiving wetlands	
Travel/accommodation expenses	Ionic composition & pH of groundwater in area to be drained	
3. Report preparation & submission	Ionic composition & pH of receiving wetland	**200**
	For open drain systems, average concentrations of nitrogen & phosphorus in drain water and receiving wetland.	
TOTAL COST: SELF-EVALUATION WORKSHEET		**$5500**
TOTAL COST		**$9550**

[1]Based on nominal rate for a drainage contractor; technical consultants rates would average $90-120/hr.

Cost Effectiveness – Technical Assessment

Basic Technical Review

This is an example of a typical scope given by a consulting company to evaluate the discharge of saline water into a natural wetland.

The outcomes would include the following:

- Mass balance model of dewatering discharge into the receiving wetland, including seasonal changes. Predicted changes to the natural wetting and drying cycles.
- Estimated ionic composition of brine in evaporative basins over several time spans and scenarios.
- Species lists of the wetland flora near the discharge site and drainage line.
- Vegetation map of discharge area and site description.
- Estimate of environmental impact due to discharge.
- Evaluation of expected changes to the receiving wetland due to the discharge.
- Recommendations for future work by the client to minimise changes due to the discharge.
- Survey of drainage systems for significant flora.
- Initial estimation of the hydrological significance of proposed discharge drain.

The cost for the work described above is:

Table 2 Cost of Basic Technical Review

Task	**Cost**
Cost of Self Assessment	9550
Field Work Consultant	10400
Accommodation/Transport	1500
Brine sample analysis (5)	850
Consultation	500
Laboratory work	800
Report writing	5000
Cartographical analysis of sub catchments	**1200**
Total	**$26,600**

The above outline (Table 2) would cover information required for a basic technical review of the impact of the discharge to the wetland. Most of the work would be desktop reviews with a minor component of field studies. It is anticipated that saline wetlands and associated wetlands with higher conservation values would require a more detailed analysis of the alternatives. The hydrological study would be superficial and rely heavily on existing records or related studies.

Advanced Hydrological Assessment

If the discharge is into a high conservation wetland, or the hydrological nature of the wetland is sensitive, or no data is available for a wetland, then the following data set would also be needed.

1. Maximum water depth in all receiving wetlands and the final receiving wetland, at monthly intervals for a year in which the total is within 40 and 60-percentile values for the area, and the rainfall distribution is not abnormal.
2. The relationship between water area and depth for the final receiving wetland (measure area at the same time as monthly measurements of maximum water depth).
3. The water level in piezometers positioned across the final receiving wetland, constructed to indicate the head of water in the shallowest aquifer beneath the (relatively impermeable) bed of the wetland. (This level must be measured relative to the same datum as the depth of water in the lake).
4. Over a period of a year take monthly measurements of discharge from each drain and inflow to any receiving wetland, and salinity of the flows.

It has been estimated that the cost of such a study would be in the region of twenty thousand dollars depending on the location in addition to the basic technical review cost.

Table 3 Cost of Advanced Hydrological Assessment (no data)

Task	**Cost**
Cost of Self Assessment	9550
Basic Technical Review	17050
Additional Hydrological Survey	20000
Total	**$46,600**

Advanced Biological Assessment

A biological assessment may be required in detail for any wetland with high, or potentially high, conservation value. However, it should be noted that such an assessment will have limited value until there is a better understanding of the tolerance thresholds for individual species with which to compare a given data set. At this stage, a biological assessment will not be able to gauge the impact of increased salinity, or hydroperiod change, or change to any other parameter on the fauna and flora assemblages. In the absence of this critical baseline data, we consider a biological assessment of this nature to be of little value in determining the impacts of drainage on wetlands.

The cost of detailed biological assessments can be very high where there is no baseline data for a given wetland. To be meaningful, such surveys will need to be undertaken monthly for a minimum of one year, but realistically for at least a three-year period to understand biological response to seasonal and annual variation in environmental parameters. This implies measurement of environmental parameters as well as biological parameters. An advanced assessment should include the following:

1. Monthly sampling of physical parameters (water depth, salinity, temperature, chemistry)
2. Seasonal sampling of invertebrate fauna (richness, abundance)
3. Seasonal sampling of aquatic flora (richness, abundance)
4. Seasonal sampling of waterbirds

This type of survey is currently being undertaken by CALM for key wheatbelt wetlands. An average cost for a single wetland is likely to be in the range of $50-60,000 for one year of sampling. Costs will be less if field-based personnel conduct monthly water sampling.

Table 3 Cost of Advanced Biological Assessment (no data)

Task	Cost
Task	**Cost**
Field surveys/12 per year	20,000
Sorting/Identifications	15,000
Data analysis	20000
Total per year	**$55,000**

Comprehensive Environmental Impact Assessment

An EIA that addresses most of the important wetland functions and values would cost in the region of $100,000 to complete. This would vary depending on the existing information base for any given wetland, and the level of degradation of a wetland. As stated previously, we consider a comprehensive EIA to be appropriate only for priority wetlands, which are currently being identified for the wheatbelt region.

Development of Evaluation Guidelines

In practice it was found that discussions on the evaluation criteria were inseparable from the draft guidelines, and it was expedient to combine both the discussions on the subjects as well as the reports. The original guidelines were more a checklist of requirements. By combining the evaluation criteria with the original guidelines, the document now allows the proponents to evaluate their own project and modify it to conform to environmental expectations.

The drainage evaluation criteria as developed by Coleman and Meney (1998) was discussed with a number of relevant stakeholders and interested parties, these included:

Ken Wallace CALM

Bruce Bone CALM

Stuart Halse CALM

Brenton Knott UWA

Jan-Paul Van Moort AgWest

Viv Read Waters and Rivers

Luke Pen Waters and Rivers

Charlie Nicholson DEP

Kevin Lyons Drainage contractor

Nyabing Drainage Project group

Prof. Bill Williams Uni. of Adelaide

VCS Research Group

Richard George

Comments were solicited from a salt lake forum on the Internet and as a result several interstate land managers asked for copies of the original criteria. A literature search was completed on the topic. The issues that were raised from the meetings can be grouped into the following headings.

Consideration of biological functions.

There was a real concern that there was not enough biological emphasis in the original criteria. The authors addressed this by reviewing the published knowledge base on salinity and hydroperiod ranges of Australian flora and fauna. As a result of specific queries several articles from the eastern section of Australia were uncovered. The unpublished knowledge base is a lot larger with several people stating that they are in the process of compiling information for publication, but the information is not yet available. A study (Aus Rivers) of 180 sites to test for salinity tolerances at family level did not show that there was a drastic impact (Stuart Halse pers. com.). This does not imply there has been no impact but rather species identification to family level is an insensitive tool to distinguish salt intolerance. The wetland biodiversity-monitoring program underway by CALM is examining 220 wheatbelt wetlands. This program is still in its early stages, but initial work has shown wide variation in wetland types and salinity ranges, with many still classified as fresh (S. Halse, pers. com.). Preliminary salinity thresholds for avifauna and invertebrates appear at 10-20 ppt and about 60 ppt (S. Halse, pers. com.). This correlates reasonably well with the boundary between hyposaline (3-20 ppt) and mesosaline (20-50ppt), and mesosaline and polysaline (50-100ppt) wetlands under Hammer's salinity classification scheme (Hammer 1986).

Halse and Williams both stated verbally that the most obvious sign of increasing salinity in a wetland was a tendency for the fauna species to become more cosmopolitan. That is, ecological changes were a better indicator than species. However ecological changes are more difficult to determine and could only really be determined by a specialist. The main value of a biological assessment would be for a very coarse split of wetlands that have been impacted by increasing salinity.

A more complete biological understanding of wheatbelt wetlands is likely to confirm the following patterns:

1. wetlands operate within, and depend on, their natural fluctuating salinity range. That is, many biota require the lower end of the salinity range to germinate and breed. A change in the distribution of high and low salinity levels is likely to be reflected in a shift in species composition. Therefore, both the upper critical thresholds, and the lower critical thresholds, need to be understood on a temporal basis.
2. wetlands operate within, and depend on, their natural fluctuating hydroperiod range.
3. the natural diversity values of secondary saline wetlands is likely to vary from wetland to wetland, depending on other variables such as hydroperiod change, surrounding habitat and original salinity status. In many cases, the loss of fauna will reflect degradation of vegetation assemblages, both within and surrounding the wetland.

On-farm issues relating to drainage.

These issues are for example; farm catchment planning, cost effectiveness of drainage, and alternative options to drainage. During the process of researching this report, it soon became obvious that there is an entire suite of issues on-farm that is often caught up in the discussion on the effectiveness of drainage. These issues are largely outside of the scope of this report. This is not to say that they are not critical in any discussion as to whether to drain or not, but this level of discussion should have taken place well before the decision to drain has been made. The type of drain and placement within the farm catchment has a large effect on the runoff composition and quantity of water. It will become apparent that if the on-farm work has not been completed and there is not reasonable expertise in designing the drains, then the completed Guidelines will be superficial and incomplete. The Guidelines are also designed to lead proponents to an understanding of catchment issues.

Monitoring/Post Drain Management

Monitoring and post drain management is a relevant issue that needs to be addressed by the land managers. One difficulty in designing the guidelines was objectively predicting the performance of the drain over time.

The problem lies in the fact that farmers often do not have the same interest in monitoring *and* reporting drain performance as government agencies. Saline water moving off the farm and the recovery of arable land is seen as a ‘success’ by many farmers who place more importance on subjective outcomes that would not be used in a cost/benefit analysis. Many farmers correctly state that they have been monitoring their environment for many years. The real issue is that there is no obvious organisation that can collect, collate and validate the data to provide the information needed to manage catchments. The LCDC's may have this role in the future but in many catchments they do not have widespread acceptance, and it is difficult to see how a volunteer organisation can fill a legal administrative role.

Desilting Creeks

The desilting of creeks is often incorporated into drainage proposals. Most creeks in the wheatbelt have been radically changed due to catchment modifications such as clearing, road and rail bridges, and contouring. The structure of creeks now reflects the changed flooding regime with large amounts of accumulated sediment raising the creek bed level. In order for most farm drains to discharge, the level of the creek bed needs to be lowered. This is often more topical than the actual farm drains. Creek desilting should not be considered the same as drainage and has not been dealt with in these guidelines. Guidelines for creek desilting need to be formulated by the relevant land managers or the level of discussion on drainage projects will always be topical. The current criterion that allows removal of silt to the original bed level is problematic because the 'original' bed level is usually difficult to define. Moreover, creek desilting does not address protection of the natural functions of the creek nor the changed water regime.

Catchment priority/Natural wetlands

There was a recurring theme that all catchments should not be treated the same, based on the belief that some catchments are already degrading and others are stable or in a better 'condition'. The logic goes that a wetland that has degraded or is determined to be degrading, does not need the same protection as one in good health. It is a complicated philosophical point that is apt to become controversial. It could easily be argued that a stressed wetland needs more protection than a wetland that is not.

The line that these Guidelines take is that the drain discharge is a set proportion of the existing sub catchment's load. This additional load is minor to the existing 'natural' fluxes. This means that if the subcatchment has an existing large salt load then the drain quota for that subcatchment is larger than for a subcatchment with a low salt load.

Do nothing option

The argument was often made that if nothing was done to improve the saline scalds; the salt load would continue to increase in the wetland. The logic is that the wetlands would continue to deteriorate with or without drains; therefore whatever damage the drain water did to the wetlands was insignificant in respect to rising groundwater. A subtle form of the same argument was that without the drain there would be a salt load from the scald that would otherwise be drained.

It was recognised that part of the salt load from a drain would have contributed to the salt load of the receiving wetland even if the drain was not in place. The guidelines allow for the calculation of salt exported from drained areas that would have ended up in the receiving wetland in any case. This calculation will benefit from further studies. An estimate was made of the salt exported from a salt scald using estimated salt loads in the creek versus salt scald area, and subjective estimates of salt on the surface per unit area of salt scald. This salt export from a scald was used to reduce the effective export of salt from a drain.

Ease of use

The difficulty of using the criteria was raised several times and it was obvious that several people who having read the methodology did not understand how to complete the form. This was addressed by incorporating a spreadsheet as part of the process. The spreadsheet requests certain data and calculates the answer to the guidelines. Rudimentary error checking is included in the spreadsheet logic. The spreadsheet would benefit from field validation by farming groups.

Nyabing Creek Catchment Group

A meeting was held with Nyabing Drainage Project proponents and a summary of the main points is provided below.

- There was agreement from the participants at the meeting that Mark Coleman and Kathy Meney could use the Nyabing Drain Proposal for evaluation purposes.
- There are a number of frustrations with the existing method.
    a. Lack of definition of impacts
    b. Definition of area of impact lacking
    c. Conflicting and repetitive requests for information.
- A clear distinction between draining of salt affected land and creek desilting is needed in submissions.
- Evaluation criteria deals with how the drain water affects the following factors in the receiving wetland:
    a. Water balance
    b. Salt load
    c. Salt concentration

d. Nutrient concentration

- Wetlands fall into two types: (i) a receiving wetland and (ii) a terminal wetland.
- The terminal wetland is defined independent of expected drain discharge distance or administrative boundary.
- The type of drain is an important consideration in above factors.
- Agreed that closed drain does not mean large flows of water.
- Reasons for putting in drain is return of arable land, improve land value and farmers perception of land.
- It was challenged that drains have been shown to have a detrimental effect on downstream wetland.
- The do nothing option may have a greater effect on downstream wetland.
- There is a need for the movement of salt in do nothing scenario.
- Questions were raised as to: (i) who is going to monitor projects?, (ii) what is a successful drain?, (iii) how does the scheme balance the changing number of drain projects against the perceived ability of the downstream wetland to tolerate discharges?
- Tradable quotas in their traditional form were discounted as a method of allocating the load of drain water into a wetland.

The Guidelines were modified after considering all comments. The Guidelines should not however be seen as reflecting the views of the people who offered their comments, even though their contribution is gratefully acknowledged. The Guidelines is one document with a number of supporting appendices and a spreadsheet for ease of calculations. The Guidelines incorporates the draft Evaluation Criteria as proposed by Coleman and Meney (1998) and revised draft requirements for drainage planners and proponents.

Currently this proposed drainage guidelines has no official status, but the expectation is that drainage proponents would use the guidelines to self evaluate their own proposals. The completed document would then form the official notice of intent that would be reviewed by the relevant authorities. It is expected that the self-evaluation would filter out the proposals that will not be significant. Proposals that need a technical evaluation would need a more detailed notice of intent but would follow the same format.

Attached to this report is the Evaluation Guidelines form that includes a Microsoft Excel spreadsheet to aid calculation. It is recommended that the spreadsheet be used as it has some error checking and is a rapid method.

References

actis Environmental and Regeneration Technology 1998; Evaluation Criteria for Assessment of Wetlands Receiving (Saline) Drainage, Unpublished report prepared for the Department of Environmental Protection.

Regeneration Technology Pty Ltd, 1998; Proponents Requirements – Notification of Intent to Drain and/or Pump, Unpublished report prepared for Department of Conservation and Land Management.

Hammer, U.T., 1986; *Saline Lake Ecosystems of the World*; Dr. W Junk Publishers.