Mt Marshall Land Conservation District Committee

Beacon River Catchment Salinity Management Project - Feasibility Study

Report On

Risk Assessment Workshop

April 2001

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SYNOPOSIS

THE NEED FOR THE STUDY

Since its inception in 1984 the Mt Marshall Land Conservation District Committee (LCDC) has investigated and implemented various tree planting and surface water management programmes in an attempt to control rising groundwater tables and encroaching dryland salinity in the Beacon River catchment (BRC). In 1998 current president, John Dunne decided that 'deep drainage' and pumping would be required to lower the groundwater on his farm in the Beacon River valley 6.5 km's upstream of Job's Lake. Mr Dunne envisaged that Job's Lake could serve as a natural evaporation lake for disposal of saline groundwater.

In March 1999 cyclones Elaine and Vance dumped between 200mm and 375mm throughout the BRC over a period of 5 days. The resulting floodwaters inundated large areas of remnant vegetation and land that had previously been revegetated in an attempt to control salinity. Water levels in Job's Lake rose to around 4.5 metres in response to an inflow of about 7 million m^3 of floodwater.

For the 12 months to February 2001 farmers in the BRC recorded as much as 1000mm of rainfall, which is 3-4 times the long term annual average for the catchment of between 300-330 mm. At this stage Mr Dunne started investigating the option of draining Job's Lake, given the continual problems with water-logging, flooding and ever encroaching salinity. Mr Dunne approached GHD in August 2000 with a request for assistance to prepare a submission to WA's State Salinity Council for a whole-of catchment approach to lower the groundwater levels. An initial estimate for a scheme was about $1.4 million. The State Salinity Council offered the LCDC $100,000 to fund a Feasibility Study of the "drainage" component of the scheme.

The Beacon River catchment is located along the north eastern fringe of Western Australia's Wheatbelt. Clearing of native vegetation, which started in the 1920's, together with periodic flooding by cyclonic activity during summer, has resulted in rising groundwater tables, reductions in available surface water storages and salinisation of some of the best agricultural land along the main drainage or floodway through the catchment.

The main drainage route along which most of the salt affected or salt threatened (SAST) sites are located is approximately 120 kilometres long and typically 2-8 kilometres wide. SAST sites are already evident along 90 kilometres of main drainage route.

GHD's study outcomes indicate that intervention and management of current and potential future SAST sites is required within the next 1-5 years to:

- Prevent the loss of upwards of $35 million/annum of agriculturally derived income.
- Preserve the investment of more than $4 million in farming infrastructure.
- Protect about 45,000 ha of good quality agricultural land.
- Protect about 2,670 ha of surviving remnant vegetation.
- Maintain the commercial viability of the towns of Beacon and Bencubbin.
- Protect the long term livelihood of about 18 families living within the catchment.
- Prevent land degradation and the resultant depopulation of the catchment.
- Prevent declines of essential services and the social fabric of the area.
- Prevent declines in fauna/flora habitats, populations and species diversity.

GHD'S PART OF THE STUDY

Submission

GHD's part in the submission phase was to determine precisely what investigations were essential to a Feasibility Study and what could reasonably be expected to be completed within a $100,000 budget limit. No funding was available for this part of the exercise.

Appointment

Through the Mt Marshall LCDC, the Feasibility Study was funded by a $100,000 grant from WA's State Salinity Council, with a further $25,000 invested by the Grains Research and Development Corporation (GRDC) for installation of groundwater monitoring piezometers, monitoring during the project, survey of the piezometers and information management.

The project was managed by the Mt Marshall LCDC overseen by a 'Reference Group', which consisted of representatives of the Department of Agriculture, Water and Rivers Commission, CSIRO, Department of Conservation and Land Management (CALM), the Avon Catchment Council, Mt Marshall Shire Council, State Salinity Council, GHD Pty Ltd and five farmers representing landholders in specific sections along the catchment.

Scope Of Work

Aspects of the study covered by GHD at various levels of detail include:

- Community consultation.
- Study risk analysis and risk management.
- Catchment flood hydrology.
- Catchment hydrogeology.
- Engineering scheme options.
- Non-engineering options.
- Impacts on conservation values.
- Scheme cost-benefit analyses.

Studies Undertaken

Field programs to install shallow monitoring piezometers and soil test pits along the main drainage route of the BRC commenced in December 2000, assisted by the Department of Agriculture. Following this a community consultation workshop, conducted on the 23 February 2001 culminated in a Risk Management Workshop held in Northam on the 15 March 2001, and subsequent preparation of a Risk Management Plan. The plan was developed to guide investigations into potential options for controlling and limiting the spread of dryland salinity in the catchment. The study considered engineering and land and water management options, within a framework of social, environmental and economic opportunities and constraints.

During the remainder of 2001 various technical studies were undertaken. These covered aspects such as catchment flood hydrology, catchment hydrogeology, the assessment of the potential for salinity to impact on conservation land values, as well as proposed engineering and non-engineering scheme options, conceptual designs and cost-benefit analyses. The feasibility of the proposed schemes were carefully assessed against the available technical, economic, environmental, social and political information made available through the various project investigations and studies.

Investigations into suitability and cost-effectiveness of adopting non-engineering intervention schemes to control rising groundwater tables included agroforestry, non-commercial tree planting, farming with perennials using various crop rotations, saltland pastures and aquaculture. The studies concluded that available research does not provide sufficient evidence to warrant broad scale adoption of these options, at this stage. The main constraints are the relatively long lead-in times (1-10years), financial risks and uncertainties of the effectiveness of these options to make them attractive.

Investigations of engineering options included phased implementations of a central catchment drain combined with abstraction bores, with options for disposal at salt-lake sites both inside (Job's, Askew's and McDermott lakes) and outside the catchment (Lake Moore, Mollerin Lake and Lake Wallambin).

Cost-benefit ratios and payback return periods for five different engineering schemes were shown to be sensitive to the agricultural operative profits figure ($50-$124.50 per ha) applied to the financial models. Except for one of the schemes the cost for implementation of the schemes varied from about $10-$14.5 million, resulting in derived benefits of between $14.25-$18.25 million, calculated to the nearest quarter million dollars. Net cashflows, were calculated to be between $2.75-$4.25 million. The payback periods for engineering works could be reduced from about 30-35 years for most of the schemes to about 20-25 years with higher operating profits.

GHD's study outcomes clearly demonstrate the feasibility of implementing engineering interventions to control and manage dryland salinity in the catchment within the timeframes (1-5 years) considered available for implementations to be successful. Delays in implementation would result in ever increasing declines in the 'rates of return' and therefore the economic feasibility of investments into management of dryland salinity in the catchment.

GHD's study outcomes further indicate that, if left too long, interventions, irrespective of whether they would comprise stand alone engineering schemes or integrated schemes comprising combinations of engineering and non-engineering options, would simply no longer be economically feasible. This would make the case of 'investment' by government or private organisations and farmers less attractive and accordingly, highly unlikely.

Recommendations

Given the potential feasibility of engineering schemes and the urgency for immediate interventions to prevent the Beacon River catchment from sliding into a situation of continuous and near-irreversible social, economic and environmental decline, GHD recommends that a pilot engineering scheme be implemented at one of several already heavily impacted sites. Trialling should include an integrated scheme, combining both a central catchment drain, abstraction bores and disposal at one of the larger salt-lake complexes.

To-date large scale trialling of engineering interventions have not been successfully completed in Western Australia. The outcomes from trialling engineering interventions in the Beacon River catchment could therefore potentially have far-reaching implications in the race to find socially, politically, economically and environmentally acceptable solutions to the salinity problem.

Piloting a predominantly engineering-based solution to the salinity problems in the Beacon River catchment could provide opportunities to further both the practical and scientific investigations of the performance, management, maintenance and sustainability of catchment-wide drainage schemes, together with the social, economic and political dynamics associated with implementation, derived benefits, ownership and the mutual co-operation between government and private organisations in dealing with the salinity problems.

Reports

The reports produced during the course of the study underwent several sets of revisions as new information became available, or as feedback was received from the study Reference Group members. A list of report references is given below, including the dates for the initial versions of the reports, as a guide to the chronological order in which the studies were completed.

1. Risk Assessment Workshop (GHD document number 6110745, dated April 2001).
2. Flood Estimation in the Beacon River Catchment (GHD document number 27049, dated July 2001).
3. Phase I Groundwater Modelling Assessment of the Beacon River Catchment (GHD document number 29000, dated July 2001).
4. Groundwater Analyses Undertaken In Support Of The Cost-Benefit Analysis (GHD document 2940, dated November 2001).
5. Engineering Options (GHD document number 30370, dated November 2001).
6. Environmental Assessment of Vegetation (GHD document number 31139, dated October 2001).
7. Cost-Benefit Analysis (GHD document number 31128, dated December 2001).
8. Feasibility Summary (GHD document number 31137, dated December 2001).

Electronic Copies Of GHD's Reports

Hard copies of GHD's reports will not generally be made available due to the relatively high cost of reproduction of the reports. Electronic copies of the reports can however be downloaded from GHD's website (www.ghd.com.au/beacon). Registration may be required for downloading. Copies will also be made available through the Mt Marshall LCDC website (www.beaconriver.com).

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Numerous individuals, from government agencies and private organizations, directly or indirectly involved with the project, provided valuable support and feedback for the project. Their contributions through attendance at the community consultation and risk management workshops, project meetings, Reference Group meetings, or through their telephonic, email and facsimile communications with project staff is much appreciated. It is much to our regret that we cannot list all the people who had a 'part' in the project.

Members of the Reference Group setup by the Mt Marshall LCDC for the study are:

Mt Marshall LCDC	John Dunne, Chairman Reference Group and President Mt Marshall LCDC
State Salinity Council	Rod Safstrom MSc BSc
Avon Catchment Council	Barbara Morrell Chairperson Avon Catchment Council
Dept of Agriculture	Dr Richard George Ned Crossley, Allan Johns, Brian Beetson, Rosemary Nott
Water & Rivers Commission	Mohammed Bari, John Ruprecht, Martin Revell
CALM	Paul Roberts, Mike Fitzgerald
CSIRO	Tom Hatton, Riasat Ali
Mt Marshall Shire Council	Ian Landsmeer, Shire President
GHD Pty Ltd	Ian Weaver, Robey Chipps
Farmer	Chris Kirby, Secretary Mt Marshall LCDC
Farmer	Helen Shemeld, Vice-Pres MMLCDC
Farmer	Tony Sachse
Farmer	Ian Evans

1. Introduction

This report was prepared by GHD Pty Ltd on the Risk Evaluation of the Beacon River Catchment Salinity Management Feasibility (Feasibility) study. The report was prepared to document the outcomes of the facilitated Risk Management Workshop conducted on 15th March 2001 at Northam. The workshop was attended by representatives from the local community, local Government, Department of Agriculture and other relevant State Government Departments.

1.1 Aim

The purpose of the risk management workshop was to identify the risks affecting the outcomes of the project, to assess the impacts of those risks and to develop a prioritised strategy for managing risk for the community's benefit. The outcomes of the risk management workshop and the management and action plans to be taken to monitor for and to deal with any adverse events that may arise during the course of the project are documented in this report and summarised in Appendix A.

1.2 Background

Farming land within the Beacon River Catchment is being threatened by rising water tables and salinity. An application by the Mount Marshall Land Conservation District Committee (LCDC) to the State Salinity Council WA for funding was approved to proceed with a feasibility study. The study is to investigate the viability of the proposed salinity management project. The project proposes a range of actions, including:

- Reducing the rate of degradation of productive agricultural land;
- Rehabilitation or management of salt affected land;
- Protection and restoration of key water resources of the catchment;
- Protection of natural vegetation and higher value wetlands of the catchment;
- Provision of the means for the community to manage salinity; and
- Protection of public and private infrastructure affected by salinity.

The Feasibility study is required to determine the existing status of the Beacon River Catchment and investigate and evaluate a broad range of management techniques including the "do nothing" approach. The Study considers the broad technical, environmental, economic and social values and outcomes of the methods considered.

While the study considers a wide range of potential options for managing salinity, the engineering solutions may include shallow and deep drainage, pumped bores, and conveyance of saline water to discharge, storage and evaporation areas.

The initial phase of the Feasibility study was to determine the hydrology and hydrogeology of the catchment and to foster community participation. The community consultation and risk management workshops were elements of the latter.

2. Community Consultation Workshop

2.1 Community Participation

Community involvement in the Feasibility study is vital to the success of any salinity management strategy. Participation was facilitated through the Mount Marshall LCDC and included two workshops designed to involve the community in the development of the strategy.

The first workshop was the Community Consultation Workshop held at Beacon on Friday 23rd February 2001. This workshop was preceded by a comprehensive bus tour of the catchment during which workshop participants were able to familiarise themselves with issues confronting landholders throughout the catchment. Following on from the Community Consultation Workshop, a second facilitated Risk Management Workshop was conducted at Northam on 15 March 2001. This workshop brought together technical experts and community representatives to evaluate the risks identified at the Community Consultation workshop and determine the need for management and action plans to manage the risks.

Members of the community who were unable to attend the Community Consultation Workshop and wished to contribute their ideas to the Feasibility Study were invited to contact the Mt Marshall LCDC or any of a number of community spokespeople who would be attending the formal Risk Management Workshop. Community spokespeople were identified at the Community Consultation workshop.

2.2 Community Consultation Workshop Outcomes

The Community Consultation Workshop identified the following risks detailed in Table 1 below. The summary results from each group of risks were categorised *(A-G)* and ranked according to the number of votes received in each category and presented in an accumulated format. Whilst an attempt was made to divide risks into 'Social', 'Environmental' and 'Economic' categories, there was some difference of interpretation of these areas. However, this did not have a major impact on the final rankings. A copy of the complete Community Consultation Report is enclosed at Appendix C.

Table 1 - Accumulated Votes for Key Risks

Votes	ID	Issue
59	*A*	Downstream effects- legal implications, damage to remnants, increased salt loads in middle & lower catchment
41	*B*	Engineering issues- leakage from drain, soil stability, ability to handle large flows, proper design, handling surface water
35	*C*	Gaining agreement – type of system used, allowing drain to pass through, maintaining community unity, information available
21	*D*	Economic impacts - cost of construction, effects on land value
20	*E*	Do Nothing Scenario- Costs of not taking any remedial action
16	*F*	Maintenance – identifying responsibilities and costs
6	*G*	Lake Mc Dermott- effects on capacity

3. Methodology

3.1 Identification of the Risk Issues and Failure Modes

The Risk Management Workshop followed the guidance provided by Australian Standard AS/NZS 4360:1999 – Risk Management. The risks were identified from:

- Input from the Mt Marshall LCDC members and GHD engineers;
- Community Consultation Workshop outcomes; and
- Concerned community representatives (written submissions).

Participants, who had not attended the Community Consultation Workshop, identified additional issues and risks during the workshop. Workshop participants were invited to consider any additional issues and provide post workshop feedback and comments. A copy of these responses is included in Appendix B.

3.2 Risk Assessment Categories

The Risk Issues and Failure Modes were grouped together into the following categories to provide participants with a contextual reference point and as a means of considering potentially related issues at the same time:

1. Technical.
2. Social.
3. Economic.
4. Environmental and Health.
5. Construction.
6. Legal and Legislative.
7. Management and Operation of the System.
8. Engineering Solutions.
9. Land Management Options.

3.3 Probability of Risk Event

The rating system used for the probability or likelihood of the event was based on the Australian Standard "Qualitative Measures of Likelihood" and scores using a 1 to 5 score as shown in the following table:

Table 2 – Likelihood Rating System

Likelihood	Definition	Score
Rare	May occur in exceptional circumstan ces	1
Unlikely	Could occur at some time	2
Possible	Might occur at some time	3
Likely	Will probably occur in most circumstances	4
Almost Certain	Is likely to occur in most circumstances	5

3.4 Consequence of Failure

The consequence of failure was considered in the following categories and assessed using a 0 to 5 scoring system for each category:

Table 3 – Risk Consequence Matrix

Level of Consequence	Category of Consequence: Agricultural Capacity				
Catastrophic Score = 5 ea	All activities cease. No resumption for at least 12 months.	Catastrophic environmental impact. Outside assistance required. Continuous and very serious damage by extensive flooding causing severe erosion, and loss of flora or fauna, and infrastructure services. Widespread destruction of crops and remnant flora or fauna.	Death.	Financial loss (compensation, fines, cost to repair) of greater than $10M.	Sustained detrimental national or state media reports. Subject to parliamentary committee hearing. Sustained community outrage.
Major Score = 4 ea	All normal activities curtailed. No resumption of normal activities for between 6 and 12 months.	Major environmental impact. Outside assistance required. Continuous and serious damage by erosion, flora or fauna. Major disruption to, or frequent death of, crops, remnant flora or fauna.	Serious injuries requiring on-site treatment by medical practitioner. Immediate evacuation to hospital.	Financial loss (compensation, fines, cost to repair) of $500,000-$10M.	Numerous detrimental national or state media reports. Subject of a number of parliamentary questions or ministerial. Organised community concern.
Moderate Score = 3 ea	Most activities affected. No resumption of normal activities for up to 6 months.	Moderate environmental impact. Outside assistance required. Continuous and moderate damage by erosion, flora or fauna. Disruption to, or some death of crops or remnant flora or fauna.	Injuries requiring on-site treatment by medical practitioner. Personnel unable to continue to perform duties.	Financial loss (compensation, fines, cost to repair) of $50,000-$500,000.	Detrimental national or state media reports. Subject of parliamentary questions or ministerial. Community concerns and complaints.

Level of Consequence	Category of Consequence				
	Agricultural Capacity				
Minor Score = 2 ea	Modification to planned activities can be expected.	Minor environmental impact. No outside assistance required. Continuous but minor damage by erosion, local loss of crops or remnant flora or fauna. Disruption to flora or fauna habitats.	Injuries requiring assistance in-situ by qualified first-aid staff. Injured personnel may not be able to continue to perform normal duties.	Financial loss (compensation, fines, cost to repair) of $5,000-$50,000.	Detrimental local media reports. Subject of local government action. Random substantiated complaints from the community.
Insignificant Score = 1 ea	Some minor modification to planned activities may be necessary.	Insignificant environmental impact. Isolated damage by erosion, flora or fauna. Some disruption to flora or fauna habitats.	Trivial injuries which may require self administered first-aid. Injured personnel can continue to perform normal duties.	Financial loss (compensation, fines, cost to repair) of less than $5,000.	Possibility of detrimental local media reports. Trivial substantiated complaints from the community.
Nil Score = 0 ea	No impact on schedules.	No environmental impact.	No injuries.	No cost impact.	No impact.

3.5 Risk Score and Risk Level

The risk prioritisation and management process used a simplified model from the Australian Standard to reflect the degree on uncertainty of the project scope and outcomes at the feasibility stage of project development. The risk evaluation process uses a mathematical model to calculate the risk level of each issue by adding the consequences of failures scores for each category and multiplying by the likelihood score to produce the Risk Score. These are used to assess the significance of risks and determine what action is required as detailed in Table 4 below:

Table 4 – Risk Significance

Score	Level of Risk	Response Required
0 to 25	Minor	Monitor only
26 to 75	Medium	Management of the risk or action is required
76 to 125	Significant	Action is required to reduce the risk to a manageable level

3.6 Management and Action Plans

As detailed in Table 4 above, all risks identified as medium and significant were required to have both management and action plans. The plans were to be relevant to the feasibility phase of the project and within the authority of the project group.

4. Workshop Outcomes

The workshop was conducted based on the following agenda:

- Review risks identified to date;
- Identify additional items;
- Establish the Likelihood of the event;
- Establish the consequences of the event;
- Prioritise the risk events; and

Develop Action and Management Plans for significant risk events.The workshop participants were advised that the purpose of conducting the workshop was to:

- Identify issues and failure events.
- Identify significant and important risks.
- Develop Management and Action Plans.

The workshop participants were provided with an overview of the activities being completed within the Feasibility study and debriefed on the outcomes from the Community Consultation Workshop.

4.1 Identification of Issues

The workshop participants reviewed the initial risk issues and failure modes. A significant amount of time was spent debating the project scope and likely outcomes of the Feasibility Study. There were very significant differences of opinion on how salinity should be tackled and cynicism on the capability of engineers and scientists to provide sustainable and effective solutions. While these issues should have been addressed at the Community Consultation Workshop, several of the community representatives expressed disenchantment with the project.

The workshop was conducted before the Feasibility study had been completed and the recommendations from the study could not be advised. This created a great deal of difficulty for the participants, who needed to consider the practicalities of a wide range of potential engineering and land management options. Also, as the results of the hydrologic and hydrogeological research and field programme had not been completed, most of the workshop participants based their assessments on their own assumptions and opinions. All of the participants had difficult identifying and assessing risks at a strategic and conceptual level.

The review of the identified risks was conducted in syndicate groups of 8 to 10 participants. Each syndicate had representation from farmers and land holders, scientists, engineers and Government Departments.

Several additional items were added to the issues list and amendments incorporated to the original items.

4.2 Assignment of Probabilities

Once the issues had been identified, the syndicate groups were requested to assign the likelihood score to each issue. Again, there was significant variation on opinion between the representative groups. Generally, the farmer and local land holders had a far more pessimistic opinion of the probability of risks that the engineers and scientists. Where possible, a consensus was established for all participants.

The analysis of the results shown in Table 5 below indicate a strong skew of the probability score to the higher end of the scale. This was not expected. A normal distribution of results should have resulted from the unfiltered collection of risks and failure modes.

Table 5 – Statistical Analysis of Likelihood Scores

Score	5	4	3	2	1
Percentage	33	25	30	10	2

4.3 Assignment of Consequences

As discussed above, the participants needed significantly more time to discuss the project scope, potential solutions and other issues and insufficient time was left to complete the assignment of consequences. To ensure that participants understood the process, the application of the consequence matrix and mathematical model, two of the issues were discussed and scored by the whole group.

Again the debate between participants showed significant differences of opinion between the various representative groups. The participants agreed that GHD should complete the scoring and provide copies to all participants for comment. This was done.

4.4 Management and Action Plans

As discussed above, the time limitations on the workshop resulted in the Risk Management and Action Plans being prepared by GHD. The resultant spreadsheets, enclosed in Appendix A, were then circulated to participants for comment. Several responses were received and used to update the management and action plans.

The Risk Management and Action Plans for each issue were restricted to matters that could be resolved or actioned within the feasibility project scope. Many items can be considered in assessing the success of the feasibility study. The majority of items need to be considered within the scope of any future salinity projects for the Beacon River Catchment.

A summary of the major and medium issues that need to be considered include:

High Risks:

??	Feasibility Study to specifically address the potential risk and consequences of flooding previously unaffected areas.

Medium Risks:

??	Feasibility Study to consider the potential risks with Legal Challenges. Risks to be minimised by community consultation.
??	Feasibility Report to provide sufficient detail of design options and scope to determine cost implications in the cost/benefit analysis.
??	Feasibility Report to define the project boundaries.
??	Community Consultation to continue through the project implementation and funding stages to address community concerns.
??	Feasibility Report is required to consider the impacts of management options in the cost/benefit analysis.
??	Community Consultation was intended to ensure that options were raised and considered. Risk Workshop demonstrated that not all issues had been addressed. Mt Marshall LCDC to continue communication with local stakeholders.
??	Risk Management Workshop demonstrated potential for disharmony. Mt Marshall LCDC to continue consultation with local stakeholder groups.
??	Feasibility Study Report to consider land implications for each option in the cost/benefit analysis.
??	Risk of capital availability is beyond the scope of project group's control but must be monitored during project development and implementation to ensure outcomes are manageable.
??	Feasibility Study to consider implications of nutrient transport and other pollutants. Mt Marshall LCDC to consider management measures during project development.
??	Feasibility Study will address the salt loading in downstream drainage stream.
??	Feasibility Study to address potential impact of the saline drained water on the downstream catchment area.

??	Means of alternative funding are beyond the direct control of the Project Group. Some influence can be achieved through local community and political support.
??	Project Design to address the formation of insect breeding sites in the channel and ponds designs.
??	Risks Management Workshop aimed at identifying those risks likely to affect approvals or likely to incur public liability. Additional risks may be raised through funding submission processes and should be addressed on a case-by-case basis.
??	Management Plan is required as a project handover deliverable. The Plan shall include management and operation responsibilities of all parties. A Management Plan shall be developed during the implementation phase of the project.
??	Mt Marshall LCDC to consult with the Department of Agriculture and CALM on appropriate species for revegetation and communicate this information to farmers within the catchment.
??	Design of engineering options to consider minimising land utilisation and access disruptions.
??	Design to include piped options in areas of porous soils.
??	Feasibility study outcomes are aimed at addressing knowledge gaps to ensure effective designs are implemented.
??	Feasibility study is required to adequately address scope of design and evaluation of the options.
??	System design to consider migration of undesirable biological elements and incorporate blocking mechanisms where necessary.
??	Feasibility Study outcomes required to assess the potential impact on the lakes. Data currently not available.
??	Channel design to safety requirements and incorporate barrier elements where necessary.
??	Community Consultation to continue through the project implementation and funding stages to address community concerns. Mt Marshall LCDC to consider pro-active campaign in local media to promote widespread support.
??	Funding and management arrangements shall consider the potential revenue implications on landowners affected by the project.
??	Feasibility Study to address potential impact on ground water levels.
??	Feasibility Study aimed at addressing the issues pertinent to design of effective water management systems. Design definition phase will further refine the scope of work to minimise risk exposure.

??	Responsibilities for ownership, management and operation of salinity management options to be defined within the Project Feasibility Report. Ultimately such responsibilities will be dictated by the scope of works appropriate for each management solution adopted.
??	Project Feasibility Study to address cost efficiency in the cost/benefit assessment of each option.
??	Project Feasibility Study outcomes to address the hydraulic performance of the discharge areas.
??	Quality Assurance applied rigorously to design process to minimise risk.
??	Land Tenure issue to be addressed within the Feasibility study and defined for each management solution chosen.
??	Design solution to consider implications of potential pollutants. Mt Marshall LCDC to incorporate appropriate management actions in the System Management Plan.
??	Feasibility Study will consider soil types and potential for drainage. Data on soil types was collected prior to and during the feasibility phase of the project.
??	Risks from extreme weather conditions to be considered in the Feasibility Report and in the project design.
??	Project outcomes are aimed at reducing the loss of productive land and the resultant impact of local population reduction.
??	Project design documents to cover latent conditions and contractor to inform on latent conditions.

Appendix A

Risk Analysis and Management Table

Appendix B

Community Concerns

Appendix C

Community Consultation Workshop Report