Sustainability Profile for the Mid Talbragar Catchment

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Executive summary

The Integrated Catchment Assessment and Management (iCAM) Centre from the Australian National University carried out Sustainability Profile surveys in the Mid Talbragar catchment during June/July 2001. The Sustainability Profiles study was part of the TARGET project funded under the NSW State Salinity Strategy and Natural Heritage Trust Murray Darling 2001 program.

The objective of the iCAM study was to provide an improved understanding of the likely long-term biophysical and socio-economic sustainability of the Mid-Talbragar catchment, and an appreciation of the social and economic impediments to uptake a variety of land management options.

Sustainability Profiles are a means of assessing the general health of a farming system. The method is based on an analysis of the stocks and changes in a farm's water, land, and vegetation resources, its social situation, and its business economics. In combination, these elements represent a "quintuple bottom line."

There were a number of key biophysical and socioeconomic findings from the surveys:

- The land condition problems of most overall concern to the group were weeds, kangaroos and foxes. At least 80 percent of respondents rated these three problems as a problem. Salinity/high watertables were mentioned as a problem for 75 percent of the group.

- The majority of respondents had implemented an increased area of perennial pasture and made greater use of conservation farming during the last five years. However, these two measures have not necessarily been in response to a salinity problem. The least implemented measures were establishment of saline agroforestry, utilization of intercropping and increased area of native pasture.

- The one measure that almost all respondents are intending to implement is an increased area of improved perennial pasture. However, at least around 50 percent of respondents in the Mid Talbragar group are not intending to implement the remaining salinity mitigation measures over the next 5 years.

- Eighty per cent of respondents recorded a farm cash income in 1999-2000 below the estimated sustainability threshold of $50,000, with about thirty per cent of respondents recording a negative cash income.

- Most farms had a low or negative business profit and rate of return to capital. There are few if any alternative enterprises that appear to offer a win-win situation with respect to farm profitability and salinity. Off-farm income was important for most of the group and averaged 22 percent of gross cash receipts per property. Farms in the Mid-Talbragar catchment had a relatively low level of debt, which increases their flexibility.

By synthesising the survey results with information from the Department of Land and Water Conservation and other sources, the iCAM group found that:

- In most of the area, farming operations are currently sustainable within their current land use with respect to the water resource. There has been a fundamental change in the water balance for both the Racecourse and Snake Gully sub-catchments as a result of the introduction of agriculture. The catchment, however, is heterogeneous and there are large variations in the salt and water balance across the region. The supply and quality of water in the catchment's farms would be inadequate for large-scale intensive horticultural irrigation enterprises.

- In some areas of the catchment, there are acidifying soil conditions and without liming these soil resources are being used unsustainably. There is also gully and wind erosion but much of this has been stabilised with producer or government supported works. There are areas of land salinisation due to dryland salinity processes in the area but discharge sites have a negative impact on only a small proportion of some of the producers and it is unlikely that land salinisation will become significant enough to make any farms unsustainable. Continuous cropping or short rotations, and conventional tillage with long fallows on some properties have led to both soil and salinity problems. Future management will have to be more intense to ensure sustainable levels of production. For some farmers that are vulnerable to small changes in profitability, this high level of inputs may lead to unsustainable conditions.

- The large mosaic of remnant vegetation on sedimentary soils is an important resource for regional biodiversity. However, there is a paucity of vegetation on more fertile soils and riparian areas. It is believed that the low percentage of remnant vegetation and associated biodiversity in a large proportion of the Mid Talbragar area is unsustainable. Weeds are being managed with inputs of time and funds. However, they should not impact on future sustainability or pose an impediment to the implementation of strategic management plans.

- The Mid-Talbragar Catchment is composed of a number of communities and there are some significant differences between these groups. The social sustainability of the catchment is driven predominantly by the stage of the lifecycle of the managers. There appears to be reasonable levels of replacement amongst the managers from both within the farm family units and from outside of the catchment. The land market in the catchment appeared to be working in providing a healthy level of turn over and the possibility of farm build up through aggregation. There appears to be a healthy social system in most of the catchment.

The findings of the socio-economic work within the Sustainability Profiles project have major implications for uptake of the land management options offered, as the options generally require producers to take on more complexity and risk, not less. In many cases, producers' management skills, decision-making capacity and family situations (especially where producers and their spouses are working several jobs and raising children) are already stretched. These social factors alone are likely to impede uptake of the land management options, even if producers were economically sustainable.

The iCAM group made the following conclusions:

- Salinity was an issue for most properties but was considered less important than weeds or pests;

- A majority of respondents are planning for an increased area of improved perennial pasture in the next five years;

- Vegetation and biodiversity decline is seen as unsustainable;

- The voluntary basis of involving landholders is considered to be less efficient than a targeted approach in achieving salinity mitigation goals for the catchment as a whole; and

- The broad range of comments collected as part of the profiles project, indicates that there are a significant number of financial and non-financial impediments to the land management options trialled in the first year of the TARGET project. The TARGET project has been an evolutionary process and feedback on the results from this project were used to revise the approach used in the second year. However, there are a range of impediments which remain and

unless addressed, these issues will constrain natural resources and environmental management strategies. It is recommended that the key government agencies responsible for the management of issues associated with the broad range of comments are identified and processes implemented to develop management actions to overcome these impediments.

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1. Introduction

The recent Murray Darling Basin Salinity Audit and the NSW Salinity Management Strategy highlight the problem that the Central West Region of NSW (catchments of the Macquarie, Lachlan & Castlereagh Rivers) faces now and in the future with salinity. For example, it is predicted that the Macquarie River at Narromine will be unfit for human consumption 30 percent of the time by 2020, and 55 percent of the time by 2050.

The *Tools to Achieve Landscape Redesign Giving Environmental /Economic Targets Project* (TARGET) is a cornerstone project of the NSW Salinity Management Strategy. The TARGET project will facilitate large-scale land use change in catchment areas that have been identified as being major contributors to Basin wide salinity. These areas are the Lachlan and Macquarie catchments, and in particular, the Warrangong, Mid-Talbragar, Weddin and Little River sub-catchments.

The degree of land use change required to mitigate the effects of salinity in some catchments and sub-catchments may need to be extensive. Best management land use options to ameliorate the salinity hazard include farm forestry, saline agro-forestry, increased use of perennial pastures, increased use of native pastures, increased use of saline pastures, adoption of conservation and intercropping practices and vegetation establishment/retention for remnant and riparian vegetation.

Departmental agencies have long been involved in capacity (knowledge) building of the physical elements affecting land use. Often, however, this has been without an accompanying knowledge of the social and economic issues. The lack of knowledge of the nature of social or economic factors has contributed to minimal broad scale uptake of best management practices by producers. Social and economic issues are often also important impediments to participation in strategic catchment management actions. In particular, there is little existing information on the biophysical, economic and social sustainability profiles of producers or catchments as a basis for understanding why current problems have occurred or identifying impediments to the implementation of natural resource and environmental management strategies.

The following report is based on surveys which were conducted in the Mid Talbragar catchment between 27th of June and 12th of July 2001.

Information on the location of the catchment and the procedure for the project is presented in the next section. Details on the Sustainability Profile concept are presented in section 2. In section three a summary of the sustainability assessment of the water, soils, vegetation, financial and social systems of the

catchment and the survey results are presented. While in section four details of the catchment Sustainability Profile are presented and discussed. A summary of an assessment of the role of the nine land management options is presented in section five. In section six details on the nature of the impediments to integrated catchment management (ICM) of the Mid Talbragar catchment are presented and the nature of a possible Strategic approach to ICM are discussed as a basis for discussions of "Where to from here" questions.

1.1 Project objective

The aim of this component of the project is to develop sustainability profiles, as part of the TARGET project, for individual farmers who participate in the surveys and for the Mid Talbragar social catchment. In particular, it is designed to identify impediments to producers participating in the strategic management of natural resource and environmental issues.

1.2 Location of properties

The consultants were asked to prepare producer profiles for a sample of 25 properties in the Mid Talbragar social catchment. There are over fifty properties in this catchment. Individual property reports have been prepared for the participants. These reports are confidential but form the basis for much of the material in this overall report. No information from individual producers is reported here.

The social catchment is different from the topographic catchment of Spicer's Creek and is based on four previous Landcare areas. Some of the surveyed properties lie outside the topographic catchment, and some farms that lie inside the topographic catchment were not interviewed.

The study area lies predominantly within the Spicer's Creek catchment in the Mid-Macquarie River Catchment approximately 40 kilometres north of Wellington and 40 kilometres east of Dubbo. The Spicer's Creek rises just east of the locality of Spicer's Creek (which is about 10 kilometres West of Goolma on the Wellington – Goolma Road) and flows to the north to the town of Gollan, where it is joined by Snake Gulley and Racecourse Gulley Creeks which drain two small sub-catchments, one to the east and the other to the west of the Spicer's catchment. The Spicer's Creek continues to the north beyond the Saxa Bridge and to where it eventually flows into the Talbragar, upstream of Ballimore.

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2. Development of sustainability profiles

A significant part of this study is aimed at assessing the medium and long-term sustainability of farming in the Mid Talbragar catchment and the nature of any impediments to the adoption of catchment management strategies or to participation in them.

Sustainability is defined for the purposes of developing Profiles as being:

> *"The ability to indefinitely provide the land managers and the broader catchment community with the lifestyle they aspire to while maintaining or enhancing the natural resource and environmental base"*

Sustainability is inherently a medium to long term concept concerning the whole farm system. Consequently, the fine detail necessary, for example, of a current year financial assessment for farm management or taxation, is not required in assessment of sustainability profiles.

Traditionally, the viability of farming systems has been based only on a financial assessment. However there has been significant change in farming systems over the past few decades, especially in farm size, impact of a range of drivers on farm values, access to off-farm income and impact of a wide range of forms of environmental degradation.

Consequently, the concept of Sustainability Profiles has been developed as the basis of assessing the general the "health" of a farming system, based on an assessment of the stocks and related flows of the following five key sub-systems (a "quintuple" bottom line):

- Water and climate
- Land, Soil and nutrients
- Vegetation, biota and genetic resources
- Social
- Farm business

Individual farm assessments of these sub-systems are aggregated to produce a 'Producer profile'.

This approach provides the basis for an integrated, multi-disciplinary analysis of sustainability. Each sub-system can be thought of as a stock, which is built up or run down by farm management decisions associated with enterprise production. Farmers can make specific decisions to increase or decrease stocks in one of the above five components. Farm viability is reliant on the maintenance of all stocks above key thresholds. In the short run, there may be enough of all of these

resources but if the stocks of any or all of the above stocks are run down, then in the long run the farm will not be sustainable. Nor will a farm prosper, in the medium or long run, if there are problems in the quality of the water, the soil, the vegetation, the social or the farm business sub-systems.

Assessment based on an integrated approach to all the farm sub-systems at the same time, is particularly important as it enables the identification of key linkages between the five components of the farm system. For example, land degradation impacts are intimately linked to farm financial performance and alternatively the pressure of a poor financial performance frequently results in pressure on the natural resource and environmental base.

Because of the TARGET project's emphasis on salinity management, the assessments of the biophysical criteria give specific attention to salinity processes and impacts both on-farm and off-farm.

The following example relates to the farm finance sub-system or to the financial viability with which most people are familiar. However, similar examples could have been presented from each of the other components.

Each farm has a stock of financial capital that includes assets, with service lives of greater than one year, and financial deposits. Farmers regularly make decisions that involve on-farm investment in capital assets and the adoption of new technologies and infrastructure replacement that have the potential to build up the financial stocks. They also make decisions with respect to asset sales, the rate at which they depreciate their assets and the degree to which savings are invested off farm which can run down the capital stocks. In a normal situation returns from farm production are required to cover variable costs (which includes the wages for labour) and a return for capital and management. Producers use their share of these returns for family expenses (eg education and food) and to provide capital for new farm investment and asset refurbishment.

In the short run (one or two years), returns may only cover variable costs. However, in the long run this would result in a run down in capital stocks and, beyond a threshold point, the farm would become unviable. For example, many farmers have postponed fertiliser applications, maintenance or replacement of assets in years of low commodity prices; however, in the long run this leads to lower productivity and an unviable farming system.

Barr and Ridges (2000) analysed farming systems in the Murray Darling Basin and concluded that in most of the Statistical Local Areas in the southern part of the Basin, fewer than 20 percent of farms generated a 'sustainable' farm family income. In this context sustainability was based on the FAST benchmark, which is an income of over $50,000. This level of income is judged sufficient to meet all

current costs of production and living expenses and to allow for investment in the maintenance and development of the farm business.

Over the past 20 years farm viability has become less reliant on income generated by farm production and to an increasing extent (in regions where this is possible) more reliant on off-farm income. The proximity of the Mid Talbragar catchment to regional centres, provides significant opportunity for off-farm income compared with many other rural areas in the west of the state.

Data from the Australian Bureau of Agricultural and Resource Economics (ABARE) shows that, throughout Australia, only 20 percent of producers accounted for 80 percent of the production and income. This implies that there is a long tail of the distributions involved and the need for farm data surveys with sufficient sample size to enable distribution analysis.

Structural change involving the continual reallocation of resources in response to environmental and market forces is a sign of a healthy economic system. For example, producers continually revise their management decisions on the nature of crops, pastures and livestock enterprises in response to changes in regulations, commodity prices and climate. In some cases, structural change is not occurring at an optimal rate (either too fast or too slow) or it has stopped. In these cases, structural adjustment policies designed to facilitate change are sometimes justified (eg. the Foundation for Rural and Regional Renewal (FRRR).

Information from an integrated assessment of the sustainability of the water, the soil, the vegetation, the social and the farm business sub-systems of properties is currently unavailable for most rural areas. Producer profiles were developed for each of the farms in the Mid Talbragar catchment based on this assessment approach and will be presented to the producers concerned as confidential individual farm reports.

Despite all the differences identified between individual farms and summarised in the Producer Profiles, there are often very many similarities (especially for relatively small areas). In addition, strategic management of agriculture, natural resources and the environment to ensure sustainable systems, requires the aggregation of individual farm units into relatively homogeneous Land Management Units wherever possible. Catchment or regional sustainability profiles can be developed based on the aggregation of individual farm profiles. Typically, the basis for aggregation is significant similarity in each of the five key sub-systems.

A Sustainability Assessment, based on a supplementary biophysical assessment and the survey based biophysical, economic and social assessment, of the Mid Talbragar catchment, are presented in the following sections of this report. A Mid

Talbragar catchment Sustainability Profile based on this information, is also presented.

The Sustainability profiles approach has allowed an assessment of questions and issues related to sustainability; impediments to the adoption of potential new enterprises; impact of incentives; the need for and nature of cost sharing arrangements; the implications for Strategic Management Plans and the need and capacity for structural adjustment.

2.1 Procedure

This procedure was initially trialled in the Oolong catchment of NSW and has also benefited from its application in the Mid Talbragar catchment as part of the TARGET project. The assessment and development of sustainability profiles for the Mid Talbragar catchment included the following key stages:

- Meeting with cooperating producers of the Mid Talbragar catchment and the Catchment Coordinator as a group to discuss the approach in detail;
- Development of a survey schedule to collect information during farm visits;
- Development of a data analysis system;
- Arrangement for suitable available data, maps and a background brief for the Mid Talbragar catchment from the Department of Land and Water Conservation (DLWC) and the Mid Talbragar Landcare Group;
- Assessment of the biophysical nature of the Catchment, including a crude estimation of the catchment salt and water balance;
- Distribution of copies of the survey schedule to participating producers which requested completion as far as possible before the farm visits;
- Individual meetings with participating producers to:
  - Obtain producer permission to include individual property information in a group report.
  - Conduct a farm tour to identify the key components of the individual farm system.
  - Complete the survey schedule including a discussion of agronomic, socio-economic and natural resource issues; the potential for new enterprises or new farm structures and the nature of impediments.
- Copies of Draft Individual Farm Reports distributed to producers for validation;
- Presentation of details from the Draft Group Report to participating producers; and,
- Incorporation of comments from participating producers and key members of the TARGET project for finalisation of Individual Farm and Catchment Group Report.

3

3. Sustainability assessment

3.1 Biophysical statement

Previous catchment management plans and studies had aggregated the catchment into a number of management units, for example, the TARGET Biophysical Brief had identified two main Ground Water Flow Systems (GFS) based on key data sets that help define geographic areas that behave homogeneously with respect to hydro-geological processes. Whilst these sub-divisions may have been useful at a simple level it is obvious that any aggregation across the catchment will need to take account of a more complex arrangement of the biophysical, social and economic issues. From the work reported here, it is still not possible to definitively identify these units.

The biophysical assessment of the Mid-Talbragar catchment is based on inspections during the survey visits and analysis of the following key supplementary studies which where run in parallel with the sustainability profiles project and designed to provide details on biophysical dimensions of the Mid Talbragar area:

- A factual description of the biophysical attributes of the Mid-Macquarie catchment – including the Mid Talbragar area, emphasising the natural resource management issues is reported in Stage 1 of the Mid-Macquarie Landcare Regional Plan;

- Baker and others (2002) – currently in the final stages of publication;

- Ann Smithson (groundwater and hydro-geology); and,

- Turbill, Doyle and Briggs (2001).

Discussions with TARGET specialists included: Anne Smithson (groundwater), John Lawrie (soils), Mary Goodacre (pastures), Justin Hughes (intercropping), Austin Whitehead (farm forestry), Allan Nicholson (salinity), Richard Chewings (conservation farming) and Kerrie Tomkins (remnant and riparian vegetation). General information was also provided by DLWC staff (Colleen Schneider and Tom Gavel).

Water and Climate[1]

Hydrogeology

The Mid-Talbragar study area lies across the lower parts of the Spicer's Creek catchment, a minor tributary of the Talbragar River, joining between Ballimore (downstream) and Elong Elong (upstream). Minor tributaries of Spicer's Creek in the study area are Snake Gully (to the east) and Racecourse Creek (to the west).

The study area lies in a geologically complex region of the Talbragar catchment. To the north and northwest lies the sedimentary sequences of the Great Artesian Basin; whilst to the south lies the complex rock sequences of the Lachlan Fold Belt. To the southeast lies the rock sequence of the Sydney Basin.

More detailed descriptions of the geology of this area can be found in other publications. This geology has been analysed and interpreted such that the area is defined by five main systems – Recent alluvium, Mesozoic Sediments, Permian and Triassic Sediments, low relief Palaeozoic rocks, and high relief Palaeozoic rocks.

Recent Alluvium

These groundwater flow systems are typically found within alluvial sediments associated with Spicer's Creek and its major tributaries. The flow systems are local in scale, with flow lines up to 5 km in length. The dominant lithologies of the aquifer are sands and gravels. The aquifers can be confined, semi-confined or unconfined depending on location and have moderate to high permeabilities and moderate to high yields.

Recharge is seasonal (winter dominant) and episodic in nature. The amount of recharge into the aquifer depends on the nature and existence of overlying regolith/soil and on the frequency and intensity of flood events, although recharge does tend to occur generally across the terrain. These systems can also be recharged by upward leakage from the underlying rocks. Groundwater discharge typically occurs in localized areas at the break of slope below the terraces. Ephemeral and perennial stream networks receive saline discharge from the discharge areas predominantly as surface wash-off, but some base flow leakage can occur.

Salt storage in the landscape is low and groundwater salinity is low to moderate. The first appearance of salinity after changed groundwater conditions can be slow

[1] *The descriptions of the study area's hydrogeology are derived primarily from information describing the groundwater flow systems of the Central West Region. These regional flow systems descriptions are the best information available for the Mid Talbragar area, in the absence of a detailed local analysis. As such, the regional descriptions may not be appropriate for answering local scale questions concerning salinity management and the sustainability of water resources.*

in this environment (up to 50 years), with equilibrium conditions taking longer to establish. The salinity risk is moderate.

Mesozoic and Permian/Triassic Sedimentary[2]

These groundwater systems are typically found associated with the broad rolling country on the western side of the catchment (particularly Racecourse Creek). The systems are local in scale, with short flow lines, usually about 1 km but sometimes up to 5 kilometres in length. The rocks are composed of layers of sandstone, siltstone and mudstone that have been lithified (that is, are relatively hard). These layers are generally flat lying, and in places have been fractured. Aquifers are present where the fracturing has allowed sufficient storage for groundwater to accumulate. Occasionally, there are harder layers (usually mudstones) that have not been fractured to the same degree. These layers interrupt the general downward flow of groundwater and force flow horizontally along the top of the layer until it intersects the ground surface. These sedimentary aquifers are generally perched but can be unconfined or semi-confined in nature.

The major source of recharge is typically from rainfall that is both seasonal and episodic, with the greatest amount of seasonal recharge occurring during the winter. Intense, episodic rainfall events occur in the summer. Recharge to these sedimentary aquifers occurs on the hilltops and slopes, particularly where the soils are lighter or the soil/regolith is thin or non-existent. Groundwater discharge typically occurs on the slopes and valley floor where the bedding planes of the aquifer intersect the topography. This can result in localized flows and springs part way up the hill slope. Ephemeral and perennial stream networks receive discharge mainly as wash off, although baseflow can provide a minor contribution. The first appearance of salinity after changed groundwater conditions has been moderately slow (30 to 50 years), with equilibrium conditions taking longer to establish. Salt storage in the landscape and groundwater salinities is high.

Low Relief Palaeozoic Rocks

These groundwater systems are typically found within the undulating lower relief terrain in the southern and south-western parts of the study area. The systems are local in scale, with moderately short flow lines, less than 10 kilometres in length. The main aquifer is fractured bedrock composed of Palaeozoic metasediments and volcanics. These Palaeozoic rocks may have associated areas where there is deep residual weathering. Shallower aquifers exist in the overlying thick, layered

[2] *The following description is an amalgamation of two flow systems described for the Central West Region – namely, the Mesozoic sediments and the Permian/Triassic sediments. However, it should be noted that the descriptions are regional in scale, and it is understood that the description given for the Permian/Triassic flow system may not be an accurate description of the Permian/Triassic sediments in the mid-Talbragar area. Differences between the Mesozoic and Permian/Triassic flow systems in the mid-Talbragar area could be expected, but in the absence of more detailed analysis, it is impossible to describe these differences*

colluvial sediments that are situated on the lower slopes. The fractured bedrock aquifers are usually confined to semi-confined and the colluvial aquifers tend to be unconfined. Generally, the permeabilities are moderate but variable.

The major source of recharge is from rainfall that is seasonal in nature, with the greatest amount occurring during the winter. Recharge to the fractured bedrock occurs on the hilltops and slopes, particularly on the mid-slopes where the colluvium/regolith is thin or non-existent. Recharge to the colluvium occurs diffusely across the slopes. Groundwater discharge typically occurs in localized areas and is linked to breaks in slope, lateral changes in lithology of the soil/colluvium, structural geological controls and valley locations. Ephemeral and perennial stream networks receive discharge as baseflow and wash off.

The first appearance of salinity after changed groundwater conditions has been very rapid in this area (less than 30 years) and is still expanding, with equilibrium conditions taking longer to establish. Salt storage in these aquifers is variable (moderate to high) and concentrated in the residual weathered horizon and the colluvium.

Salinity

No map of salinity outbreaks for the study area was available, though it is known that the Mesozoic/Permian flow system is suffering from expanding salinisation and waterlogging. Observational information from local DLWC officers indicates that:

- The catchment has rapidly expanding dryland salinity sites with some 400 acres becoming saline last year (2000).
- A further 50 acres salinised in the last three months and formerly dry creeks are now running permanently.
- Landholders maintain that the area changed from grazing to cropping in the late 1960's, which coincided with cheaper tractors and depressed cattle prices.

There are few bores in the region that have groundwater salinity information. DLWC is in the process of installing observation bore nests at 'Binginbar' and 'Ringwood'. Results are preliminary at this stage, but groundwater salinities across both sites vary between 4 and 20 dS/m.

Spicer's Creek shows relatively constant salinities of about 3 dS/m.

Land, Soil and nutrients

The soil landscapes of the region are described in some detail in the Dubbo 1:250,000 Soil Landscapes report and associated map by DLWC. Those requiring more detailed descriptions are referred to this document.

The soils of the study area can be summarised by 6 main soil types. Deep Tenosols (weakly pedologic soils directly on bedrock) are found developed on Pilliga Sandstone areas. Shallow Tenosols are generally found on the Mesozoic/Permian/Triassic Sediments. Poorly developed young soils (Rudosols) are confined to the lower floodplains of the major creeks and streams. Three soil types cover the Palaeozoic rocks – thin gradational soils showing poorly developed B horizons (Dermosols and Kandosols) and deeper texture contrast soils exhibiting sodicity (Sodosols). Generally, Sodosols are not known for major soil acidity problems, but do suffer from dispersive B horizons and problems associated with B horizon drainage capacity. The Tenosols have been identified as having the most widespread topsoil acidity problems.

Vegetation and Biota

Habitat quantity, structure and condition were assessed within remnant vegetation as indicators of biodiversity within the Mid Talbragar catchment study area for the TARGET project. The TARGET project is a collaborative study between the Murray-Darling Basin Commission, NSW Government, and Landcare that aims to assess the affect of changes in land management on natural resources. The following details are a summary of the Turbill, Doyle and Briggs (2001) report.

Biodiversity—the diversity of living things—is positively related to habitat structure, such as shrub cover, fallen branches and tree hollows. Habitat structure can be simplified or degraded from its natural state by detrimental human land use activities, leading to a decrease in habitat condition.

Most of the 3,570 ha of native woody vegetation found in the study area (11 percent of the total area) occur in a mosaic of remnants on infertile sedimentary soils in the eastern section of the study area, and in Yarindury State Forest in the west. The shrubby open forest habitat of these remnants, dominated by ironbarks, tumbledown red gum, and cypress pine, contained many structural elements—such as a patchy, diverse shrub layer, and a high density of hollows, dead trees, and fallen logs—that are beneficial to biodiversity. Very little native vegetation remains on alluvial and basalt soils. These remnants were small, largely isolated, and invaded by feral grasses and weeds.

Remnants on alluvial soils, dominated by yellow box, fuzzy box, and Blakely's red gum, had a simple structure, with a high groundcover and low cover of shrubs and fallen logs. White box remnants occur on several basalt hills. These small remnants also had a high groundcover, and contained very few shrubs or regenerating eucalypts.

The large mosaic of remnant vegetation on sedimentary soils is an important resource for regional biodiversity. However, there is a paucity of vegetation on more fertile soils and riparian areas. Moist fertile habitats are important for many

plants and animals, and riparian vegetation serves important ecological functions such as filtering ground water and erosion prevention.

Remedial management activities should focus on creating and improving remnants of vegetation on fertile soils, concentrating on riparian systems and creating linkages between moist and dry habitats. Continuous grazing should be prevented in all remnants. Active management, such as low-intensity fires, or short-term high-density grazing, may be needed to stimulate the restoration of a healthy groundcover and understorey, and regeneration of eucalypts, especially remnants on fertile soils.

3.2 Mid Talbragar survey results

This section summarises the results of the property survey questionnaires that were completed as part of the 24 property visits. The complete tables of results are presented in Appendix A. Most financial and production data relate to the 1999-2000 year.

Biophysical and socio-economic data

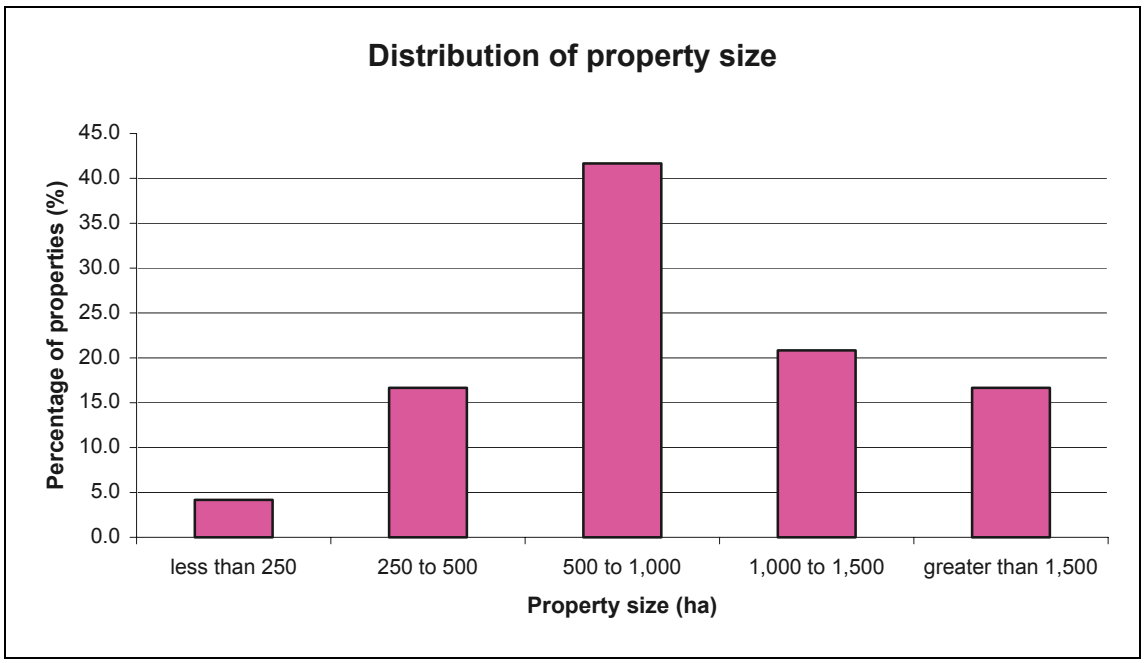
Land use

The size of properties surveyed in the Mid Talbragar catchment varied from less than 200 hectares to well over 2,000 hectares. The largest proportion of properties (42 percent) was between 500 and 1,000 hectares in size. The proportion of property area leased was negligible.

On average, around 65 percent of total property area was devoted to pasture. Nine properties (38 percent) had between 40 and 60 percent of total area devoted to pasture while a further ten properties had between 60 and 80 percent of their total property area under pasture. Five properties (21 percent) had a pasture proportion of over 80 percent. The dominant pasture type was improved perennial pasture, making up 50 percent of total pasture area.

The area devoted to farm forestry, revegetated and remnant vegetation was small (average of 9 percent of total property area or 76 hectares). The largest area of trees was 28 percent of total property area and the smallest area was less than one percent.

Farm forestry comprised the lowest proportion of total tree area with about one percent. Remnant vegetation comprised the largest proportion with 87 percent and revegetated area at 12 percent.



All properties in the catchment undertook some form of livestock production (92 percent of properties had sheep and 63 percent had cattle). Twenty-three out of the 24 properties undertook grain cropping with the major crop enterprise being wheat. Twenty-two properties grew wheat during 1999-2000. The next most grown crop was canola (8 properties) followed by barley, oats and lupins (5 to 6 properties). Ten properties produced hay or silage during the year and seven properties grew a dedicated fodder crop.

In terms of area grown, wheat was the dominant crop for the Mid Talbragar group with an average area grown of 154 hectares. Six properties grew less than 50 hectares of wheat, six properties grew between 50 and 100 hectares of wheat and a further six properties grew between 100 and 200 hectares of wheat. The remaining six properties grew in excess of 200 hectares of wheat. The average yield for wheat was 2.3 tonnes per hectare.

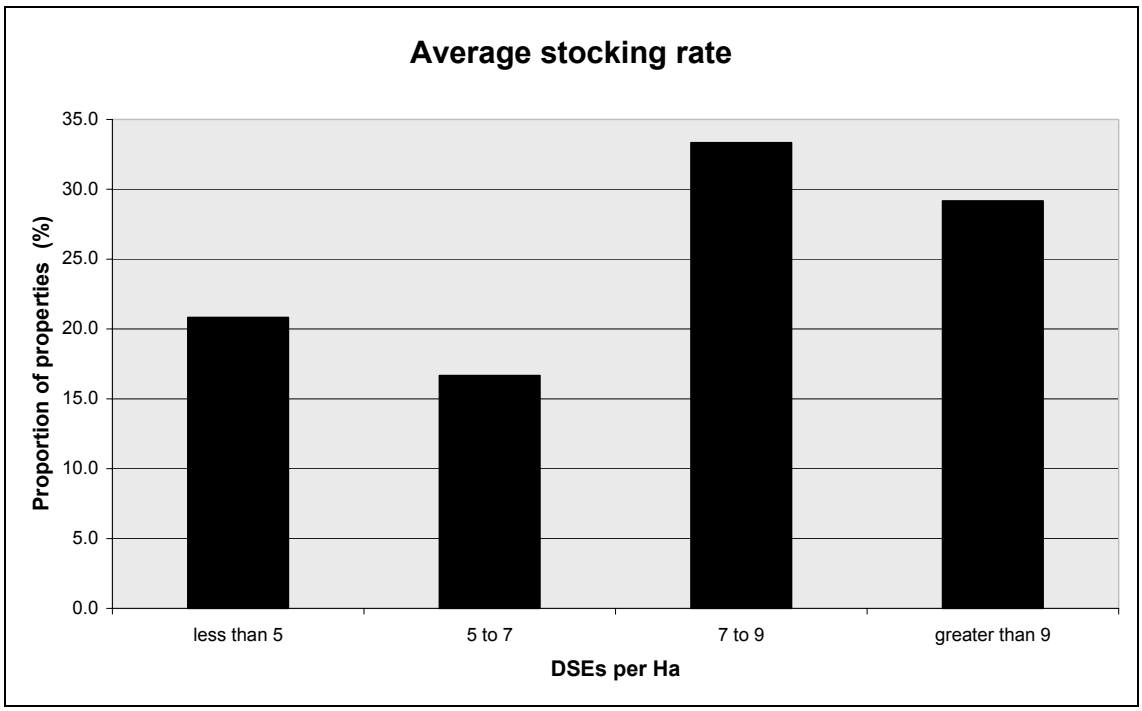
With respect to crop production methods, around one third of respondents used minimum tillage and crop rotations. Sixteen percent of respondents used zero tillage and conventional tillage. Full details of land use survey responses can be found in tables 1, 3 and 11 in Appendix A.

Livestock production

As indicated previously, sheep and cattle were the dominant livestock activities for the Mid Talbragar group. Around 50 percent of the group ran both sheep and cattle. The most common grazing system used for sheep and cattle was rotational grazing.

With respect to stocking rates, the average number of dry sheep equivalents (DSEs) carried was about 7.5 per pasture hectare with a range from just over 3 to 14 DSEs. The majority of properties running sheep and/or cattle had stocking rates of between 7 and 9 DSEs per hectare (8 properties) or greater than 9 DSEs per hectare (7 properties).

On average around 1,400 ewes were run with a group maximum of over 5,400 ewes. The average lambing percentage was 97 percent. Average wool cut was about 3.6 kilograms per animal shorn. The average sale price per sheep was $31. The average sale price for cattle sold was over $400. The average calving percentage was 89 percent and the maximum number of breeders run was 140 head. Refer to table 3 in Appendix A for further details on livestock production.



Fertiliser usage

All respondents topdressed their pastures, however, the frequency with which this was done varied considerably. The two most common frequencies were every 1–2 years and during pasture establishment. Just over a third of the group topdressed pastures with lime while very few respondents topdressed with other soil conditioner products.

Most respondents (22 out of 24) applied fertilizer to wheat on a regular basis while 15 respondents applied fertilizer regularly to oat crops. Eight respondents applied fertilizer to both canola and barley on a regular basis. In general, lime was not usually applied on a regular basis to crops.

The most common basis for making both fertilizer and lime application decisions were soil tests and to a lesser extent agronomist's advice.

With respect to general soil pH levels, most respondents rated their pH range as being between 5.6 and 6.5. Around 60 percent of respondents indicated this was the range for both their crop and pasture paddocks. Around 25 percent rated their crop and pasture paddocks as being in the 4.6 to 5.5 pH range. No respondent rated either a crop or pasture paddock as less than 4.5 and only four percent rated their pH as above 6.5.

Full details of fertiliser use survey responses can be found in tables 7, 8, 9 and 10 in Appendix A.

Water resources

Dams were the most common source of on-property water. All respondents had at least one dam. On average, the maximum quantity of water stored in property dams was just over 30 megalitres. The average number of dams per property was 14 (range 1 to 33) while the average number of bores was one (range 0 to 5). Eighteen properties had bores and 16 properties had rivers/creeks as sometimes usable sources of property water. Refer to table 4 in Appendix A for further details on water resources.

Labour use

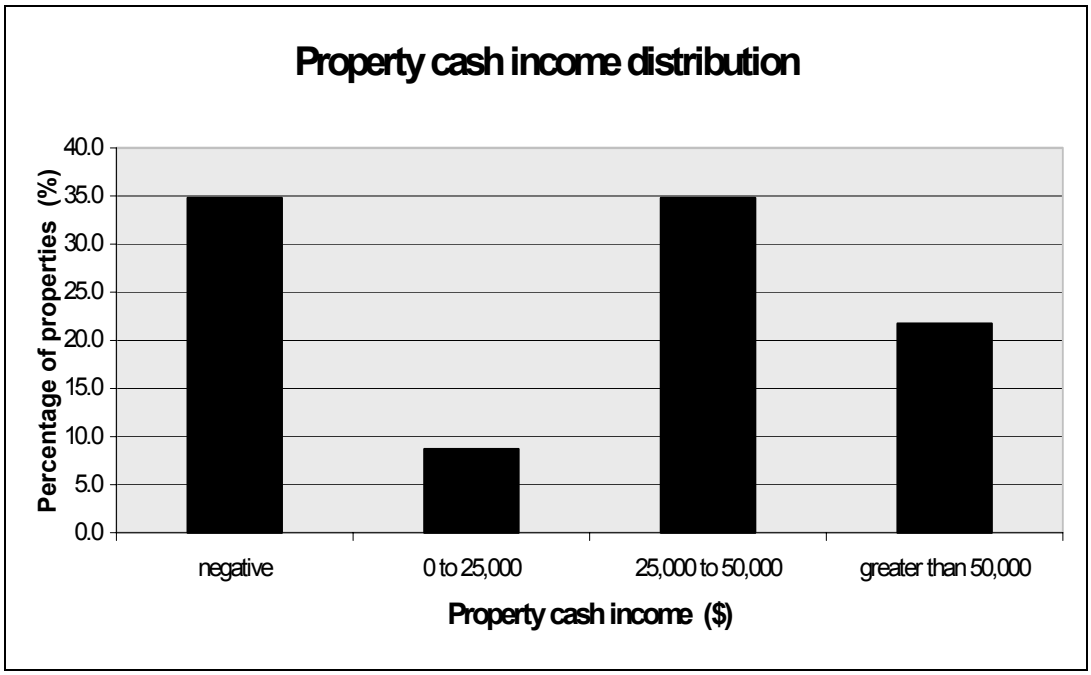
The majority of labour use on properties was provided by the owner-operators (average 20 months per property). An average of three months came from casual labour while permanent labour was rarely used. Refer to table 2 in Appendix A for further details on labour use.

Financial performance

In this section, receipts and cost data is based on responses from 23 properties and debt/asset data is based on responses from 24 properties. In 1999-2000, the 23 properties generated a total of over $3.6 million in gross cash receipts from primary production activities. The average gross cash receipt per property was just over $157,000.

Total cash costs averaged about $128,000 per property, and on average, properties in the Mid Talbragar survey had a property cash income of almost $28,700. There was, however, significant variation around this average. Thirty-five percent of respondents recorded a negative property cash income while the same proportion of respondents recorded a positive figure of between $25,000

and $50,000. Just over 20 percent of respondents had a property cash income exceeding $50,000.



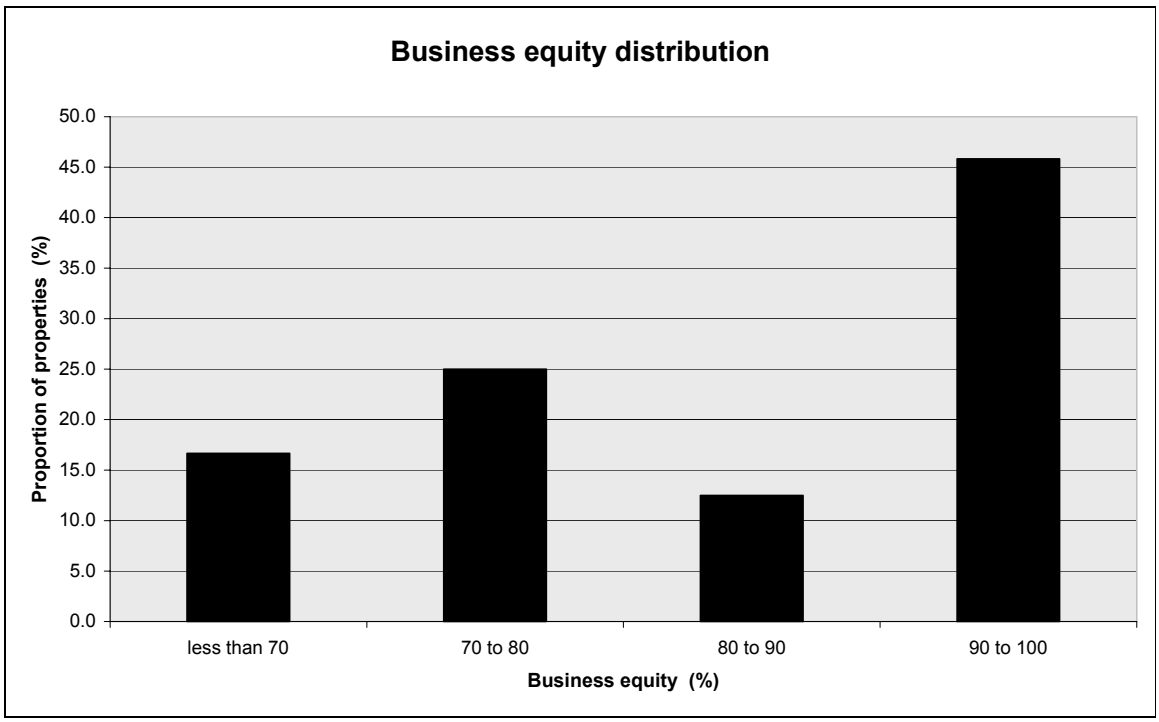
After accounting for inventory changes and depreciation, the average property business profit for the group fell to about $21,000. Again there was considerable variation around this average with about 40 percent of the group recording a negative business profit and 35 percent and 25 percent having a business profit of between zero and $50,000 and greater than $50,000 respectively.

The main contributors to cash receipts were livestock and grain sales (28 percent and 27 percent respectively). Wool sales comprised 16 percent. Off-property income was a significant contributor at 22 percent of total cash receipts.

On average, surveyed properties had total business assets valued in excess of $1.3 million and an average debt of about $175,000. Average business equity for the group was 85 percent. This relatively high average was reflected in the distribution of business equity with over 45 percent of the group having an equity ratio of between 90 and 100 percent.

Of respondent's total equity, an average of 86 percent was based on primary production equity (e.g. land, machinery) while 14 percent was based on non-primary production equity (e.g. town property, shares).

Refer to table 5 in Appendix A for further details on financial performance.



Social profile

Within the Mid Talbragar catchment there was a relatively broad distribution of age groups. Forty-three percent of males and 44 percent of females were 46 years and over. Nineteen percent of males and 26 percent of females were between 26 and 45 years of age while 21 percent of males and 26 percent of females were dependent children (less than 15 years).

In general, it is an experienced male group with 58 percent of males having more than 21 years of farming experience. However, reflecting the broad age distribution within the group, 30 percent of males and 37 percent of females had less than ten years farming experience and 12 percent of males and 20 percent of females had between 10 and 20 years experience.

Sixty-five percent of male respondents had post secondary school qualifications (37 percent tertiary and 28 percent trade/vocational). For female respondents, the corresponding figure was 69 percent (47 percent tertiary and 22 percent trade/vocational).

Refer to table 6 in Appendix A for further details on social profiles.

Attitudes of landholders to biophysical, production and social issues

Respondents were asked a number of attitudinal and intentions type questions relating to land condition, salinity/high watertable trends and damage, past and intended implementation of salinity mitigation measures, property future and threats, condition of capital equipment, current and prospective enterprises and local services.

Land condition

The land condition problems of most overall concern to the group were weeds, kangaroos and foxes. At least 80 percent of respondents rated these three problems as either a *slight*, *moderate* or *serious* problem and a minimum of 50 percent of respondents rated these three as at least a *moderate* problem.

Salinity/high watertables were at least a *slight* problem for 75 percent of the group although 21 percent of respondents rated it as *no problem/non-existent*.

At least 60 percent of respondents considered waterlogging, acidity, erosion gullies and scalds/bare earth to be at least a *slight* problem. The problems of least overall concern were rabbits and sodicity (around 50 percent of respondents rated these two problems as *no problem/non-existent*).

Across all possible problems the most common rating was *slight* (37 percent of total ratings). A *no problem/non-existent* rating was the next most common at 31 percent of total ratings. A *moderate* rating accounted for 24 percent of all ratings while a *serious* and *don't know* rating accounted for just seven and one percent respectively.

For problems rated as either *serious* or *moderate*, respondents were asked to estimate the area affected by the problem. In general, for pests and weeds the areas affected were large because these problems are not generally site specific. Therefore, for example, the average area affected by weeds, foxes and kangaroos was 334 hectares, 505 hectares and 189 hectares respectively.

With respect to land condition problems that are more site specific such as salinity and erosion gullies, the areas are relatively small. The average area affected by salinity/high watertables was just 9 hectares. The average areas affected by waterlogging and acidity were 42 and 112 hectares respectively.

Full details of land condition survey responses can be found in tables 12 and 13 in Appendix A.

Salinity/high watertable trends

About 85 percent of respondents who had rated salinity/high watertables as at least a slight problem believed it had worsened over the past five years. Ten percent believed the problem had stabilized and five percent were not sure.

The most common category of cost or damage incurred in the past five years as a result of salinity/high watertables was lost production from salted land. Of lesser importance were damage to infrastructure, salinisation of on-property water supplies, loss of shade and shelter and loss of aesthetic value. Refer to tables 14 and 15 in Appendix A for further details on salinity/high watertables.

Past implementation of salinity mitigation measures

The majority of respondents had implemented an increased area of perennial pasture and made greater use of conservation farming during the last five years. However, these two measures have not necessarily been in response to a salinity problem. Of the 80 percent (19 respondents) who had increased their perennial pasture area, almost all said it was not because of salinity. Of the 71 percent (17 respondents) who had implemented conservation farming measures, all said it was not because of salinity.

The remaining salinity mitigation measures were less frequently implemented. Nine respondents (38 percent) had fenced off creeks and waterways and five respondents (21 percent) had established farm forestry and had fenced off remnant vegetation. Four respondents (17 percent) had increased their area of saline pasture.

The least implemented measures were establishment of saline agroforestry, utilization of intercropping and increased area of native pasture.

Past implementation of salinity mitigation measures

Salinity mitigation measure	Had measure been implemented			
	Yes (Mainly due to salinity)	**Yes** (But not due to salinity)	**No**	**Not applicable**
	no.	no.	no.	no.
Increased area of perennial pasture	1	18	5	0
Used conservation farming	0	17	6	1
Fenced off creeks and waterways	2	7	15	0
Established farm forestry	2	3	16	3
Increased area of saline pasture	4	0	18	2
Fenced off remnant vegetation	0	5	19	0
Used saline agroforestry	3	0	19	2
Utilised intercropping	1	2	20	1
Increased area of native pasture	0	2	22	0

Future implementation of salinity mitigation measures

Respondents were then asked if they intended not to implement any of the same set of salinity measures in the next five-year period. Furthermore, respondents were asked to provide their main reason if they were not intending to implement any particular measure.

Future implementation of salinity mitigation measures		
Salinity mitigation measure	*Number NOT intending to implement measure* no.	*Major reasons for not intending to implement measure* Reason and (no.)
Increase area of perennial pasture	1	▪ Wouldn't fit-in with existing set-up (1)
Increase use of conservation farming	16	▪ Already doing as much as intend to (9) ▪ Not profitable or productive (3) ▪ Wouldn't fit-in with existing set-up (3)
Fence off creeks and waterways	11	▪ Not profitable or productive (4) ▪ Already doing as much as intend to (2) ▪ Other reason (2)
Establish farm forestry	18	▪ Not profitable or productive (11) ▪ Other reason (3)
Increase area of saline pasture	12	▪ No/insignificant salinity/watertable problem (6) ▪ Other reason (4)
Fence off remnant vegetation	14	▪ Other reason (4) ▪ Not profitable or productive (3)
Utilise saline agroforestry	17	▪ No/insignificant salinity/watertable problem (7) ▪ Not profitable or productive (5)
Utilise intercropping	18	▪ Wouldn't fit-in with existing set-up (7) ▪ Don't know enough about it (3) ▪ Don't have the right equipment (3)
Increase area of native pasture	14	▪ Not profitable or productive (10)

The one measure that almost all respondents (23 out of 24) are intending to implement is an increased area of improved perennial pasture.

However, at least around 50 percent of respondents in the Mid Talbragar group are not intending to implement the remaining salinity mitigation measures over the next 5 years.

The three measures most respondents are not intending to implement are farm forestry (75 percent), intercropping (75 percent) and saline agroforestry (71 percent). For farm forestry, the major reason given for not implementing the measure was it was considered not profitable or productive. For intercropping the main reason was it would not fit in with the existing property set-up and for saline agroforestry there were two main reasons–it was not profitable/productive and there was no or an insignificant salinity/high watertable problem.

Around 67 percent of respondents were not intending to make more use of conservation farming principally because respondents were already doing it to their preferred extent. Just under 60 percent was not intending to either increase their area of native pasture or to fence off remnant vegetation. For native pastures, the dominant reason was lack of profitability or productivity whereas for fencing off remnant vegetation there was no predominant reason given for not implementing this measure. Refer to tables 16 and 17 in Appendix A for further details on past and future implementation of salinity mitigation measures.

Farming intentions and threats

Most (92 percent of respondents) in the Mid Talbragar survey group intended to still be owning/operating their current property in five years time. Over half the group (58 percent) intended to stay much as is in terms of their current operation and 33 percent intended to increase their property size.

The greatest perceived threats to respondents still being farming in five years time were the cost-price squeeze (25 percent), climate risks, such as drought, (20 percent), and age/health reasons (19 percent). The next most nominated threats were government regulations, land availability and other reasons at around just 6 percent of total nominations.

Full details of survey responses regarding farming intentions and threats can be found in tables 22, 23 and 24 in Appendix A.

Capital items condition

A majority of the group believed their plant and improvements were in at least a good working condition. The combined ratings for the *good condition*, *above average* and *excellent* categories amounted to 72 percent of total ratings. The most common individual rating was *good condition* (40 percent of all ratings).

Around 25 percent of total ratings were attributed to the *below average* category and just three percent of total ratings were for the *poor condition* category.

Part of the reason for the generally good condition of major items of plant was decisions to invest in these items. At least half of the group had made significant expenditure on both improvements and plant and machinery during the past five years. The average amount spent per farm over this period was $131,000 on plant and machinery and $59,000 on improvements.

Refer to tables 18 and 21 in Appendix A for further details on capital items condition.

Enterprise preferences

The most liked enterprises were cattle, sheep and cropping with 83 percent, 79 percent and 75 percent of respondents respectively applying a *highly liked* or *liked* rating. Cattle were the only enterprise not to get a *highly disliked* or *disliked* rating.

The enterprises that were least liked were pigs and horticulture (annuals). Sixty-seven percent of respondents applied either a *highly disliked* or *disliked* rating to these two enterprises.

Farm forestry had the greatest proportion of *not sure* ratings (50 percent of respondents). A further 21 percent of respondents gave this enterprise at least a *liked* rating while 29 percent gave it at least a *disliked* rating. Refer to table 19 in Appendix A for further details on enterprise preferences.

Preferences or liking for enterprises

Enterprise	*Disliked or highly disliked* *no.*	*Not sure* *no.*	*Liked or highly liked* *no.*
Cattle	0	4	20
Sheep	3	2	19
Cropping	5	1	18
Farm forestry	7	12	5
Horticulture – trees/vines	11	8	5
Pigs	16	7	1
Horticulture - annuals	16	7	1

Local services

In terms of perceptions regarding improvements/deteriorations in local services, 41 percent of total responses indicated that services had *stayed the same*. The proportion of total responses for the *improved* category was 27 percent while the *worsened* category attracted 25 percent of total responses.

The two services given the most nominations in the *worsened* category rating were banking and other government agencies (accounting for 36 percent of nominations in this category). The two services receiving the most nominations in the *improved* category were shopping – groceries/small goods and shopping – other household items. Refer to table 20 in Appendix A for further details on ratings of local services.

4

4. Mid Talbragar sustainability profile

The following profile is based on the previous biophysical assessment and the surveys.

4.1 Water and climate

In most of the area, farming operations are currently sustainable within their current land use with respect to the water resource. That is, the current quantity and quality of water will not change (within the natural climatic fluctuations) to the point where current enterprises are no longer sustainable.

There has been a fundamental change in the water balance for both the Racecourse and Snake Gully sub-catchments as a result of the introduction of agriculture. The catchment, however, is heterogeneous and there are large variations in the salt and water balance across the region. This change has seen an increased amount of runoff, together with an increase in groundwater discharge (either via the land or directly to streams) in some areas. This will likely lead to increased levels of salt being mobilised in the creeks and streams, and will limit future enterprise options. Conversely, in some other areas the development of soil structure and the increase in organic content (via the adoption of conservation farming practices and establishment of deep rooted perennial pastures) is resulting in a reduction in runoff.

The supply of water (in terms of quantity and quality) in the areas farms would be inadequate for large-scale intensive horticultural irrigation enterprises. On most properties there is frequently insufficient good quality water to even maintain a good farm house garden.

In addition, there are major structural impediments to intensive horticulture in the catchment, which include the need for irrigation licences and major investment in water storage infrastructure. Even though olives are less demanding for water quality and quantity than viticulture, it is unlikely that there will be sufficient water available to support these enterprises. Although salinity levels would have to increase by a factor of 10 to be a problem for livestock, in the majority of the catchment they are unsuitable for irrigated intensive horticulture or vegetable enterprises.

4.2 Soil and nutrients

In some areas of the catchment, there are acidifying soil conditions and without liming these soil resources are being used unsustainably. The production of pH sensitive crops in acidifying soils (for example canola) needs the application of

lime. Fortunately, the long run profitability of canola and other acid sensitive crops ensures the feasibility of a lime management program.

There are two components to the issue of pasture liming. In the first instance, while pastures on low pH soils produce less, they are also less water efficient which results in increased levels of deep drainage. Secondly, higher water-using deep-rooted perennial pasture species (lucerne and phalaris in particular) don't persist on low pH soils.

Whether liming of pastures is economic (in terms of on-farm investment decisions) depends critically on returns for livestock enterprises. During 1999/2000 livestock returns made liming of pastures only an economically marginal activity, however, livestock enterprise prices for 2000/2001 were more favourable. Lucerne, which is acid sensitive, is seen as a key pasture component for the management of dryland salinity due to its deep rooted perennial nature. Where there are off-site impacts associated with salinity the community may choose to share the cost of liming.

There are areas of land salinisation due to dryland salinity processes in the area with the largest area of discharge sites in the GFS associated with the Snake Gulley. Recent research results indicate that the extent of salinisation is depending on the long term climatic fluctuation. It is unknown how large the affected area will become in the medium term. However, in terms of the sustainability of the agricultural productivity of the Mid Talbragar area, discharge sites have a negative impact on only a small proportion of some of the producers and it is unlikely that land salinisation will become significant enough to force any farms to become unsustainable.

In some areas of the catchment, the nature of the deep drainage and its interaction with the underlying groundwater systems means that most increased recharge will never be expressed as land salinisation, but will, instead, be transferred to streams and creeks as an increased base flow.

In some instances, farms may become unsustainable where there is pressure brought to bear from a perception at the catchment level that land use change is required to meet catchment salinity targets. Especially, if the required land use change is uncompensated.

In some areas there is gully and wind erosion but this is much less than earlier in the last century and much of this has been stabilised with producer or government supported works. As long as this degradation is managed at current levels, erosion and associated turbidity issues will not severely impact on long term sustainability. Absorption banks designed to manage erosion have exacerbated salinity problems on some properties.

There is anecdotal evidence that increased bed-load sediment transport is impacting negatively on the riverine environment, especially in the lower parts of the Spicer's Creek. It is unknown how this will affect the sustainability of the ecosystems in the creek now and in the future.

There are concerns about the fragile nature of a large proportion of the soil resource base (in terms of nutrient balance, soil biota and structure). Continuous cropping or short rotations, and conventional tillage with long fallows on some properties have lead to both soil and salinity problems. Future management will have to be more intense to ensure sustainable levels of production.

Many of the soils in the catchment suffer from low fertility levels. This will require an increasing level of inputs to maintain sustainable levels of production. For some farmers that are vulnerable to small changes in profitability, this high level of inputs may lead to unsustainable conditions.

4.3 Vegetation and biota and genetic resources

As with other aspects of the resource base, the Mid Talbragar area has a complex distribution of vegetation, biota and genetic resources. Much of this information was described earlier in section 3.1.

It is believed that the low percentage of remnant vegetation and associated biodiversity in a large proportion of the Mid Talbragar area is unsustainable and would be a target under the Central West Catchment Plan (the Blueprint).

Some species trials have been instigated (under the auspices of a number of government programs, for instance, MF&F, and some small plantings for commercial agroforestry have been made. There are limited agroforestry plantings as a result of the TARGET project; however, there is no commercially viable forestry in the Mid Talbragar area to date as few of the plantations have an identified market product.

Weeds, kangaroos and foxes are the land condition problems of most concern for the group. Weeds of concern include broadleaf weeds such as thistles, there is growing concern in the local area about annual grasses in the cropping areas and woody weeds are a problem on some properties in the eastern parts of the area. Weeds are being managed with inputs of time and funds. However, they should not impact on future sustainability or pose an impediment to the implementation of strategic management plans.

4.4 Social

The Mid Talbragar area is composed of a number of semi-independent communities and there are some significant differences between these groups

which present barriers to community action (for example, groups from different religions - some with different attitudes to alcoholic beverages- which are concentrated in some areas of the catchment are more likely to work together rather than with members of the other groups). There appeared to be almost glass wall boundaries between the communities of the Mid Talbragar area and those of the Mitchell Creek, upper Spicer's Creek and the Talbragar valley areas (not including the Ballimore community with its school and Hotel). However, the recent revival of the Gollan Hall as a district social centre appeared to be a very positive development.

Respondents identified the following as key issues associated with the TARGET project and Landcare generally:

- Landcare was not seen as representative of the whole catchment, even from within Landcare itself (key categories included those in Landcare who were active, those who were in Landcare and were inactive, those who wanted to get into Landcare and who had not been allowed and those who never wanted to be associated with Landcare or any form of government assisted natural resource management);

- The majority of participants identified significant impediments to integrated catchment management; and

- A significant number of participants think that Landcare is not a good model for the implementation of integrated catchment management.

Of the producers interviewed in the Mid Talbragar area, generational transfer issues have affected a significant proportion. Land degradation can result from a poor outcome of the process due to economic hardship and unsuccessful transfer can be a major impediment to participation in integrated catchment management. The reasons for this impediment are complex and different for each family, but lies in the old adage that "farmers live poor and die rich". For example, some producers, while waiting for the transfer process to proceed, are less likely to make capital investments in property production systems or land degradation rehabilitation. The catchment wide impact of this process is unknown, but appears to represent a significant risk to TARGET and related programs.

Based on information gained from interviews related to the value of land in the catchment and the healthiness of the land market, it is unclear whether property build-up, fragmentation or churning is occurring. However, in most cases there appeared to be a healthy turn over of land driven by a desire to invest in primary production. The land market in the catchment appeared to be working in providing a healthy level of turn over and the possibility of farm build up through aggregation. Unlike other areas closer to the regional centres, the land values are

primarily determined, for the majority of the area, by primary production-driven market forces.

The age profile of farm managers is healthy, spread broadly from 27 to 70 years and with an average age of 50 years. There appears to be reasonable levels of replacement amongst the managers from both within the farm family units and from outside of the catchment – this is seen as a healthy social indicator.

There is also a significant group of people that may be classed as dependent children—21 percent of males and 26 percent of females. This could be interpreted as another positive social indicator, but has implications for the levels of farm income necessary to sustain these family units.

For most producers, farm education and access to information associated with most "Best Management Practices" and with forms of land degradation do not appear to be an impediment to farm or catchment sustainability. The managers interviewed are open to new ideas and aware of the changes taking place both in grazing and in rural society generally. Management systems on most of the farms include implementation of best management practices and information systems (for example, state of the art computer hardware and software and farm record keeping systems). This situation is another healthy indicator and may promote movement to a longer term sustainable base. However, many producers with secondary education were frequently challenged in two areas – the first was in understanding the nature of integrated catchment management concepts and land degradation processes, and the second, the more technical aspects of best management practices. For example, although most producers involved in cropping were using soil testing services many lacked the technical knowledge required for interpretation of results.

There are relatively high levels of experience amongst the farm managers with 58 percent of males having more than 21 years of farming experience. Long term experience across a range of farming conditions is necessary for natural resource management. It was noted that the skill sharing amongst the husband/wife partnerships on the farms in the catchment was a significant feature that impacts positively on farm sustainability. Although 37 percent of females had less than 10 years of farming experience, 69 percent had post secondary education—with 47 percent tertiary educated and many with non rural career experience.

In terms of future enterprise choices, the surveyed producers indicated a major preference for the current set of land uses. Their preference for enterprises that are seen as beneficial for natural resource management are at best neutral, and in most cases disliked.

Survey results indicate a wide distribution of managerial expertise and that for a significant proportion of the catchment community this would be an impediment

in their participation in integrated catchment management. For instance, high levels of managerial expertise are essential to deal with the more technical aspects of natural resources and environmental issues; issues that are usually not visible, move beyond the farm boundary and occur over long times.

Although most local services were perceived to have improved or to have remained the same over the past few years, banking related services, other government services and roads were generally believed to have deteriorated. As with other regions, as services deteriorate, people tend to compensate by travelling larger distances to access required services at acceptable levels. For example, key service centres identified by the catchment community included Dubbo, Orange and Wellington. Accordingly respondents are more sensitive to the condition of the local roads – most respondents rated local roads as a major concern. In particular, the use of the Goolma to Muronbung road as part of the main road from Mudgee to Dubbo has resulted in a significant increase in traffic and road maintenance (which has not been helped by the road being used beyond its carrying load capacity and the increase in high water tables and salinity).

The owners and managers supplied the majority of property labour. A shortage of skilled labour was identified as a major impediment to current land management and would be a significant impediment to the adoption of any ICM Strategic Management activities by producers with limited time availability.

The Mid Talbragar area is surrounded by regional centres that offer opportunities for employment and off-farm income. Two different groups from the farm are accessing these employment opportunities – spouses and rural youth. However, these opportunities are generally limited and are decreasing in the smaller centres (such as Wellington). Local youth employment opportunities have traditionally been an important outlet for farm youth whilst retaining them in the region. With the need to now move further a field to gain employment, a key family labour resource as well as future farm managers is being lost from the system – with an associated link to a reliance on an extremely limited skilled, farm labour pool. As well, with the reduction in local service industries (such as banks, schools and hospitals) a source of employment for spouses (who may have strong training in these service areas) is also being lost. These same service industries have also been an extremely important source of (usually better educated) family farm partners for young producers.

The nature of communication is a major impediment to participation in TARGET related activities. For example, in some farm families, at least one spouse is working full time off-farm, and when this is coupled with a lack of skilled labour, there is little time to attend meetings. Feedback from the community included comments that there was a need for a range of approaches to communication (for example, many producers simply missed the notices for meetings when

volunteers were called for TARGET projects and as a consequence missed out on participating).

Information from the Sustainability Profile surveys suggests that 76 percent of producers surveyed could be considered socially sustainable, while 24 percent could be considered socially unsustainable.

In summary, the question of whether the Mid Talbragar area will be socially sustainable into the future is very complex. Based on the surveys undertaken there appears to be a healthy social system in most of the area. However, there are some farm families that may be vulnerable to further change. This will require further monitoring to assess their social health, and may require specific programs to address any impediments that arise. This approach will need to be carefully integrated into integrated catchment management.

4.5 Farm business

The financial results for the group showed some wide variations in most summary statistics. Most farms had a low or negative business profit and rate of return to capital. Farming 500 studies recommend a business profit of $50,000 for medium term sustainability. About 80 percent of those interviewed had a property profit of less than $50,000 and this is seen as unsustainable in the medium term. Commodity prices in 1999/2000 were viewed as being close to long term averages.

There are few if any alternative enterprises which appear to offer a win-win situation with respect to farm profitability and salinity. For example, a preliminary assessment, within the TARGET project, of farm forestry enterprises indicated a decrease in farm profits compared with the profitability of existing enterprises. As well, carbon, salinity and biodiversity credits and other strategic incentive schemes would have to be substantial to have any impact, based on the above farm forestry economic analysis.

An important characteristic of the group was the very high equity of all properties (the average business equity for the group was 81 percent). About 10 percent of the respondents had equity of less than 60 percent. This is the equity lower limit for some financial institutions' lending requirements. Producers in this category are facing a major impediment in their ability to borrow, especially for natural resource management.

Producers at the higher levels of equity will have a future opportunity to financially adjust against falling profits by refinancing or selling. However, given the high opportunity cost of capital, most farmers in this situation would be financially better off investing their asset outside agriculture. That is, there continuation in primary production is a lifestyle choice.

Off-farm income was important for most of the group and averaged 22 percent of gross cash receipts per property. Off-farm income partially compensated for low farm returns. The effort involved in earning off-farm income means that there is less opportunity to provide labour into the farm enterprise as well as participation in natural resource management. This, coupled with the scarcity of quality labour, provides a major impediment to participation in integrated catchment activities for this group.

A majority of the group believed their plant and improvements were in at least a good working condition with an average of 72 percent having a combined rating of *good condition*, *above average* and *excellent*. The generally good condition of plant and equipment is due to continued capital expansion or replacement over the past five years.

5

5. Producer comments on TARGET

Producers provided comments on the TARGET process and the recommended management options during the interview process. This was an unstructured process that does not support rigorous statistical analysis. Although the questions were neutral and designed to elicit any feedback, the majority of comments were negative (ie complaints) or neutral (ie suggestions for improvements of perceived inadequacies), very few were positive. However, there were a number of generic themes identified. The following is a listing of the generic themes with a summary of the nature of the comments and related key issues.

Communication

Nature of comments

(4) Four comments related to inadequacies in the communication approach and possible improvements.

Key issues

Complicated and new programs like TARGET require a strategic communication approach in parallel with the implementation process – before, during and after. In particular, communication strategies associated with more targeted programs (ie non voluntary projects which need to have full community participation) will need to include a range of approaches and scheduled times to ensure effective communication. This is a major problem with a project like TARGET where there was an expectation that the project would be implemented from the first day with a very short time for overall implementation (2 years). There were a significant number in the community who indicated that they would not attend a public meeting convened by a government agency to address the management of natural resources and environmental management issues.

Technical support

Nature of comments

(2) Two comments related to inadequacies in the technical support.

Key issues

Producer investment decisions require appropriate technical information about the biophysical, social and financial nature of the problem associated with a 'business as usual' approach and how that outcome would change following the implementation of management actions. The broad range of management actions associated with the TARGET project required a broad range of technical expertise, much of which was not available as part of the TARGET project process or from within DLWC (for example, forestry expertise).

Extension

Nature of comments

(3) Three comments related to inadequacies in the extension services.

Key issues

A significant number of producers lacked the information for assessment of their salinity problems and the development of an appropriate management plan, even when they had a general awareness of the issue. Appropriately qualified and respected extension officers are required to facilitate information flows needed for producer investment decisions related to the adoption of program management actions. Many producers indicated that they would prefer to deal with non-government agents who did not have the same 'conflicts of interest' as occurs with many government extension officers.

Funding/implementation process

Nature of comments

(15) Fifteen comments (the largest number of comments for all themes), related to inadequacies in the funding/implementation process.

Key issues

Complicated and new programs like TARGET require an accountable, transparent (for example, publicly available information on the eligibility criteria) and consistent approach, with appropriate funding over a suitable time schedule. This research identified a broad range of financial and non-financial impediments to the adoption of the management actions associated with the TARGET project, some of which where taken into account in the second year of the project. Funding/implementation processes varied between focus catchments in year one and evolved with many improvements between year one and year two based on information from the profiles project.

DLWC relationships

Nature of comments

(3) Three comments related to inadequacies in producer-DLWC relationships.

Key issues

Management of natural resource and environmental issues, frequently involves winners and losers and will always be subject to criticism. The success of complicated and new programs like TARGET will rest on key government agencies working hard to maintain community respect (the dual 'game keeper-

poacher' roles held by the DLWC is a significant impediment for many producers). Some of the comments related to mistakes made by DLWC many years ago associated with the soil conservation program.

TARGET project

Nature of comments

(13) Thirteen comments (the second largest number of comments for all themes), related to inadequacies in the nature of the TARGET project (excluding funding and the implementation process), of which one producer had a positive comment of support.

Key issues

Complicated and new programs like TARGET require a comprehensive community consultation phase, well in advance of the implementation phase, during which key components are thoroughly discussed and negotiated. At a minimum there is a need for a general awareness of the nature of the perceived problem and the details of the proposed management plan and for those who will be expected to participate, 'relative consensus' will be required regarding the nature of management actions and the funding /implementation process.

Government Policy and programs

Nature of comments

(11) Eleven comments (the third largest number of comments for all themes), related to inadequacies in the nature of Government policies and programs designed for the management of natural resources and environmental issues.

Key issues

In addition to comments of disapproval of a range of government policies and programs (for example, Landcare), there was considerable confusion as to the exact role and nature of the TARGET project and its relationship with the broad range of other natural resource and environmental management strategies and programs (for example, CMB Blueprints and the Mid Macquarie Landcare Plan).

The broad range of comments made by producers above, indicates that there are a significant number of financial and non-financial impediments to the TARGET project. Unless addressed, these issues will remain as constraints to achieving the objectives associated with TARGET and other related natural resources and environmental management projects. It is recommended that the key government agencies responsible for the management of issues associated with the broad range of comments are identified and processes implemented to develop management actions to overcome these impediments. The following section also lists a number of other impediments identified during the study.

6

6. Impediments to ICM land management options

There are a range of impediments that can be identified as a result of the analysis of the information in the Mid Talbragar Area.

- Salinity is not impacting negatively on all of the catchment equally. No individual producer is likely to be unsustainable because of salinity in the medium term. There is a lack of information on the nature of off-farm impacts associated with salinity within the Mid Talbragar area. There are some areas that will be contributing substantially to the internal salt and water budget, whilst there are some areas that have been assumed to be doing so, but are probably not;

- There was no linkage between the TARGET management options and the goals of the broader Central-West Catchment Management 'Blue Print". This lead to an inability to assess the merits of TARGET management options in delivering against these goals. This reinforced a focus on an inputs-based Landcare model rather than a strategic approach based on outputs;

- Most producers lack an appreciation of the ICM salinity management problem and the ICM implications are not specific to their catchment, in particular there were no clear goals or performance criteria for salinity management of off-farm impacts for the Mid Talbragar area, against which success could be measured. For example, some producers believed that the Mid Talbragar area salinity problem was a result of regional groundwater flows from the Burrendong area;

- There is a great range of circumstances amongst the farmers in the catchment, and DLWC needs to tailor its programs to take account of this diversity;

- Some of the producers are socially unsustainable (for example they have significant succession planning problems). Succession planning issues impact on family relationships, farm management decisions and farm finances and are a significant impediment to natural resource management in the Mid Talbragar area;

- Many non Landcare producers disapprove of the use of taxpayers funds for the management of land degradation on the properties of those who have caused the problem (ie. a perverse motivation system);
- Most producers lack the understanding of the salinity processes and the way it impacts on their production processes – nor do they have salinity management plans;

- Most producers lack appropriate information for farm scale investment decisions associated with the TARGET management options;

- Most alternative enterprises are risky, capital intensive or long-term crops with a common feature of uncertain long-term market outlook;

- Most producers lack specialist skills for some of the key TARGET management options, nor are they interested, in alternative enterprises;

- There is a lack of time to spend on implementing and learning about options;

- There is a lack of skilled labour to backfill for farm operator participation when undertaking environmental projects;

- Some producers have implemented all of the "Landcare" they intend to (consistent with farm plan), as part of a previous Landcare funded project;

- Wellington Local Government rates are relatively high and are an impediment to producers taking land out of the most profitable production;

- Property rights which clearly define rights for natural resources and duty of care responsibilities are a major impediment. A number of producers made it clear that they had no intention of participating in any community based approach to natural resource and environmental management. Some made it clear they wouldn't even work with neighbours;

- DLWC have a conflict of interest in their Landcare and regulatory roles – some producers were not keen to have DLWC representatives on their properties;

- The lack of a properly quantified problem statement (in particularly biophysically) associated with the current land management practices, against which the various salinity (and other) management options can be assessed in terms of a net future improvement in conditions. For example, whilst the nine land management options have been proposed as a *no regrets* approach for natural resource management, some of the options

may have little impact on the salinity problem in the future. This emphasises the role of monitoring and evaluation in reducing the level of uncertainty associated with the *no regrets* approach, which was the central objective of the TARGET project;

- Key data sets were not available (that is, had not been collected) that would have better informed the development of a problem statement for the area. These data sets need to be spatially and temporally defined so that the impacts of management options can be accurately predicted; and

- The approach adopted for TARGET in the first year relied heavily on the implementation model used under Landcare, which was predominantly a voluntary, grants-based, input subsidised program, rather than a program that focussed on achieving defined ICM goals. It is acknowledged that the mix of options was a *no-regrets* approach put forward as a means of progressing the development of an implementation model for a broad range of natural resource management issues. Further, the options are not being strategically located to produce a salinity benefit, and therefore the impact on salinity by the investment of public monies under TARGET is likely to be limited The management options are also being offered via a voluntary process which mitigates against achieving strategic salinity reductions—there are no compliance criteria to assess whether the management options are best sited on the areas as volunteered by the producers. Finally, the selection criteria did not include the requirement for demonstrated salinity outcomes at the catchment scale (as opposed to the farm scale). Consequently, it is likely that attempts to determine the effectiveness of TARGET in terms of a change in the salinity condition within the catchment will be inconclusive.

7

7. Strategic ICM in the Mid Talbragar

ICM in the Mid Talbragar catchment has two dimensions. Firstly, there are ICM issues that relate to the Mid Talbragar catchment itself, and secondly, issues that relate to how the Mid Talbragar catchment fits within the broader Macquarie catchment.

Issues with a high priority at the catchment scale reflect those with the highest community costs, those for which off site impacts are involved and those for which the failure to manage the situation may result in irreversible consequences (for example, loss of biodiversity). The different forms of degradation, as identified in the Central West Catchment Blueprint 2002/2012 are:

- Dryland salinity
- Declining surface water quality
- Declining health and abundance of native vegetation
- Degradation of riparian and wetland eco-systems
- Deterioration of the soil resource

Issues identified during producer interviews were (in order of priority):

- Weeds
- Kangaroos
- Foxes
- Dryland salinity

Problems of least overall concern were rabbits, woody weeds, soil sodicity and vegetation decline.

The current operating environment for regional and catchment planning of agriculture, natural resources and environmental management issues is undergoing some significant changes. In the past, planning has been achieved through a range of Landcare activities that have developed procedures and a culture focussed on inputs related to management activities (mainly at the farm scale). For instance, this focus results in funds allocated to the cost of fences, or the cost of trees, and a cost sharing debate solely based on how these input costs are valued and shared. The assumption in all this planning is that the implementation of appropriate inputs will result in the desired outputs.

Recently, however, there has been a concerted effort to implement an approach based on integrated catchment management (ICM). For example, an ICM strategy has been developed by the Murray-Darling Basin Commission as a blue print for future catchment planning and, in turn, it has been adopted as a primary objective of the Mid Talbragar Landcare Plan, the Mid-Macquarie Landcare Regional Plan and the Central West Catchment Management Board Plan. This approach will produce two significant changes. Firstly, ICM will require a

systems approach to planning – recognising that catchments are composed of natural systems where changes to one part have ramifications in another part. Secondly, ICM will also focus on the purchasing of outputs or benefits that contribute to achieving catchment targets. For example, managers will be inclined to fund a change for the better in the natural system – a reduction in river salinity at a certain point over a certain timeframe, or a maintaining of a number of species. The primary funder will be less concerned with inputs, but rather will leave the work program required to deliver the benefits up to local concerns.

As well, there will be issues of scale related to the way in which targets are managed and works implemented. By purchasing targets at the catchment level, implementation will be driven by a *down-scaling* process. That is, priority will be given to those areas where the most significant outcome at the whole of catchment scale will be achieved. This change from a focus on input costs to a focus on purchasing system benefits will produce a fundamental shift in both the distribution of responsibilities and the accountabilities. In particular, it has implications for the way in which work plans prioritise different parts of the catchment system to be managed so that a change can be guaranteed (that is, no more "vegemite" policies and programs). It will also have fundamental impacts on the way in which catchment plans are implemented.

For instance, in the previous funding model where money was expended on the basis of voluntary subscription, it would be difficult to ensure that catchment outcomes could be guaranteed. Under the new model, funds will need to be targeted to areas where the highest priority result can be found. The targeted recipient of funding may not, in fact, be a volunteer for the actions.

However, there will be issues within a catchment that will require action at the sub-regional scale but have little bearing on the whole of catchment output. In particular, areas of land significantly affected by dryland salinity may not be contributing to stream salinisation, but in themselves, will be of a high enough priority at the local scale to warrant action. Thus, management and implementation will be different at different scales within a catchment – ranging from the Catchment Management Board, through groups such as the Mid-Macquarie Landcare down to groups such as the Mid Talbragar Landcare group. In effect, each layer of catchment planning will require encapsulating the main issues from the plan immediately above them, and adding in those elements that are key to the desired objectives. That is, a plan such as for Mid-Macquarie Landcare will need to re-enforce those elements in place from the Macquarie CMB plan as well as introducing actions that would satisfy local objectives.

This new model will require a range of new information needs for it to work effectively. It will be critical to understand what processes need to change that will result in the desired benefit (for example, where will actions be required to reduce salinity to the required level in the given time frame). It will be critical

also, to understand the capacity of landscapes to produce the desired change – can this landscape be altered significantly enough to achieve the result and in what period of time.

Catchment plans are also changing in a different sense. In the past planning has been driven by the need for actions related to natural resource issues. However, the identification and prioritisation of the key natural resource and environmental issues does not provide the basis for strategic management. A professional assessment of the biophysical nature of the issues is required in terms of the likely nature of impacts and extent under a "business as usual "approach. In addition, information on the biophysical linkages or relationships associated with landscape change and the impacts on the natural resource base and the environment is required.

Strategic management of agriculture, natural resources and environmental issues requires the development of plans for all stakeholders. In particular, as indicated above, management plans are required for farm level and for catchment level managers. Farm level managers operate at scales up to 1:10 000 while catchment managers operate at scales from 1:50-100 000. Whereas farmers may also be required to manage issues of concern to catchment managers, catchment managers are only required to manage issues, which flow beyond the farm gate.

There is a need for a strategic management plan that deals with the issues of concern for the Mid Talbragar catchment, as a complement to the broader Central West Catchment Blueprint and the Mid Macquarie Landcare Plan. It is recommended that a Mid Talbragar Catchment Plan be developed based on an ICM process and should include the following:

- Development of a professional problem statement associated with a *business as usual scenario*;
- Identification of the stakeholder's vision for the catchment;
- Identification of the technical, economic and social feasibility of management options;
- Implementation; and
- Monitoring and evaluation.

Landcare programs have frequently failed to differentiate between the two scales. For example, management of biodiversity and most weeds, are not catchment management issues requiring catchment scale analysis. Most issues requiring catchment analysis and management are related to water quantity and quality.

The Mid Talbragar catchment of the Sustainability Profiles project was strategically selected as a small scale catchment which would provide information on the most appropriate approach for scaling up to develop profiles for the whole of Macquarie catchment. Experience associated with the collection

of the above information indicated the nature of heterogeneity likely to occur in catchments similar to those with the Mid Talbragar scale. This information will be used in the development of the approach and the sample selection process required for the development of profiles for relatively homogeneous sub-catchments of the Macquarie catchment.

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A

Appendix

A. Property survey results tables

Results for some of the survey information are presented in table format under the following four column headings; "Total for group", "Average for group", "Highest value" and "Lowest value".

As the heading suggests, "Total for group" is simply the summation of relevant results for the group. The "Average for group" figure is in most cases the calculated mean for all properties. However, for certain variables such as crop yield and stock sale price, the average is based on the subset of respondents who had a particular crop or sold livestock and is therefore not necessarily the average for all properties. "Highest" and "Lowest" value refers to the respective highest and lowest value recorded by any member of the group. Where there were fewer than three responses to a question, then the average and highest/lowest figure is not necessarily provided in order to retain respondent confidentiality.

Financial performance terms

Property business cash receipts
: Includes all property business cash receipts.

Property business cash costs
: Includes all property business cash costs (excludes capital costs and household/private/other business costs)

Property cash income
: Equals property business cash receipts less business cash costs.

Build-up in trading stocks
: The value (using standard numbers) of any changes in the inventories of livestock numbers and produce, hay, silage and grains.

Property business profit
: Equals property cash income plus build-up in trading stocks and less depreciation.

Business capital
: The value of all property business assets at 30 June 2000. Values are at market rates as estimated by the respondent.

Business debt
: The value of all property business debts at 30 June 2000.

Business equity ratio
: Equals business capital less business debt, divided by business capital. It represents the amount of business capital owned by the property owners.

Business/non-business equity ratio
: Equals business equity capital divided by business equity capital plus net non-business capital. It represents the proportion of property business equity relative to total equity.

1 Land use

		Catchment group			MT
		Total	*Average*	*Maximum*	*Minimum*
Total property area	ha	21,720	905	nc	nc
Proportion of area - owned	%	nc	100	100	97
- leased	%	nc	0	3	0
Area used for trees/vegetation:					
Revegetated area	ha	209	9	104	0
Remnant vegetation	ha	1,592	66	250	0
Farm forestry	ha	16	1	4	0
Total tree area	%	nc	9	28	0
Area used for pasture:					
Native	ha	4,113	171	980	0
Improved perennial	ha	7,083	295	990	0
Improved annual	ha	2,768	115	623	0
Other	ha	343	14	257	0
Total pasture area	%	nc	66	95	41
Area used for cropping:					
Wheat	ha	3,691	154	700	0
Canola	ha	866	36	300	0
Barley	ha	334	14	200	0
Oats	ha	250	10	75	0
Lupins	ha	234	10	120	0
Other grain	ha	0	0	0	0
Fodder	ha	279	12	121	0

nc = Not Calculated.

2 Labour

		Catchment group			
		Total	*Average*	*Maximum*	*Minimum*
Owner-operator labour	mnth	476	20	44	3
Permanent labour	mnth	28	1	12	0
Casual/contract labour	mnth	72	3	10	0
Total property labour	mnth	576	24	50	4
Off-property labour	mnth	155	6	26	0

3 Crop and animal production

		Catchment group			
		Total	*Average*	*Maximum*	*Minimum*
Crops					
Wheat yield	t/ha	nc	2.3	5.0	0.0
Canola yield	t/ha	nc	1.3	2.1	0.0
Barley yield	t/ha	nc	2.0	2.4	0.0
Oats yield	t/ha	nc	1.8	2.1	0.0
Lupins yield	t/ha	nc	0.7	1.3	0.0
Hay/silage produced	t	nc	38	244	0
Livestock					
Av. DSEs per area pasture	dse/ha	nc	7.5	14.2	3.4
Have livestock enterprise	no.	24	nc	nc	nc
Sheep					
Av. number ewes	no.	nc	1,425	5,450	0
Lambing percentage	%	nc	97	130	60
Wool cut per animal shorn	kg	nc	3.6	7.8	1.5
Average wool price/kg	$	nc	2.8	5.0	0.0
Average value sheep sold	$	nc	31	119	0
Cattle					
Number of breeders	no.	nc	29	140	0
Calving percentage	%	nc	89	100	38
Average value animal sold	$	nc	417	733	9

nc = Not Calculated.

4 Water

		Catchment group			
		Total	*Average*	*Maximum*	*Minimum*
Annual rainfall	mm	nc	593	672	500
Dams - no.		346	14	33	1
- maximum quantity	ML	nc	32	120	3
Bores - no.		30	1	5	0
- maximum quantity	L/h	nc	4,973	81,828	0
Springs - no.		1	0	1	0
- maximum quantity	L/h	nc	0	0	0
Wells - no.		8	0	2	0
- maximum quantity	L/h	nc	0	0	0
Creeks - no.		16	1	2	0
- maximum quantity		nc	nc	nc	nc

5 Financial

		Catchment group	
		Total	*Average*
Property business cash receipts	$	3,612,674	157,073
less property cash costs	$	2,952,651	128,376
Property cash income	$	nc	28,697
plus build-up in trading stocks	$	170,435	7,410
less depreciation	$	353,565	15,372
Property business profit	$	nc	20,734
Total cash receipts from:			
Livestock sales	%	nc	28
Wool sales	%	nc	16
Grain sales	%	nc	27
Misc. business receipts	%	nc	7
Off-farm income	%	nc	22
Off-farm income	$	993,593	43,200
Business capital at 30 June '00	$	31,711,238	1,321,302
Business debt at 30 June '00	$	4,200,835	175,035
Business equity ratio	%	nc	85
Business/non-business equity	%	nc	86

nc = Not Calculated.

6 Social profile

	Male		Female	
	no.	%	no.	%
Age group				
< 15 years old	13	21	11	26
16 - 25	11	18	2	5
26 - 35	4	6	3	7
36 - 45	8	13	8	19
46 - 55	11	18	10	23
56 - 65	6	10	2	5
> 65 years	9	15	7	16
Farming experience (since age 15)				
< 10 years	15	30	13	37
10 - 20	6	12	7	20
21 - 30	8	16	6	17
31 - 40	10	20	2	6
41 - 50	3	6	4	11
> 50 years	8	16	3	9
Highest qualification				
Secondary	16	35	10	31
Trade/vocational	13	28	7	22
Tertiary	17	37	15	47

7 Soil pH in pasture/crop paddocks

	Catchment group				
	<4.5 (1)	*4.6 - 5.5* (2)	*5.6 - 6.5* (3)	*> 6.5* (4)	*Don't know* (5)
	no.	no.	no.	no.	no.
Crop paddocks	0	7	14	1	2
Pasture paddocks	0	6	15	1	2

8 Usual application frequency for pasture topdressing with fertilisers/soil conditioners

	Every 1 - 2 yrs (2)	Every 3 - 5 yrs (3)	Every 6 - 10 yrs (4)	No pattern (5)	During estab'ment (6)
	no.	no.	no.	no.	no.
Fertiliser applications	8	3	3	3	7
Lime applications	0	1	3	2	3
Other applications	0	0	1	1	0

9 Crops usually applied with fertilisers/soil conditioners

	Wheat	Canola	Barley	Oats	Other
	no.	no.	no.	no.	no.
Fertiliser applications	22	8	8	15	2
Lime applications	6	2	2	1	0
Other applications	2	3	0	0	0

10 Usual basis for fertiliser/soil conditioner application decisions

	Soil tests	Agron-omist's advice	Visual assess-ment	District averages	Historical routine
	no.	no.	no.	no.	no.
Fertiliser applications	19	12	9	3	8
Lime applications	13	7	4	1	2
Other applications	4	1	2	0	0

11 Use of various methods and approaches to cropping

	Catchment group	
Method/approach	no.	%
Zero tillage	9	16
Minimum tillage	17	30
Intercropping	1	2
Opportunity cropping	0	0
Crop rotations	20	36
Phase farming	0	0
Conventional tillage	9	16

12 Rating of possible land condition problems on properties

	Group's rating of problems				
	Serious (1)	*Moderate* (2)	*Slight* (3)	*No problem/ non-existent* (4)	*Don't know* (5)
Problem	no.	no.	no.	no.	no.
Weeds	5	9	8	2	0
Woody weeds	1	6	5	12	0
Rabbits	0	0	12	12	0
Foxes	3	9	8	4	0
Kangaroos	4	9	7	4	0
Waterlogging	2	4	10	8	0
Salinity/high watertables	3	7	8	5	1
Acidity	0	8	7	8	1
Sodicity	0	3	9	11	1
Erosion gullies	0	4	12	8	0
Scalds bare earth	1	3	11	9	0
Other	0	1	0	0	0

13 Area affected if problem rated as either Serious or Moderate

	Catchment group			
	Total	*Average*	*Maximum*	*Minimum*
Problem	ha	ha	ha	ha
Weeds	8,004	334	2,000	0
Woody weeds	854	36	330	0
Rabbits	0	0	0	0
Foxes	12,128	505	2,340	0
Kangaroos	4,537	189	809	0
Waterlogging	1,018	42	773	0
Salinity/high watertables	213	9	100	0
Acidity	2,687	112	750	0
Sodicity	261	11	150	0
Erosion gullies	18	1	10	0
Scalds bare earth	6	0	2	0
Other	830	35	830	0

14 Perceptions of salinity/high watertable trend over past 5 years

	Group's perceptions	
Trend in salinity	no.	%
Worsened	18	86
Improved	0	0
Stabilised	2	10
Not sure	1	5

Only completed by respondents rating salinity/high watertables as al least a slight problem.

15 Damage and costs incurred due to salinity/high watertables

Category of cost/damage	Group's reporting of damage	
	no.	%
Lost production from salted land	18	38
Damage to infrastructure	6	13
Salinisation of water supplies	8	17
Increased fertiliser requirement	1	2
Loss of shade/shelter	5	10
Loss of aesthetic value	8	17
Other	2	4

Only completed by respondents rating salinity/high watertables as al least a slight problem.

16 Respondents implementing salinity mitigation measures over past 5 years

Mitigation measure	Yes (mainly due to salinity) (1)	Yes (but not due to salinity) (2)	No (3)	Not applicable (4)
	no.	no.	no.	no.
Increased area perennial pasture	1	18	5	0
Increased area native pasture	0	2	22	0
Increased area saline pasture	4	0	18	2
Used saline agroforestry	3	0	19	2
Established farm forestry	2	3	16	3
Used conservation farming	0	17	6	1
Utilised intercropping	1	2	20	1
Fenced remnant vegetation	0	5	19	0
Fenced creeks/waterways	2	7	15	0

17 Intentions to implement salinity mitigation plans in next 5 years

	Salinity mitigation plan				
	Increase area of perennial pasture	*Increase area of native pasture*	*Increase area of saline pasture*	*Utilise inter-cropping*	*Establish farm forestry*
Intention NOT to implement plan	1	14	12	18	18
Main reason for not implementing					
Not profitable or productive	0	**10**	**1**	**1**	**11**
Wouldn't fit-in with existing set-up	**1**	**1**	0	**7**	0
Simply not interested	0	0	0	**1**	**1**
Too much owner labour required	0	0	0	0	0
Already doing as much as intend to	0	**1**	0	**1**	0
Don't know enough about it	0	**1**	**1**	**3**	**1**
Don't have the right equipment	0	0	0	**3**	0
Country/climate not suitable	0	0	0	**1**	**1**
No need for it	0	0	0	0	**1**
No/insignificant salinity/w'table problem	0	0	**6**	0	0
Not applicable (eg. don't have a creek)	0	0	0	0	0
Other	0	**1**	**4**	**1**	**3**

	Salinity mitigation plan cont.			
	Utilise saline agro-forestry	*More use of conser-vation farming*	*Fence off remnant vegetation*	*Fence off creeks & waterways*
Intention NOT to implement plan	17	16	14	11
Main reason for not implementing				
Not profitable or productive	**5**	**3**	**3**	**4**
Wouldn't fit-in with existing set-up	0	**3**	**2**	**1**
Simply not interested	0	0	0	0
Too much owner labour required	0	0	0	0
Already doing as much as intend to	0	**9**	**2**	**2**
Don't know enough about it	**1**	0	0	**1**
Don't have the right equipment	0	**1**	0	0
Country/climate not suitable	0	0	0	0
No need for it	**2**	0	**1**	0
No/insignificant salinity/w'table problem	**7**	0	0	0
Not applicable (eg. don't have a creek)	0	0	**2**	**1**
Other	**2**	0	**4**	**2**

18 Rating of major plant items and improvements

	Group's ratings				
	Poor (1)	*Below average (2)*	*Good condition (3)*	*Above average (4)*	*Excellent (5)*
Item	no.	no.	no.	no.	no.
Main tractor	1	5	11	3	4
Crop seeding implements	0	6	8	5	2
Fences	0	5	17	2	0
Stock yards	0	5	10	8	1
Farm motor bike	0	5	7	5	4
Farm utility	1	8	4	7	3
Harvester	2	5	5	2	2
Wool shed	1	4	10	7	1
Machinery shed	1	6	8	7	2
Other	1	0	2	2	0

19 Preferences or liking for rural enterprises

	Group's enterprise ratings				
	Highly disliked (1)	*Dislike (2)*	*Not sure (3)*	*Like (4)*	*Highly liked (5)*
Enterprise	no.	no.	no.	no.	no.
Sheep	1	2	2	11	8
Cattle	0	0	4	10	10
Pigs	11	5	7	1	0
Farm forestry	1	6	12	5	0
Cropping	0	5	1	14	4
Horticulture - trees/vines	3	8	8	5	0
Horticulture - annuals	4	12	7	1	0

20 Rating of local services over the past 5 years

	Group's service rating			
	Worsened (1)	*Stayed the same* (2)	*Improved* (3)	*Not sure or not applicable* (4)
Service	no.	no.	no.	no.
Banking	15	7	2	0
Primary school	0	11	8	5
Secondary school	1	7	9	7
Doctor	8	13	2	1
Hospital	8	10	5	1
Other government agencies	12	6	5	1
Shopping - groceries/small goods	2	9	13	0
Shopping - other household items	0	11	13	0
Shopping - farm/machinery goods	9	9	6	0
Livestock/grain sale centres	0	17	7	0
Public transport	5	9	2	8
Entertainment	2	12	9	1
Mobile phone	7	1	0	0
Roads	3	4	1	0
RLPB	7	1	0	0

21 Significant expenditure on capital items during past 5 years

	Catchment group		
	Number buying item	*Average amount spent*	*Total amount spent*
Capital item	no.	$	$
Plant and machinery	14	131,119	3,146,858
Improvements	12	59,317	1,423,604

22 Intention to be owning/operating current property in 5 years time

	Group's intentions	
Intention to remain	no.	%
Yes	22	92
No	0	0
Unsure	2	8

23 Respondent's intentions for their property in the next 5 years

	Group's intentions	
	no.	%
Intention		
Stay much as is	14	58
Increase property size	8	33
Sell whole property	0	0
Sub-divide & sell small part of property	0	0
Lease out property	0	0
Sub-divide and sell most of property	0	0
Other	2	8

24 Perceived greatest threats to still be farming in 5 years

	Catchment group	
	no.	%
Climate risk (eg. drought)	14	20
Cost-price squeeze	17	25
Government regulations	5	7
Land availability & price	4	6
Lack of off-farm income	3	4
Animal pests	2	3
Weeds	1	1
Salinity/high water tables	2	3
Acidity/sodicity	0	0
Erosion	0	0
Age or health reasons	13	19
Property transfer	1	1
Wish to retire or change of lifestyle	3	4
Differences within family business	0	0
Differences in money distribution	0	0
Other	4	6