



Lower Goulburn Rehabilitation Project Socio-economic Issues Assessment

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Earth Tech Engineering Pty Ltd

ABN 61 089 482 888

Shepparton Office 108 Wyndham Street

Shepparton VIC 3630

Tel +61 3 5831 8777

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Introduction

As the value of water for irrigation increases and the imperative for maintaining environmental flows in natural watercourses gains public support, there is increased motivation to adopt water efficient irrigation delivery systems. Part of this process involves the transfer of water from marginal farming land to areas where irrigation returns can be maximised. Goulburn Murray Water anticipates that over time, this process could see a doubling of agricultural production from half the land currently used for irrigated agriculture. Clearly, this process will result in both social and economic change in many marginal agricultural districts.

The Lower Goulburn area is characterised by a combination of a small number of large farming properties, and many unoccupied farming properties used as out-paddocks by 'parent' farms, generally located within the Goulburn Valley dairying districts. There is also evidence of irrigation water rights being sold out of the area on a temporary and permanent basis. In addition to this process, the Lower Goulburn area is subject to regular flooding.

The Goulburn Broken Catchment Management Authority, with the assistance of specialist consultants, has worked through a long-term solution to the management of the floodplain by proposing a Lower Goulburn Floodplain Rehabilitation Scheme. This will re-establish 9,740 hectares of the natural floodplain through the relocation of levees and removal of flood control structures.

The re-establishment of the floodplain will be achieved through compulsory property acquisition, principally through the authority conferred on the GBCMA under the Water Act, 1989. As a result implementing the scheme, up to 41,000 hectares will receive greater flood protection, which will make this area less marginal for agricultural investment.

The acquisition process and the changes to land use that will result from the implementation of the Scheme will have some socio-economic implications for the Nathalia rural population, farming activity and local infrastructure. The purpose of this study is to investigate and identify where these changes will be positive, negative or where no change is anticipated.

The general study area is from Loch Garry to Barmah, between the Goulburn River and the Barmah to Shepparton Road. The Nathalia Township has also been included to consider changes to community services and business activity that may result from the implementation of the Rehabilitation Scheme. The focus of attention is on the 9,740 hectares that are proposed to be acquired along the Deep and Bunbartha Creeks.

Study Brief

The study has been based on the following areas of investigation contained in the Study Brief:

1. *Changes in land values outside the floodway resulting from the implementation of the floodplain rehabilitation scheme.*

2. *An estimate of the projected changes to income from agriculture, district employment and local government rate revenue.*
3. *An estimate of the change to community assets such as local roads. For example, returning the floodplain to its natural state will result in a reduction in the length of local roads to be maintained, but may also result in a requirement for some new road connections to maintain the integrity of the local road network. Information is required to determine:*
 - *The rate at which roads deteriorate within the floodplain.*
 - *The number and length of roads to be closed.*
 - *The number of crossings of the floodplain required*
 - *Responsibility for road maintenance in leased areas.*
4. *The potential for development of ecotourism (e.g. interpretive centre, accommodation, walking trails, wetland hides etc.)*
5. *The economic and social impact on the Town of Nathalia (e.g. retail catchment, business services, schools, health services and local government services).*

Addressing the requirements of the Brief has required the following areas of investigation:

- A review of recent studies into solutions for the remediation of flood impacts on the Lower Goulburn System. These documents are listed in Appendix 1 - References.
- An analysis of demographic data in the Australian Bureau of Statistics Collectors Districts (4) for the rural area that includes the study area and for the CD's (3) that cover the Township of Nathalia. Particular attention has been given to the age profile of the rural community in the study area.
- A property analysis of land affected directly by the proposed Rehabilitation Scheme, that is, properties that will be entirely or partially subject to compulsory acquisition.
- An estimate of the changes to agricultural production resulting from the implementation of the Rehabilitation Scheme.
- The potential for future ecotourism and other recreation activities within the rehabilitated area.
- The effect of the Rehabilitation Scheme on public infrastructure assets such as roads and bridges, based on a field survey within the study area.
- Potential effects on municipal rate revenue.
- Anticipated impacts on community services and business in Nathalia, based on interviews, field survey and existing census information.

Changes in Land Value

The Brief for the 'Socio-Economic Issues Assessment' of the Lower Goulburn Rehabilitation Project requires an investigation into the effect of the proposed Lower Goulburn Floodplain Rehabilitation Scheme on land values in the district.

It is expected that land values will be impacted by the proposed scheme (details of which are described elsewhere in this report). Some landholdings will be afforded a benefit via a reduced flooding regime, or a greater degree of flood protection than previously enjoyed. The landholdings within the proposed 'buy back' area will be subject to a more frequent flood regime than previously experienced. A significant area of land, north and south of the scheme, will gain the regional benefits of a more certain and manageable floodplain system, and the economic benefits which flow from certainty via reduced risk elements in investment decision-making processes.

Hann McKenzie & Co has been retained as part of the Earth Tech Engineering project team to:

- Undertake research and analysis to project the effects of the scheme on land values, and
- Report on the resultant effects on municipal rate revenue.

Assumptions

A literature review has been conducted of relevant reports, studies, and documentation. To avoid going over old ground, or embarking on a course of investigation that has already been explored, it was decided to adopt several key assumptions as the starting point for our research.

Key documents considered included the PriceWaterhouseCoopers Business Plan for the Lower Goulburn Floodplain Rehabilitation Scheme, and the specialist consultants' reports included in that report as Appendices (November 1999); NRE Flood Data Transfer Project; and the Lower Goulburn Floodplain Management Study prepared by Cameron McNamara in 1987.

The most important assumptions from these and other previous works that have been carried forward into this research are as follows:

- The area within the 'buy back' zone is 9,740 hectares;
- The area inundated under existing conditions from a 100 ARI flood is assumed to be 59,315 hectares (SMEC, 1998);
- The area deemed to receive a direct and primary benefit from the works is estimated at 41,000 hectares (Sinclair Knight Merz, August 1999); approximately 19,000 hectares of this land is estimated to be in the Shire of Moira, and 22,000 hectares in the Shire of Campaspe and City of Greater Shepparton (Refer to Appendix 7 - Information provided courtesy of Sinclair Knight Merz);

- In the event of compulsory acquisition, each land owner will be given a maximum initial lease option of 3 years, subsequent to a partial reversion to a floodplain (recommendation from PriceWaterhouseCoopers Business Plan, November 1999);
- Three years following acquisition, 4,188 hectares of land will be leased back to district landowners, the balance to be allowed to revert to natural habitat (perhaps with limited grazing rights);
- Lease caveats will be applied to areas of land deemed to be of environmental significance. Caveats will also be placed on other land subject to leaseback;
- Items in these caveats may include provisions against rice growing, some fencing, cropping, earthworks, etc (PriceWaterhouseCoopers Business Plan, November 1999);
- The total rate revenue generated by the Shire of Moira within the proposed buyback area is estimated at \$20,000 per annum (in current dollars) (PriceWaterhouseCoopers Business Plan, November 1999);
- There will be no significant loss of rate revenue to the Shire of Campaspe (PriceWaterhouseCoopers Business Plan, November 1999);
- There will be no significant loss of rate revenue to the City of Greater Shepparton (PriceWaterhouseCoopers Business Plan, November 1999);

Methodology

The report prepared by Sinclair Knight Merz in August 1999; 'Provisional Rating for Levee Maintenance' was utilised as the base resource document to determine the areas most likely to benefit from the scheme. In this report, land perceived to benefit from the levee construction was divided into two categories;

- Category 1 for those areas deemed to receive a primary benefit from the levees, and
- Category 2, for those areas deemed to receive a secondary (or regional) benefit from the levees.

These areas are shown in Appendix 7.

Land Subject to Rehabilitation, as defined by NRE's 'Flood Data Transfer' digital information, was used to determine the boundaries between the two categories.

Three reasons were given as to why this method of delineation was considered appropriate;

- The 100 ARI flood extent maps (i.e. an average frequency of 1 in 100 years) have been incorporated into municipal planning schemes, and as a result, have gone through a process of public exhibition and modification in response to panel hearings;

- Previous flood extents (particularly 1974) relied on a number of assumptions in the distributions of the flows of the floodplain which may not necessarily occur in a repeat of those events, and;
- The difference in flood level impacts of a 100 ARI and the 1974 flood are generally considered to be marginal.

Using the digital planning resource Pdata, a GIS layer of 'Land Subject to Rehabilitation' overlay and 'Rural Floodway' overlay was created from the Moira Planning Scheme, Campaspe Planning Scheme, and the Greater Shepparton Planning Scheme. This layer was superimposed over a digital layer of land sales for a three-year period, utilising data already held by Hann McKenzie & Co.

The land sales database held by Hann McKenzie & Co has been developed over a 15 year period, and has involved extensive field data collection, property inspections, and analysis over that time. It now provides the most comprehensive land sales database in regional Victoria, and tracks every land transaction in 14 municipal areas, and relates the sale price (reported via the local municipality and the Valuer General Victoria), back to a data record, which stores a high level of detail on each property.

Data elements collected, stored and regularly updated for each property on the Hann McKenzie & Co system include;

- Owner, address
- Land area
- Crown description
- Land Use
- Water right
- Land classification (dry, irrigated, bush, rising, stony, etc)
- Pasture or plantings
- Structural improvements (age, area, construction, condition)
- Access
- Services.

The sales considered to be most relevant (selected on criteria of location, size, date, and type) were inspected (on a kerbside basis) to verify the data already held. The prices realised were then analysed back to a 'land value' only, using a commonly accepted valuation technique, which deducts the added value of the structural improvements (having regard to the age, size, functionality, and condition of each), and then apportioning the remaining value to the different classes of land within the sale property.

Each sale considered relevant was therefore reduced to a 'dollars per hectare excluding buildings' figure; and this unit of comparison was then utilised to draw conclusions as to the effect of the property being above or below the 'Land Subject to Rehabilitation' or 'Rural Floodway' delineations.

Further analysis was then undertaken to establish whether any variance in the analysed sales results could be attributed to the existing land use (at the time of sale), and by inference, to the level of infrastructure and development on each class of property. This was achieved by applying another digital information layer to the GIS, which mapped Land Use through the relevant areas, (existing conditions as at 2001), and observing any correlation.

Sales of working dairy farms, former dairy farms, irrigated cropping and grazing farms, and dryland holdings located above and below the 100 ARI delineation, were analysed and compared, enabling several conclusions to be drawn.

Analysis

The process outlined above resulted in a series of results that could be applied to various classes of affected land, and help to establish conclusions regarding the effect of the proposed scheme.

Analysis of the sales established that there was a clear difference in value for landholdings located above the 100 ARI, and those below this level. Although the marketplace would not generally be sophisticated enough to have the benefit of computer mapping techniques, and would be unlikely to refer to Shire Planning Schemes to establish flood levels prior to negotiating a purchase, local knowledge would play a strong part in establishing this market differential. Most property in the vicinity of the proposed scheme is 'working agricultural' in nature, with few lifestyle holdings, or diversified practices being pursued. Most properties in the vicinity are devoted to dairying, dryland cropping and grazing, or irrigated fodder production and grazing. Horticulture, rice, and timber production are present, but to a limited degree.

Apart from management techniques and individual property characteristics, annual returns on the dominant agricultural pursuits within the vicinity are strongly influenced by seasonal variations and fluctuations, such as timing and amount of rainfall, temperature at critical times during growing seasons, frosts, availability of irrigation water, and flooding.

Longstanding local knowledge has informed marketplace transactions where factors that lessen exposure to risk can be identified. Clearly, no control over climatic conditions is possible, however, reducing flood exposure is possible, by buying farms or paddocks that are historically known to have a lesser chance of inundation. This knowledge is reinforced by Municipal Land Information Certificates that (among other things), identify the zoning and overlay controls relevant to each property, and must by law be included in a Vendors Statement in a sale of land contract.

Sales of property subject to flood planning controls were compared to sales of property unaffected by such controls, but in as close proximity as possible. Generally, it is true that heavier ground, with higher clay content, (and generally less well regarded), is situated on the lower country, but this is not universally the case. Consideration was given to the soil types on each sale property, and adjustments made to the analysed sale results to try and reduce the influence of soil type on the results.

Over time, Hann McKenzie's analysis indicates that the market does discern generally between low lying land and higher ground in the vicinity of the proposed scheme, and that this discernment has led to the establishment of a 'two tiered' market for land of similar quality, but subject to different flood regimes.

Conclusion - Land Values

The analysis indicates that land generally above the 100 ARI delineation shows an average differential in the range of 4% - 11% stronger value than land below this delineation.

This premium, or market differential, indicates a relatively wide potential increase in value for the land that is perceived to benefit from the proposed scheme. The Sinclair Knight Merz report into Provisional Rating for Levee Maintenance of August 1999 calculated an area of 41,000 hectares which would meet the 'Category 1' criteria of receiving a direct benefit from the levees, or that land above the 100 ARI.

It was determined useful to try and refine the degree of benefit via increase in land value, by analysing the existing land uses of the sale properties, to determine if a varying degree of premium attaches to properties with different land uses.

Comparison of dairy properties, dryland cropping and grazing properties, and irrigated grazing and cropping properties above and below the 100 ARI, has revealed that each of these classes of property appear to benefit by varying degrees. Our analysis indicates as follows:

- Dairy farms above the 100 ARI are typically 9-11% more valuable, on a 'dollars per hectare, excluding buildings' basis, than those below this delineation.
- Irrigated and cropping farms above the 100 ARI are typically 5-7% more valuable, on a 'dollars per hectare, excluding buildings' basis, than those below this delineation.
- Dryland cropping and grazing farms above the 100 year-ARI are typically 3-4% more valuable, on a 'dollars per hectare, excluding buildings' basis, than those below this delineation.

Hann McKenzie's interpretation of these results is that the level of investment and infrastructure required for an average dairy farm is significantly greater than that required (on a 'per hectare' basis), for an irrigated cropping and grazing enterprise, which in turn requires a higher degree of investment and infrastructure than dryland cropping and grazing.

A land purchase in this district, which is historically partly subject to flooding, will typically involve a consideration of the risks involved with the enterprise, as already discussed. One of the prime risks of flooding is the interruption to the farming enterprise, and the eventual effect on cash flow.

A dairy enterprise has the ability to generate the greatest returns, on a 'per hectare' basis, of all the most commonly practiced agricultural pursuits in the vicinity of the proposed scheme. The price per hectare is accordingly greater, and

the level of infrastructure required to produce the relatively strong returns is also both relatively intensive and expensive.

Logically, the need to protect the infrastructure, such as close fencing, lanes, water delivery and drainage systems, pastures and the actual dairy building and plant, would be a consideration foremost in potential purchasers' minds. With greater rewards potentially available to a well risk managed farm, the greater the value differential the market is willing to pay to reduce exposure to risk.

The same principle applies to each of the agricultural pursuits practiced in the vicinity of the proposed scheme, but to a reducing degree for each 'lower' pursuit, in line with the reducing degree of greater potential returns accruing from a lessened flood regime.

Utilising the GIS land use overlays, the areas devoted to the main agricultural pursuits within the Category 1 area within the Shire of Moira, as defined by Sinclair Knight Merz in August 1999 were individually estimated as follows;

▪ Dairy;	2850	Hectares
▪ Irrigated Cropping & grazing;	8550	Hectares
▪ Dryland cropping & grazing;	7600	Hectares

The areas within the Shire of Campaspe and the City of Greater Shepparton defined as Category 1 by Sinclair Knight Merz, are estimated as follows;

▪ Dairy;	3300	Hectares
▪ Irrigated cropping & grazing;	9900	Hectares
▪ Dryland cropping & grazing;	8800	Hectares

Applying benchmark values derived from ongoing analysis and market observations throughout the vicinity of the proposed scheme to each of these land categories, multiplying these indicative values by the relevant area within the Category 1 area, and applying the appropriate market premium factors analysed and previously described, will reveal the total level of benefit on land value that the Floodplain Rehabilitation scheme will confer within the Moira Shire.

These calculations are as follows;

- **Dairy;**

$$2850 \text{ Hectares @ } \$3500 = \$9,975,000 \times 10\% = \$997,500$$
- **Irrigated cropping & grazing;**

$$8550 \text{ Hectares @ } \$2500 = \$21,375,000 \times 6\% = \$1,282,000$$
- **Dryland cropping & grazing;**

$$7600 \text{ Hectares @ } \$1000 = \$7,600,000 \times 3.5\% = \$266,000$$

The total positive benefit on land value within the Shire of Moira conferred by the floodplain rehabilitation scheme is therefore considered to be \$2,546,000.

Applying the same factors to land within the Shire of Campaspe and the City of Greater Shepparton (utilizing the same proportion of land use as observed in the Shire of Moira) shows the following results;

- **Dairy;**

$$3300 \text{ Hectares @ } \$3500 = \$11,550,000 \times 10\% = \$1,150,000$$

- **Irrigated cropping & grazing;**

$$9900 \text{ Hectares @ } \$2500 = \$24,750,000 \times 6\% = \$1,485,000$$

- **Dryland cropping & grazing;**

$$8800 \text{ Hectares @ } \$1000 = \$8,800,000 \times 3.5\% = \$308,000$$

The total positive benefit on land value within the Shire of Campaspe and the City of Greater Shepparton conferred by the floodplain rehabilitation scheme is therefore considered to be \$2,948,000.

It should be noted that this benefit will not accrue immediately to the land within the Category 1 areas on completion of construction of the scheme, but rather will be a gradual adjustment over the short to medium term, perhaps two to five years and dependent upon the frequency of flooding.

Estimated Employment Changes

Employment directly related to the rehabilitation area can be identified in the following areas:

- Self employed farmers.
- Employed farm staff.
- Business activities (e.g. plastics factory at Lower Moira).
- Contractors supplying services.
- Supply of goods and services (e.g. farm supplies, food, education and health); particularly from Nathalia.

Given that it may not be necessary to acquire properties in the Lower Moira (Deep Creek) area to realise the objectives of the rehabilitation scheme, the number of people directly engaged in work within the remainder of the rehabilitation area is very small. Based on the number of farm dwellings and the information gained from interviews, the labour force is estimated to be less than 12. The pattern of land ownership demonstrates that most of these people will also have employment associated with properties outside the rehabilitation area, either on separate farms or on properties contiguous with, but outside the rehabilitation area.

By far the greatest impact on rural and township employment will result from a flood event that causes loss of production. While seasonal in duration, a severe event can have longer-term impacts on property viability and employment.

The rehabilitation scheme is intended to reduce this prospect by affording increased flood protection to a larger proportion of the farming land in the Lower Goulburn area. This in turn will provide a basis for increased farm productivity and continuation, if not increase, in employment. If the rehabilitation scheme is implemented, employment changes will be gradual (and positive), as the scheme is phased in over time.

The impact of the rehabilitation scheme on Nathalia is discussed elsewhere in this report, however, based on business interviews and field observation, the greatest impact on township employment is likely to result from a flood event, rather than any change the rehabilitation scheme may cause. Improved flood protection, on the other hand, will benefit business through improved farm reliability and investment. Farm supply businesses in particular acknowledged the benefits of improved seasonal reliability derived from flood protection.

Local Government Rate Revenue Changes

The main municipality potentially affected in terms of rate revenue is the Shire of Moira, and therefore, research has been focused on this municipal area. The research confirms the findings of previous reports that the Shires of Campaspe and Greater Shepparton will have only a minimal rate loss (if any), and the short to medium term net result will be strongly positive on rate revenue, as values increase via the market mechanism described earlier.

The Floodplain Rehabilitation Project can potentially affect municipal rate revenue in the Shire of Moira in two ways:

- Firstly, there is a potential for loss of rate revenue as land in the 'buy back' area is transferred to, and eventually occupied by, the Goulburn Broken Catchment Management Authority.
- Secondly, there is potential for increased rate revenue via both the increase in values that occur to newly protected land, (as described earlier), and the higher level of development on that land over time.

Municipal valuations arise in one of two ways:

1. General revaluations of all rateable property in a particular shire are undertaken each two years. At this time, properties are reinspected, and their valuations updated with reference to benchmarking research of relevant property sales in the district. Those levels of value then prevail until the next General Revaluation, regardless of any movement in the market in the interim.
2. The supplementary valuation process, under section 13DE(2) of the Valuation of Land Act (1960). This section of the Act specifies a long list of circumstances that may give rise to a property being revalued via the supplementary process between general revaluations. In the case of the proposed Floodplain Rehabilitation Scheme, the land within the 'buy back' area could possibly be revalued under sections (b), which deals with changes to zoning via Planning Scheme amendments; (h), which deals with physical

changes of a permanent nature via works or adverse natural causes; (i), which deals with Conservation Covenants; or (n), which deals with likely changes in value due to Orders in Council published in the Government Gazette.

It is possible that, once the land within the 'buy back' zone is zoned for Public Acquisition to facilitate the compulsory acquisition, a supplementary valuation could be carried out to reflect the market realities associated with that encumbrance. It is certain that, once the new levees are constructed, supplementary valuations will be required to reflect the changed physical characteristics of the properties within the zone; notably the increased flooding regime. The decline in value on properties within the zone will depend on several key factors:

The nature of tenure granted to the private occupiers after buy back, lease or license.

Land occupied under a lease will have less adverse effect on values for rating purposes than land occupied under a license. The definition of Site Value under section 2 of the Valuation of Land Act (1960), specifically precludes the valuer from having consideration for the onerous terms of a lease, but instructs the valuer to assess the 'unencumbered' value.

While this scenario has less implications for the municipal rate base, it would probably lead to an inequitable and politically undesirable situation where the private occupiers of the land are bound to pay rates on 'fully valued' land, but are constrained from 'full use' of the land via the proposed caveats restricting certain management practices.

Tenure granted via a grazing license.

This would allow the land to be occupied on the same terms and conditions as may be imposed via lease caveats, but would allow reasonable and more realistic municipal valuations to be returned, via section 2 of the Valuation of Land Act, which defines the approach to Net Annual Value in subsection (c) specifically for 'parklands, reserves or other lands owned by the Crown or any other statutory authority, occupied (other than under any lease) for pastoral purposes'.

To achieve ongoing goodwill with lessees after the construction of the project, it is recommended that tenure for 'leaseback' be offered via a standard NRE grazing license, even though this will result in a more immediate impact on the municipal rate base.

The timing of the transfer from private occupiers to eventual ownership and complete control of the GBCMA, and the amounts of land involved at each stage.

It is noted that for the first three years after buyback, all land will be offered back to dispossessed landowners. After this time, 5,522 hectares will be utilised for natural habitat, perhaps with limited grazing rights. For the purposes of being conservative, it is assumed that the balance of the land will gradually be similarly returned to habitat over a period of time. Once land is 'alienated' from private ownership or occupation, it will cease to be rateable, and the loss to rate revenue will therefore be dependent on the timing of this transition.

The flowing table details the first ten years after buyback, and calculates the net present value of future changes in land value, subject to the assumptions already detailed. The transition of land to complete GBCMA control is assumed to be 20% of the remaining balance for five years after the initial three-year period.

The negative and positive effects on land value are calculated for each year, and rates derived from these movements are calculated by applying a factor of 0.3879% to the net result. This factor is the Moira Shire's current 'rural rate in the dollar'.

Net present value of future changes in land value for the first 10 years after buyback.

Year	Rate loss	Rate gain	Net annual change	Present Value
1	\$0.00	\$1,975	\$1,975	\$1,880.95
2	\$0.00	\$1,975	\$1,975	\$1,791.38
3	\$0.00	\$1,975	\$1,975	\$1,706.08
4	\$11,600	\$1,975	(\$9,625)	(\$7,918.51)
5	\$1,680	\$1,975	\$295	\$231.14
6	\$1,680	\$0.00	(\$1,680)	(\$1,253.64)
7	\$1,680	\$0.00	(\$1,680)	(\$1,193.94)
8	\$1,680	\$0.00	(\$1,680)	(\$1,137.09)
9	\$1,680	\$0.00	(\$1,680)	(\$1,082.94)
10	\$0.00	\$0.00	\$0.00	\$0.00
Total	\$20,000	\$9,875		(\$6,976.58)

Rate = 5.00%, based on payment occurring at end of interval.

The benefits from the scheme to protected land are phased in over a five-year period. After this time, the market perception of the newly protected land will have "caught up" with the market perceptions of the land above the 100 year ARI, and the market premium observed and previously described will from then on, be subsumed in normally prevailing district values. It should be noted that there would also be an ongoing benefit to total rateable value, as increased investment and development occurs into the future within the protected zone. The negative impact is first noticed in year 4, when 5552 hectares of land commences its return to natural habitat. The remaining balance of the land is then "phased out" of private occupation at an assumed rate of 20% per annum for five years.

This approach is conservative, as it is intended that an ongoing portion of the land within the rehabilitation (buyback) area will be leased to private landowners, and

thus rateable, for many years after this timeframe. However, the calculation as detailed reveals a present value loss in municipal revenue to the Shire of Moira of \$6,976.58 over a ten-year period, assuming all the land in the rehabilitation area is taken out of agricultural production.

Impact on Community Assets

Local Roads

A visual conditions assessment of the existing gravel road surfaces of the region situated between the Barmah-Shepparton Road and the Goulburn River was prepared as a component of this socio-economic issues assessment of the Lower Goulburn Flood Rehabilitation Scheme.

The objective was to establish a database of the gravel roads within the Study area, and particularly the area designated for public acquisition. These roads are predominately maintained by the Moira Shire. The review provides a basis for both the GBCMA and Moira Shire to analyse these assets and assist in their future management.

The survey addressed the current condition of the gravel roads, noted signs of distress and determined their cause. The analysis includes a number of rehabilitation treatments available to maintain the pavement and the estimated cost associated with such treatments.

The main function of these roads within the study area is to provide access to the residences and the transportation of goods to their intended destinations. The safe travelling speed of vehicles along these roads is approximately 60km/hr (*some lengths of the existing layout would allow a maximum speed of 80km/hr*), the network allows for a mix of vehicles and there is an estimated 50 vehicles per day utilising the network.

It is assumed that the gravel road network has been maintained by the respective municipalities by grading as a minimum, and by the placement of additional materials by an order of importance basis - i.e. based on overall community benefit. This has lead to a minimal maintenance regime. The placement of better grade materials has only occurred within the last 20 years.

The general shape of the gravel roads is fair, with the existing table drains (*borrow pits*) in need of some cleaning and reshaping. The general view of the gravel roads is that they are currently fit for their intended purpose - to provide access.

Condition Assessment of Existing Gravel Roads

- A total of 39 roads were assessed (refer to Appendix 3, Drawings 2001384-1 and 2)
- 35 roads were within the Shire of Moira and the remaining 4 within the City of Greater Shepparton.
- 2 sections of sealed main road were within the survey area, namely Kotupna-Barmah Rd. and Hancocks Bridge Rd.
- The length of gravel roads surveyed was 129.32 kilometres and 20.90 kilometres of sealed road.




- The gravel roads were further broken down into 3 categories namely: -
 - ↳ Formed & Gravelled 94.53km - 73%
 - ↳ Formed 21.36km - 17%
 - ↳ Unformed 13.43km - 10%
- The average safe travelling speed along these gravel roads is 65kph
- The average width of these gravel roads is 4m
- The length of gravel roads within the rehabilitation (inundation) area are:-
 - ↳ Formed & Gravelled 33.43km
 - ↳ Formed 9.34km
 - ↳ Unformed 3.85km

These represent 36% of the roads surveyed in the study area.

- The common surface defects along these gravel roads are as follows:

	Formed & Gravelled				Formed				Unformed			
	slight	moderate	severe	nil	slight	moderate	severe	nil	slight	moderate	severe	nil
Deformation	92%	3%	0%	5%	67%	33%	0%	0%	14%	29%	57%	0%
Corrugations	45%	26%	26%	3%	50%	17%	17%	17%	29%	14%	57%	0%
Rutting	56%	25%	11%	8%	50%	0%	33%	17%	13%	25%	63%	0%
Shoving	32%	22%	30%	16%	33%	50%	0%	17%	80%	0%	20%	0%
Potholes	78%	11%	3%	8%	83%	0%	0%	17%	13%	25%	63%	0%

- The table drains (borrow pits) that were observed along these roads were in the following conditions:

 Good - 14%
 Fair - 47%
 Poor - 39%

- The main safety concerns along these gravel roads are:

	Trees	Dust
Slight	35%	15%
Moderate	30%	55%
Severe	35%	30%

- The gravel roads are predominately straight with only the occasional curves and have no adverse cross fall or minimal longitudinal grades.
- The level of ridability defects are as follows:

	Channelling		Loose surface		Course Surface	
	Extent	Severity	Extent	Severity	Extent	Severity
Slight	53%	74%	51%	63%	82%	92%
Moderate	6%	8%	29%	29%	4%	4%
Severe	41%	18%	20%	8%	14%	4%

Maintenance of Rehabilitation Area

The following discussion relates specifically to the suggested maintenance of the area proposed to be rehabilitated, where the flood frequency is designed to increase.

During Dry Weather

Maintenance normally consists of reshaping pavement cross-sections, replacing lost material, adding material where weakness show up, cleaning and extending roadside drainage and the removal of surface defects.

The pavement, batters and supplementary culverts require routine maintenance as mentioned above. Warning signs and depth indicators need special attention, the former because they warn of a dip in the pavement during dry weather as well as indicating the possible presence of water over the pavement in wet weather, and the latter because they must be easily read at a distance when there is water over the floodway.

During Flooding

Regular inspections are necessary to ensure that the high priority roads within the floodway are safe for traffic, having regard to the fact that deep holes and wash out batters may not be apparent to all drivers. Debris that may collect on the floodway should be removed; similarly, holes in the road caused by flood water should be filled with rock pending permanent repair when the water has receded.

After Flooding

High priority must be given to the repair of physical damage to the roads, so that the floodway is safe for traffic and is not further damaged by subsequent floods. Debris should be cleared from the upstream culverts. Markers and signs should receive attention to ensure that they are sound. It is also important to ensure that the road cross fall is reinstated where required.

Many dry weather courses contain loose sand and gravel which may be deposited on the roads in sufficient thickness to prevent the passage of vehicles or at least create hazardous conditions. The removal of this loose material is generally the most urgent restoration work after the floods. In some cases it might be also desirable to raise the pavement levels on the roads in which this occurs to inhibit the further deposition of sand when the area next carries water, provided this does not cause damage upstream by afflux or lead to scour due to increased velocity.

Maintenance Implications

Existing Asset

Overview

The field survey of the existing infrastructure revealed the road and drainage assets to be in a generally deteriorated condition requiring reshaping, resheeting and drainage works.

Estimated Life

In its present condition the existing assets are expected to have a variable serviceability life ranging from 12 months for 13% to up to 3 years for 21% and up to 20 years for the remainder (66%).

Existing Asset Value

From a visual condition assessment, the estimated existing value of the assets is considered to be as follows;

	Survey Area	Rehabilitation Area
Formed & Gravelled	\$179,607.00	\$63,517.00
Formed	\$4,272.00	\$1,868.00
Unformed	\$0.00	\$0.00

Road Asset Improvements

Overview

With some maintenance works the existing infrastructure could be upgraded to enhance its value to the community and users. The effects of inundation are best withstood by undertaking preventative road surface construction.

A sealed surface would enhance the roads durability during inundation. However the upkeep of sealed roads is considerably higher than gravel pavements. Periodic resealing is required to maintain the integrity of the surface. Further the development costs of upgrading the road to a sealed surface are significant.

The application of a coarse, hard crushed rock wearing surface would protect the road surface from erosion, wash and irregular wetting and drying. The use of this type of crushed rock will cause an increase in road noise and a decrease in the travelling speed of the vehicles.

Estimated Life

The current estimated life span for each of the gravel road classifications is:

- Formed & Gravel - 8yrs

- Formed - 20yrs
- Unformed - 50yrs

If protection of the gravel roads from flooding were afforded (*including the upgrading of surface drainage*), the estimated life span for each of the gravel road classifications is anticipated to be increase to the following:

- Formed & Gravel - 15yrs
- Formed - 50yrs
- Unformed - 100yrs

Improvement Costs

For the gravel roads within the rehabilitation area to be protected with an application of a coarse (*hard crushed rock*) wearing surface, the estimated improvement cost will be as follows.

- Formed & Gravel - \$200,000
- Formed - \$60,000

These estimates are based on maintaining all of the existing roads within the rehabilitated (rehabilitation) area. The cost would be less if the number of roads to be maintained were reduced.

Improved Asset Value

Flood protection of the existing road network alone would:

- Basically double the life span of the gravel roads and by improving the wearing course of the gravel roads within the rehabilitation area.
- Increase their value by reducing the frequency of required maintenance during dry periods.
- Minimise rehabilitation works after inundation.

Basis of Analysis

	Formed & Gravelled	Formed	Unformed
Grading Costs	\$400/km/yr	\$200/km/yr	\$0/km/yr
Material Costs	\$1,500/km/yr	\$0/km/yr	\$0/km/yr
Totals	\$1,900/km/yr	\$200/km/yr	\$0/km/yr
Depreciation	8yrs	20yrs	No Depreciation

- Grading of formed & gravelled roads occurs twice a year;
- Grading of formed roads occurs once a year;

- Resheeting of formed and gravelled roads occurs every 4 years with a 50mm layer of crushed rock;

Summary of Road Condition Survey

The visual inspection of the gravel road network in the study area indicates that the main cause of defects within the gravel road system is water reaching the base and/or sub grade to weaken it, with speed/braking and possible maintenance practices causing the corrugations.

Defects along the gravel road display the normal characteristics associated with unsealed pavements and require annual maintenance to ensure longer service life, safety and performance.

The application of good practice and the latest technology has the potential to provide considerable benefits by extending the life of the gravel road network.

The best solution may well be one that is cheap but must be repeated every five years or so. The expensive and long lasting result may give a good result on a short length of the network but may well limit funds to rehabilitate other deserving assets.

The essential element in the management of any road system is that there must be a programme to continually rehabilitate and to keep it viable. Failure to do so will result in a decline of the road system, leading to its eventual demise.

Modelling by Water Technology of the predicted impacts of flooding following the implementation of the rehabilitation scheme indicates that inundation of the road system during the more frequent 5 and 10 year ARI events will be minor. Damage to the road system during 5 and 10 year ARI events is likely to be confined to specific low points, not the system in general. The greatest damage will come from traffic using these roads during periods of inundation. This raises two issues; firstly, the management of the road system during flooding (i.e. road closure) and secondly, improvements to selected priority roads to increase their all weather capability.

Gravel roads outside the rehabilitation area will benefit from greater flood protection and a consequent reduction in the amount of water across the road surfaces. Within the rehabilitation area, as indicated above, a reduction in the number of gravel roads within the floodway will reduce the cost of maintenance and flood repairs.

Potential for Ecotourism

The recreational value of the Lower Goulburn area is currently limited due to poor access and frequency of inundation. This can lead to degradation of banks, levees and roads, particularly from four-wheel drive vehicle use. The farming community would prefer limited access to the river to minimise damage to gates, fencing and stock loss.

Most of the recreation access to the river is for fishing, with some boating activities. Implementation of the rehabilitation project is likely to increase the attraction of the Lower Goulburn for fishing, which will require on-going management of access. There is an opportunity, under GBCMA control, for access to be more clearly defined to avoid the presently 'random' movement of vehicles along the banks of the rivers and creeks.

The return of approximately 5,000 hectares to 'natural' floodplain will make a major contribution to the habitat for native species and improve the quality of run-off into the river and creeks of the Lower Goulburn. Over time, this process will increase the attraction of the floodplain for passive recreation activities.

Based on current recreation activity levels, the rehabilitation of the floodplain is likely to increase the attraction of the Lower Goulburn for fishing and boating. The economic benefit to the Nathalia and the Lower Goulburn rural community will be positive, but not significant.

In the longer term, more structured recreational experiences are likely to be developed as the habitat value of the Lower Goulburn floodplain improves over time. However, it is unlikely that the Lower Goulburn floodplain will have the characteristics of, for example, the Barmah Forest. The Lower Goulburn is more likely to be perceived as part of the Goulburn Murray floodplain system, rather than as a recreation destination.

In terms of land management, it is understood that the GBCMA intends to retain the compulsorily acquired land in title. As land managers, there is merit in this proposal, as it will allow the Authority to undertake land management works as a foundation for long-term sustainable recreational access to the rehabilitation area.

Eventually, the option exists to allow the land to revert to the Crown under the Crown Reserves Act 'for any particular purpose'. In such an event, a land manager needs to be nominated (Natural Resources and Environment or Parks Victoria, for example). The decision will reside with the GBCMA as the landowner, and presumably will depend on the future land management priorities of the Authority.

Nathalia - Community and Business Influences

Nathalia Township has a static population of approximately 1,450 (1991 - 1459; 1996 - 1455). The town performs an important service centre role for the local rural community, providing education, health care, hospital, aged care, general retail and rural supply services.

A key issue for the town is the gradual loss of population, largely due to an ageing rural community. Therefore, Nathalia's business and community services are sensitive to any loss of rural population, but in particular, loss of agricultural productive capacity within the service centre catchment.

Discussion with businesses in the Town revealed a high level of awareness about the Lower Goulburn Rehabilitation Project objective, but uncertainty about the impact on the rural population and business activity following implementation. There was an acknowledgement by some interviewees of the environmental and flood control benefits of the proposed scheme, but scepticism that the environmental benefit would translate to economic benefit for the Town.

With specific reference to the study area, the following community and economic interactions were identified between Nathalia and the Rehabilitation Project study area:

<p>Primary and Secondary Schools.</p>	<p>Initial investigation identified 20-30 school pupils within the broad sector south west of Nathalia. A school bus route passes through part of the rehabilitation area to service Kotupna. The precise location of students was not investigated due to privacy issues associated with a small student population. The number of school students residing directly within the proposed rehabilitation area is estimated to be less than 6.</p> <p>Of greater significance for Nathalia is the prospect of a combined secondary college to consolidate the educational opportunities for students in the Nathalia catchment. Even in the absence of the rehabilitation scheme, based on demographic trends, the prospect is for a reduction in school aged children.</p> <p>More intensive agricultural enterprises that involve value adding such as processing and packaging will attract younger families to the district. New agricultural enterprises are emerging, and there is no reason why Nathalia should not attract a share of this growth.</p> <p>Implementation of the rehabilitation project will result in improved agricultural reliability that will be conducive to attracting new agribusiness.</p>
<p>Hospital and Aged Care.</p>	<p>The Nathalia District Hospital and Nursing Home is part of the Goulburn Valley Health network of facilities. While the Nathalia Hospital services the needs of the local Nathalia population, service provision is provided on a regional basis. It is unlikely that changes in population (positive or negative) within the flood rehabilitation area will impact on the provision of health services in Nathalia.</p>

Issue

Public acquisition of land within the rehabilitation area will reduce the amount of business for rural suppliers in Nathalia.

Comment

There is a strong relationship between rural businesses in Nathalia and the surrounding farming community. Activity includes fertiliser, seed and fuel supplies plus wool, meat and grain purchases. There is also strong interaction with Shepparton for agricultural chemicals, machinery and fuel, and to a lesser extent, with Echuca for the similar services.

The total study area (i.e. all of the land from Loch Garry to Barmah and between the Goulburn River and the Shepparton Barmah Road) constitutes between 1% and 12% of the Nathalia business market, depending on the type of service provided (source: personal communication with farmers and Nathalia businesses).

Given that the rehabilitation area carries a small population and the reliability and productivity of protected land (41,000 hectares) will compensate for reduced agricultural activity in the 'buy-back' area, it can be argued that the net impact on local rural suppliers will be positive. An estimate provided by a respondent during the interviews was that increased flood protection could improve district productivity by 10%-20%. On the other hand, farming land in the rehabilitation area is less likely to be cropped, resulting in a reduced demand for fertiliser and other inputs. On a net benefit basis, the improved flood protection is likely to be positive for rural business.

Issue

The implementation of the rehabilitation project may decrease the retail catchment of Nathalia, and therefore have an adverse effect on local traders.

Comment

In purely demographic terms, the number of people directly displaced by the rehabilitation scheme is small and unlikely to impact on retail activity.

A more significant impact would result from a reduction or cessation of business by local farms in the study area, causing a drop in demand for rural supplies and services. Nathalia maintains a strong economic relationship with local farmers, despite the proximity of Shepparton and Echuca.

Land Use Implications

The broad strip of land generally prescribed by the Goulburn River and the Nathalia Barmah Road from Loch Garry to Barmah comprises 35,000 hectares, of which approximately 9,740 hectares is proposed to be acquired to rehabilitate the floodplain. The remaining area (plus an additional area of approximately 16,000 hectares south of the Goulburn River) will be afforded greater protection from flooding up to a 2.5% event (or 1 in 40 year flood). Effectively, with the rehabilitation scheme in place, these areas will receive protection for 97.5% of the time.

The confluence of Deep Creek and the Murray River on the western edge of the study area contains a community of approximately 20 people that can increase to over 250 during holiday periods. This area is predominantly flood prone, which constrains residential dwelling construction. This part of the proposed land acquisition area contains a mixture of temporary and permanent dwellings, a total of approximately 10-14, depending on the degree of habitability. A photo survey of these dwellings is included in Appendix 6.

Land Ownership and Economic Activity

Within the rehabilitation area, there are approximately 90 land tenements (or holdings) that vary in size from a few hectares to over 1,500 hectares. The predominant agricultural activity is rotational 'dryland' cropping and grazing (beef and sheep for meat and wool). Most of the properties are unoccupied and function as supplementary sites for irrigation properties in the Goulburn Valley. There are three significant large land holdings (Ascot Park, Summit Farm and Madowla Park) involved with rotational grazing and cropping, plus some seasonal pasture for hay production. Madowla Park also has areas devoted to irrigated rice production, but outside the proposed acquisition area.

An analysis of property records has established that 50% of the property owners in the rehabilitation area reside outside the Moira Shire. Of these, about half live in metropolitan Melbourne, while a further significant group reside in the dairy farming areas of Kyabram and Tongala. There are significant multiple ownerships of land within the study area. This signals clearly that the rehabilitation area is used predominantly to supplement farming activity outside the study area. In particular, the dairy industry finds the Lower Goulburn area attractive for raising young cows before bringing them into the dairy herd, or for 'drying out' milkers.

Establishing an accurate figure for agricultural output within the proposed rehabilitation area is difficult due to:

- Information being published at a broader scale than just the rehabilitation area.
- The lack of economic data specific to the Lower Goulburn, particularly gross margins for various forms of agricultural production.

(This work is normally carried out by specialist units in the Department of Natural Resources and Environment but is currently unavailable for the Lower Goulburn. Original research to establish the specific economic returns from the Lower Goulburn area is beyond the resources available to this study).

- Significant contributors to agricultural production cover areas both inside and outside the rehabilitation area.
- Individual landowners are understandably reluctant to divulge production information.

It is possible, however, to cite data from previous studies and assess current data available for other districts and apply this information to categories of land-use in the rehabilitation area derived from satellite photography and field observation.

As a consequence, economic activity within the rehabilitation area has been estimated from:

- Aerial photographic survey (1998).
- Interviews with agribusiness specialists and valuers.
- Published data on gross margins from Natural Resources and Environment.
- Anecdotal information from landowner and business interviewees.

The methodology for assessing agricultural output from the rehabilitation area is focussed on the larger land holdings as follows:

- Determine typical dryland gross margins per hectare for:
 - Annual sub-clover (seasonal non-irrigated hay production).
 - Seasonal grazing.
 - Annual cropping (cereal production).
- Determine typical annual rotation to estimate proportion of property under different production regimes.
- Estimate from aerial photography the proportion of properties that are actively farmed.

In addition, there is a contribution to the local economy from some categories of agricultural services such as grain harvest contracting, shearing and hay contracting. This can be a significant seasonal contribution, although these services tend to be mainly contracted by the larger farming businesses. It is difficult to apportion the expenditure on these services within the rehabilitation area, as the larger farms straddle the rehabilitation area. Based on known contract expenditure for some properties, and taking into consideration the small number of large farming businesses, up to \$200,000 can be expected to be spent on contract services in the rehabilitation area when rainfall conditions are favourable. In the event that a significant proportion of land within the

rehabilitation area will be farmed on a leasehold basis following acquisition, these contract services will continue to be required.

Less quantifiable contributions come from machinery sales and maintenance, business services and domestic goods and services for families residing in the rehabilitation area.

Information derived from the above sources has been used to estimate agricultural output from the 9,740 hectares proposed to be acquired for rehabilitation.

The estimate derived from the 1998 satellite photograph indicates the following land use categories:

Type	Area (ha.)	Likely use
Oaten hay	2800	Seasonal hay production.
Mixed pasture/ light tree cover	800	Seasonal grazing.
Annual cropping	2400	Wheat, barley, oats, canola
Fallow/rested paddocks	1790	Generally rotated on a seasonal basis.
Non-arable	1950	Public land, streams etc. Assume approximately 20% of total area.
Total	9740	

Gross margin information for the northern districts is not current. The most accurate figures available are Mallee Gross Margins for 2001-2002. (Hall N. 2002. Mallee Gross Margins 2001-2002, Natural Resources and Environment ISSN 1400-5024). Gross margin figures are also current from the NSW Agriculture for the Southern Zone (West) - dryland winter 2002. There are also older estimates (1997/98) available in work undertaken by Farmanco Pty. Ltd. for SKM Consultants (contained in the *Lower Goulburn Waterway and Floodplain Management Plan (Appendix C - Land Valuation Assessment)*).

For this study, the gross margins for different land-use activities may be adjusted by taking into consideration the difference in mean rainfall between the Mallee and the Lower Goulburn District (estimated to be 17% greater than the Mallee). These considerations should be assessed year by year, based on seasonal conditions.

In terms of grazing, an assumption has been made that agistment is the most likely activity.

Based on the above sources and information gained through interviews, the following economic returns can be estimated for the Lower Goulburn area:

Land use activity	Annual gross margin, or agistment return or crop value per hectare
Seasonal hay production.	\$86.00
Mixed pasture and light tree cover (seasonal cattle grazing - assume 20 weeks @ \$5.00 per head per week carrying 1 head/ha.)	\$100.00
Annual cropping (wheat, barley, oats, canola)	\$130.00

When these figures are applied to the areas in the rehabilitation area estimated under each category of land use, the total value of production is between \$600,000.00 and \$700,000.00 per annum from the 9,740 hectares. It must be emphasised that seasonal conditions have a critical influence on annual output.

There are clearly many cautions associated with the above estimate. For example the total value of production assumes that all of the land in each land use category is farmed. Field observation indicates that some areas are not actively farmed. For example, during a dry period, a proportion of properties may not carry any stock.

The figure also assumes that flooding has not occurred during the production season. Floods can also be expected to negatively impact on agricultural output.

Seasonal hay production is dependent on annual rainfall, and will therefore vary from year to year. Seasonal hay production will also be subject to stock grazing pressure in some seasons.

The above exercise is useful, however, to compare with the gross value of production from the whole of the Moira Shire, which in 1997 was \$320.6M from all agricultural sources (ABS). The rehabilitation area therefore represents at best, less than 0.25% of the value of gross agricultural production in the Shire. It can be reasonably concluded from the above estimations that while there are a small number of active farms that have part of their holding in the rehabilitation area, the majority of the land does not contribute significantly to the agricultural production of the Shire. Over time, a greater economic contribution will occur from the increase in agricultural reliability resulting from flood protection to land outside the rehabilitation area.

Demographic Issues

The rehabilitation area proposed for acquisition has an extremely low dwelling density. The most recent Country Fire Authority Regional Directory for the area (Regions 12 and 22) was released on 12th March 2002, and is accurate to 2001. Field survey has identified only 2 occupied dwellings directly within the rehabilitation area (9,740 hectares), excluding the dwellings in the Deep Creek subdivision. A further 5 dwellings are just outside the rehabilitation area, but attached to properties that are within this area. There are also a number of shearing sheds in the rehabilitation area.

An indication of the demographic profile of the occupants of these dwellings has been obtained from an analysis of the rural census collectors' districts that include the rehabilitation area, supplemented by information obtained during interviews with some of the farming interests in the area and field observation. Conclusions can also be drawn from the location of school bus routes. The observations are necessarily broad, rather than individually described, to protect the privacy of local residents.

The rural collectors' districts within which the rehabilitation area is located contained 1,504 persons in the 1996 census. Compared with the previous census (1991), the population grew by 45 persons. At the 1996 Census:

- 72% of the local population were aged 15+.
- Median age was 34 years (the same as the national median age).
- 20.6% of the rural population was aged 55+ (0.3% above the national proportion).
- Approximately 20% of the population were primary or secondary school attendees.
- Unemployment was 4.8%
- Median weekly household income was in the range \$300-\$499.
- Average household size was 2.9 persons per dwelling.

It is difficult to translate the above information to the rehabilitation area, due to the small number of dwellings. However, it can be reasonably expected that the total permanent population in and adjacent to the rehabilitation area (including the Deep Creek settlement) is less than 35, including approximately 6-8 school attendees. It is not possible to comment on other demographic characteristics due to the small number of dwellings.

Following implementation of the rehabilitation project, which will increase the frequency of flood rehabilitation, it can be expected that:

- Some occupants will relocate locally to other farm sites.
- Some will move to nearby towns.
- Some will leave the local district.

Given the small number of residents in the rehabilitation area, the demographic impact on the Shire is unlikely to be significant. Of greater significance to the local community would be changes that might result from the rehabilitation

project causing a reduction in farm size, cessation of farming or reduced agricultural output from the study area. These types of changes may impact detrimentally on the local economy, although conversely, improved flood protection outside the rehabilitation area may also increase local economic activity. These issues are discussed later in this report.

Consultation Issues

The following section summarises the key issues raised during the consultation with various business and community interests in the study area and in Nathalia. Comments are made on their implication in the context of the proposed rehabilitation project.

Issue

Non-irrigated farming properties within the study area are generally managed on a grazing/cropping rotation basis. The cycle of grazing and cropping is necessary to control weeds and native vegetation regeneration, particularly saplings.

Acquisition of land for the rehabilitation of the floodplain may reduce the land available for cropping and make grazing less viable due to the long term re-establishment of native vegetation.

Comment

Land within the rehabilitation area proposed for acquisition and subsequent leaseback will result in a reduced area for both grazing and cropping. The selection of areas available for continued farming will be determined during the next stage of planning for the rehabilitation project. It may be possible for individual properties to negotiate both the amount of land available for farming and the use (e.g. cropping).

Issue

A reduction in the area available for farming through compulsory acquisition will require some owners to undertake private acquisition of land outside the rehabilitation area to re-establish farm size. There is concern that it will be difficult to acquire contiguous land areas for re-structure purposes. There is also a belief that the land market will be 'distorted' as a result of concentrated demand.

Comment

Problems associated with farm restructure and private land acquisition will be apparent if owners consider that leaseback arrangements will constrain farm management and they are therefore forced onto the open market for land.

The problem is likely to be of less concern to single title landowners, but could affect some larger, multiple title farms.

Issue

There is a generally held view within the farming community that allowing the rehabilitation area to revert to volunteer vegetation will result in unmanageable weed infestation, as grazing will become less viable as native trees re-establish.

Comment

It is proposed that all the land acquired in the rehabilitation area will either be leased or under the control of the GBCMA. In the case of leasehold land, there will be an obligation for weed management under the terms of the lease. Based on their record as land managers, it is reasonable to expect that land under GBCMA control will be appropriately managed.

Issue

The reduction in land available for farming as a result of the 'buy-back' proposal may cause some large farms to cease operation in the Lower Goulburn area, resulting in a loss of local economic activity.

Comment

Comments have been made above regarding the availability of land on the open market for restructure purposes outside the rehabilitation area.

While there may be short-term problems associated with land availability and difficulty in assembling contiguous parcels, the reality of the market place will solve most issues over time.

It is unrealistic to conclude that a large farming operation will be forced to cease business purely as a result of the rehabilitation buy-back scheme.

Issue

Should the rehabilitation levees be restored/constructed, it would be preferable to follow existing title boundaries or fence lines, rather than cut across title boundaries.

Comment

Should be implemented where possible, however, the hydrology of flood flows and the location of existing levees may preclude following title boundaries.

Issue

Unless the rehabilitation scheme is able to offer total protection from flooding, it is not considered worth pursuing.

Comment

Current flood modelling of the proposed rehabilitation project indicates that the scheme will give flood protection at least equivalent to the 1993 event, but expected to provide protection in a 1:40 year event. This level of protection would greatly improve agricultural reliability outside the rehabilitation area.

The rehabilitation project will also result in a more reliable levee system, reducing the impact of more frequent 'nuisance' floods.

In reality, floods larger than the events for which the proposed rehabilitation scheme is designed to give protection will occur. Designing a scheme to cater for 'all' flood events would require consideration of the probable maximum flood. In practice, flood protection schemes need to strike a 'balance' between

affordability and effectiveness. The approach taken for the Lower Goulburn Rehabilitation Project is to achieve a cost-effective level of flood protection.

Issue

Fences in the rehabilitation area will require more maintenance as a result of increased flood frequency.

Comment

The issue is also related to public assets such as local roads. The regeneration of a proportion of the rehabilitation area is likely to mean that there will be less demand for local roads and a reduction in the amount of fencing required. The areas that continue to be available for agriculture will require road access and fencing. The next stage and the project will involve detailed planning to identify the areas available for farming, involving:

- Consultation with landowners under leaseback or perhaps management arrangements.
- Identification of priority local roads in the rehabilitation area.

Summary of Findings

1. The Lower Goulburn Rehabilitation Project is estimated to increase the flood protection and agricultural reliability of 41,000 hectares of farming land by restoring the Deep Creek floodplain, comprising 9,740 hectares of rehabilitated floodplain.
2. The timeframe (three years) between acquisition and implementation should provide sufficient time for property restructure on the part of existing landowners or alternatively, the introduction of new farming interests as a result of improved reliability in the flood protected areas. However, on some larger farms, compulsory acquisition of property in the rehabilitation area may reduce the total area of land for farming. Open market acquisition of land outside the rehabilitation area to compensate for the areas lost may be difficult due to the fragmentation of available land, the inability to assemble contiguous land areas and a short term distortion of demand.
3. The net effect of increased flood protection will create conditions for increased farm productivity outside the rehabilitation area, over an area of up to 41,000 hectares.
4. Reduction in the size of larger farm holdings through compulsory acquisition has the potential for a short-term impact on farm production inputs and contract services, which may have a negative impact on local business, particularly in Nathalia. However, this could be more than compensated by the improved reliability and output from the land outside the rehabilitation area. The short-term injection of funds to the local economy as a result of public acquisition of land within the rehabilitation area (estimated to be up to \$22M) will also have a positive impact. It is likely that a proportion of

these funds will be used for the purchase of goods and services in the local economy.

5. The proposed acquisition area contains approximately 95 rural properties, including 3 large farms, Summit farm, Madowla Park and Ascot farm. The number of people within this area is small (less than 20). Their relocation to adjoining farming areas, nearby towns, or possibly away from the study area, is unlikely to have a significant economic or social impact on the Lower Goulburn area or the Township of Nathalia. Relocation may produce a short-term benefit from local house construction.
6. The Deep Creek settlement is located at the confluence of Deep Creek with the Murray River. The area contains properties within a floodway, meaning that under the Victorian Planning Provisions, no further dwelling construction will be permitted.

There are some 28 small titles in two subdivisions, containing approximately 18 structures comprising houses, temporary dwellings and sheds. This situation provides an opportunity to undertake a subdivision restructure to reduce the environmental impact of existing permanent and temporary dwellings on the adjacent stream. Subdivision restructure is the responsibility of local government as the planning authority, in conjunction with the Department of Infrastructure. A photographic survey of properties in the Deep Creek (Lower Moira) area is included in Appendix 6.

7. The total positive benefit on land value conferred by the floodplain rehabilitation scheme is considered to be:

Shire of Moira - \$2,546,000.

Shire of Campaspe and the City of Greater Shepparton - \$2,948,000.

This benefit relates to land described as Category 1 (refer to Appendix 7), and will accrue as a gradual adjustment over the short to medium term, perhaps two to five years and dependent upon the frequency of flooding.

8. The analysis of rate revenue within the proposed 'buy-back' area reveals a present value loss in municipal revenue to the Shire of Moira of \$6,976.58 over a ten-year period, based on the conservative assumption that all the land in the rehabilitation area is taken out of agricultural production. Given that over half of the rehabilitation area will continue to be available for agriculture, leasehold and/or management arrangements may remove this present value loss.
9. Within the rehabilitation (buy-back) area, the general shape of the gravel roads is fair, with the existing table drains (*borrow pits*) in need of some cleaning and reshaping. The general view of the gravel roads is that they are currently fit for their intended purpose - to provide access.
10. The gravel roads outside the rehabilitation floodway will benefit from greater flood protection and a consequent reduction in the amount of water across the road surfaces. Within the rehabilitation area, a reduction in the

number of gravel roads within the floodway will reduce the cost of maintenance and flood repairs.

11. For the gravel roads within the rehabilitation area to be protected with an application of a coarse (*hard crushed rock*) wearing surface, the estimated improvement cost will be as follows.

Construction	Improvement cost	Length (km)	Annual maintenance (per km)
Formed & Gravel	\$200,000	33.43	\$1,900
Formed	\$60,000	9.34	\$200

These estimates are based on maintaining all of the existing roads within the rehabilitation area. The cost would be less if the number of roads to be maintained were reduced.

Conclusion

The results of this socio-economic assessment indicate a number of changes that may result from the implementation of the rehabilitation scheme on the Lower Goulburn Floodplain:

- Land values outside the rehabilitation area, that will be afforded a higher level of flood protection are likely to increase by between 4% to 11%, over a two to five year period, depending on the type of land use.
- The number of occupied dwellings directly affected is estimated to be 2 (excluding the Deep Creek or Lower Moira settlement), with a further 5 immediately outside the rehabilitation area that may also be affected due to title configuration. Some of these dwellings are on elevated land within the rehabilitation area and will only suffer access restriction during times of flood.
- The Deep Creek (Lower Moira) settlement may benefit from a subdivision restructure, rather than direct acquisition.
- Compulsory acquisition of substantial areas of the larger farming properties may result in some loss of viability. Certainly, some owners of larger farms will vigorously resist a compulsory acquisition process. Over time, an increase in the availability of flood-protected land is likely to result in a net increase agricultural activity.
- The social and economic impact on the implementation of the rehabilitation project on the Town of Nathalia is likely to be minimal, provided the larger farming properties remain in operation. The increase in the area of flood-protected land resulting from the rehabilitation project is likely to increase economic activity due to greater agricultural reliability. The positive impact of an improved floodplain environment over time has not been factored into this assessment, however, the recreational and tourism impact is likely to be positive rather than negative.

- The total benefit on land value accruing from the rehabilitation project within the Moira Shire is considered to be \$2,546,000, while the benefit to Campaspe Shire and the City of Greater Shepparton is considered to be \$2,948,000.

Summary of Recommendations

1. Subject to more detailed identification of agricultural land in the rehabilitation area, the number of local roads be rationalised and the remaining roads be brought up to a standard that will resist deterioration from increased flooding (Refer to items 10 and 11 in the Summary of Findings - pp32-33).
2. Acknowledging that local roads are the responsibility of local government, consideration be given to up-grading designated roads within the rehabilitation area. The most appropriate mechanism to achieve this objective may be a cost sharing arrangement between the GBCMA (within the implementation budget) and the respective local governments.
3. The increase in flooding of the Deep Creek subdivision resulting from the implementation of the rehabilitation project is unlikely to be significant. The rehabilitation project provides an opportunity for the Shire of Moira (with the assistance of the Department of Infrastructure) to undertake a restructure plan for the Deep Creek subdivision, given that there are a number of permanent and temporary dwellings located within a floodway. It may be unnecessary to include the Deep Creek properties in the compulsory acquisition program; however, acquisition by GBCMA on a 'voluntary' basis could assist the restructure program.
4. Rehabilitated areas not leased for agriculture could gain recognition as integrated native habitat areas. The future management of this area may benefit from a discussion between the GBCMA, NRE and Parks Victoria; e.g.
 - Land held in title by the GBCMA.
 - Reversion to the Crown under the Crown Reserves Act and nominated for management by NRE or Parks Victoria.
 - Or a combination of the above.

Appendix 1 - References

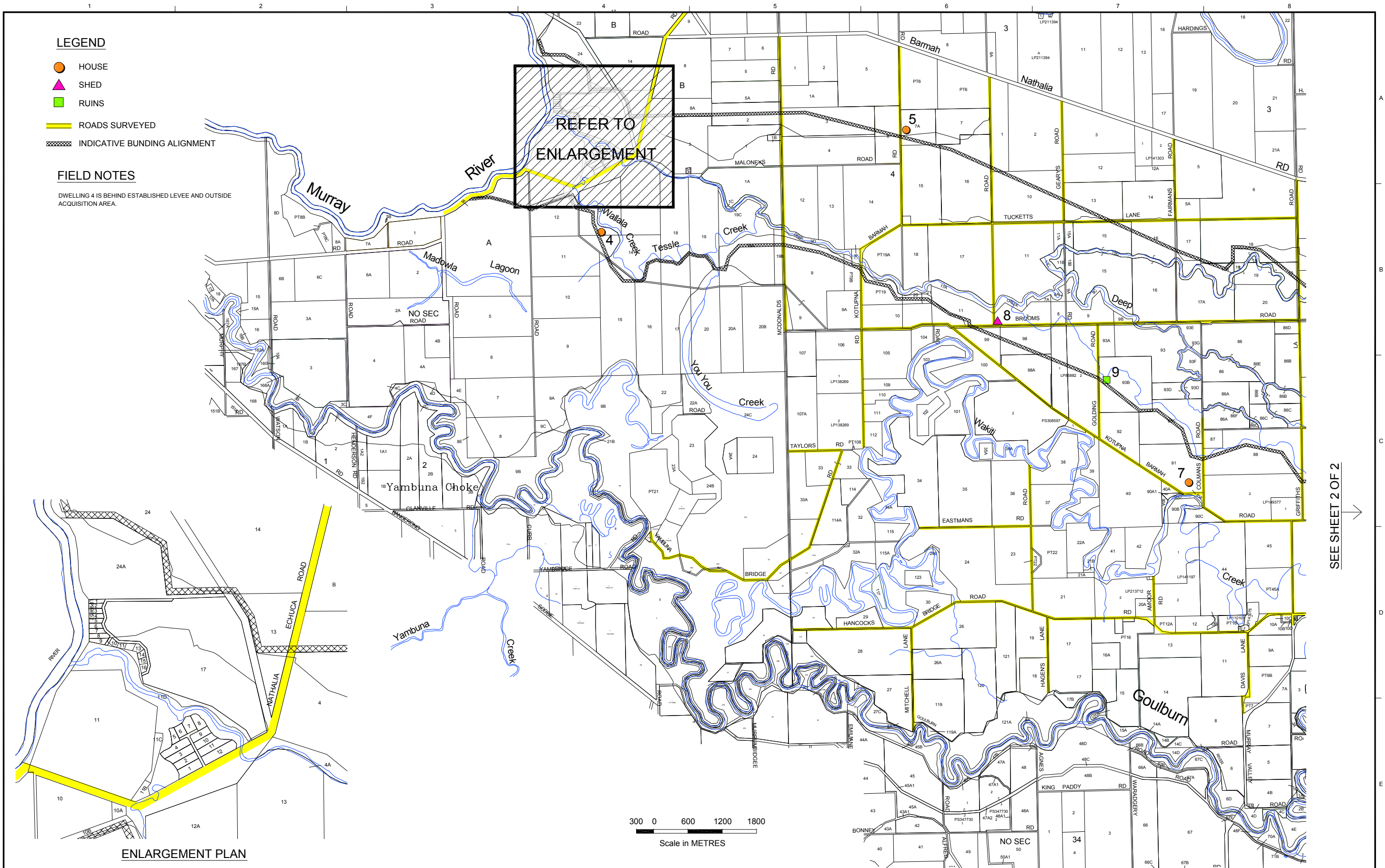
- *Lower Goulburn Floodplain Management Study*, Carr McNamara and Muir, 1987.
- *Lower Goulburn Waterway and Floodplain Management Plan*, Sinclair Knight Mertz, May 1998.
- *Lower Goulburn Levee Audit - Modified Findlay Scheme Report*, SMEC, October 1998.
- *Agricultural Production in the Lower Goulburn*. Stuart Brown - Farm & Co. 2000.
- *An Economic Profile of the Goulburn Broken Catchment 2000*. Myfora Pty. Ltd. - Michael Young and Associates. 2000.
- *Identification of Likely Prime Development Zones in the Shepparton Irrigation Region*. Sinclair Knight Merz, November 2000.
- *Lower Goulburn Rehabilitation Scheme Business Plan*, PriceWaterhouseCoopers, 1999.

Appendix 2 - Field Assessment Form

							From		To		Length within Inundation Area	Traffic Vol. (A.A.D.T.)	Traffic Composition Data		Speed			Pavement			Surface Types			Deformation			Corrugations			Rutting			Shoving			Potholes					
No.	Rd. Name	Rd. Classification	Climate	Topography	Origin	Destination		(km)		(km)	(km)			Design (kph)	Safe Travel (kph)	Safe Travel (kph)	Minimum Width (metres)	Maximum Width (metres)	Thickness (mm)	Type	Formed & Gravelled (km)	Formed (km)	Unformed (km)	Formed & Gravelled	Formed	Unformed	Formed & Gravelled	Formed	Unformed	Formed & Gravelled	Formed	Unformed	Formed & Gravelled	Formed	Unformed	Formed & Gravelled	Formed	Unformed			
1	Lock West	Rural	Moderate	Flat	Barmah-Shepparton Rd.	Pogues	Barmah-Shepp	0	Burgess	2.66	2.66	<50	Light & Heavy Vehicles	100		70	3.5	3.7	50mm	Hill Gravel	2.66			Nil			M			S			Nil			Nil					
2	Lock West	Rural	Moderate	Flat	Barmah-Shepparton Rd.	Pogues	Burgess	2.66	Pogues	4.82	0.94	<50	Light & Heavy Vehicles	100		70	2.5		50mm	Natural Material		2.16			S			Nil			Nil			Nil			Nil				
3	Lock West	Rural	Moderate	Flat	Barmah-Shepparton Rd.	Pogues	Burgess	4.82	Pogues	5.18		<50	Light & Heavy Vehicles	100		70	2.5		50mm	Hill Gravel	0.36			S			M			S			Nil			Nil					
4	Lock West	Rural	Moderate	Flat	Burgess Rd.	Bridge @ Lock Garry		0		1.24		<50	Light & Heavy Vehicles	100		60	2.5		50mm	Hill Gravel	1.24			S			M			Nil			Nil			Nil					
5	Burgess	Rural	Moderate	Rolling-Structured	Barmah-Shepparton Rd.	Loch West Rd.	Barmah-Shepp	0	Lock West	1.53	0.40	<50	Light & Heavy Vehicles	100	50	70	3.5		50mm	Hill Gravel	1.53			S			M			S			Nil			S					
6	Boundary Rd.(Pogues)	Rural	Moderate	Flat	Barmah-Shepparton Rd.	Goulburn River	Barmah-Shepp	0	River	2.77	1.00	<50	Light & Heavy Vehicles	100		80	4.5		50mm	Hill Gravel	2.77			S			S			S			S			S					
6a	Boundary Rd.(Pogues)	Rural	Moderate	Flat	Barmah-Shepparton Rd.	Goulburn River	Barmah-Shepp	2.77	River	5.15						10	2.5			Natural Material			2.38			X							X							X	
7	Post Office Rd.	Rural	Moderate	Flat	Barmah-Shepparton Rd.	Lock West Rd.		0		1.16	1.16	<50	Light & Heavy Vehicles	100		60	3.2		50mm	Blue Metal	1.16			S			M			Nil			Nil			S					
8	Wood Lane Lane	Rural	Moderate	Flat	Lock West Rd.	River		0		0.51	0.51	<50	Light & Heavy Vehicles	100		50	2.5	3.2	50mm	Blue Metal	0.51			S			M			Nil			Nil			S					
8a	Wood Lane Lane	Rural	Moderate	Flat	Lock West Rd.	River		0.51		1.06	0.55					30				Natural Material			0.55			X			X			M								M	
16	Sandlands Rd.				Barmah-Shepparton	River		0		2.3	1.60			100		80	4.5			Blue Metal	2.3			S			S			S			M			S					
17	Purdies Rd.				Barmah-Shepparton	River		0		1.5				100		80	3	3.5		Hill Gravel	1.5			S			S			S			S			S					
18	Purdies Rd.							1.5		4.2				100		60	3	5		Natural Material		2.7			S			S			S			S			S				
19	Grinters Pit Rd.				Barmah-Shepparton			0		3.7				100			4.5			Natural Material	2.5	1.2		S			S			S			S			S					
20	Flanners Rd.				Barmah-Shepparton			0		1.9	1.40			100		80	3	3.5		Hill Gravel	1.9			S			S			S			S			S					
21	Flanners Rd.							1.9		3.9							2			Natural Material			2			M			S			M			S				M		
22	McLellands Rd.							0		2.6	2.60			100		80	5			Hill Gravel	2.6			S			S			S			S			S					
23	McLellands Rd.				Barmah-Shepparton			2.6		3.7	1.10			100		40	6			Natural Material		1.1			S			S			S			M			S				
24	McLellands Rd.				Barmah-Shepparton			3.7		5	1.30			100		50	6			Natural Material		1.3			S			S			S			S			S				
25	Rathbones Rd.				Murray Valley H'way			0		6.1	1.50			100		80	4.5			Blue Metal	6.1			S			M			S			X			S					
26	Booths Rd.				Murray Valley H'way			0		2.5				100		80	4.5	6		Blue Metal	2.5			S			X			S			X			S					
27	Griffiths Lane				Barmah-Shepparton			0		6.2	3.50			100		80	8			Hill Gravel	6.2			S			M			M			M			S					
28	Kotupna-Barmah Rd.	Main Road - Sealed			Murray Valley H'way			0		12.4				100		100	4			Sealed																					
28a	Kotupna-Barmah Rd.	Main Road - Sealed			Murray Valley H'way			14.4		16.3										Sealed																					
29	Kotupna-Barmah Rd.				Murray Valley H'way			12.4		14.4	2.00			100		80	8			Hill Gravel	2			S			S			M			M			S					
30	McDonald Rd.				Barmah-Shepparton			0		4.9	2.30			100		80	4.5	6		Hill Gravel	4.9			S			M			M	Extreme rutting @ 3.8km			M			M	Extreme potholes	safety speed 20km/hr		
31	Fairmans Rd.				Barmah-Shepparton			0		1.5	1.50			100		80	4.5			Hill Gravel	1.5			S			S			S			S			S					
32	Garrys Rd.				Barmah-Shepparton			0		2.2	2.20			100		80	4.5			Hill Gravel	2.2			S			S			M			M								
33	Tucketts Lane				Kotupna-Barmah Rd.			0		7	3.70			100	40	50	7			Natural Material		7			M			X			X			M			S				
34	Brooms Rd. (ext.track)							0		2.1	2.10			-	20	40	3			Natural Material			2.1						M			X			S			X			
35	Brooms Rd.																																								

No.	Rd. Name	Table Drains		Safety Features						Municipality	Predominantly Straight (S); Curves Radius <115m (C1); Curves Radius <300m (C2)				Irrigation Structures; Drainage Structures	X - Cross Roads; B-Bridges; F-Floodway; CG-Cattle Grids				G-Longitudinal Grade >10%; CF-Crossfall >6%	Channelling		Loose Surface		Coarse Surface		Observations	Vision through rear view mirror	Suspension of dust in air
		G,F,P	<200mm deep, <900mm wide; >200mm deep, >900mm wide	Trees S,M,X	Signs S,M,X	Topography S,M,X	Structures S,M,X	Dust S,M,X	Other S,M,X					Comments							Comments		Ext.	Sev.	Ext.	Sev.			
1	Lock West	F		M		X		M		Greater Shepparton City Council	(S)	(C1)	(CS)	Number of small C1 & C2 sections along section	Equalisation Culverts						1	1	1	1	1	1	Sealed Bell Mouth with Barmah/Shepp Rd.		
2	Lock West	F		S				M		Greater Shepparton City Council	(S)	(C1)								1	1	1	1	1	1				
3	Lock West	F		S				M		Greater Shepparton City Council	(S)								1	1	1	1	1	1	1				
4	Lock West	G		S		S	Closed	M		Greater Shepparton City Council	(C2)			Nil	B		B - Bridge Closed	G	1	1	2	1	1	1	1				
5	Burgess	F	>200mm deep >900mm wide	M		S		M		Greater Shepparton City Council	(S)			Penstock at Lock West Rd intersection Dge Channel X-ing; Supply Channel X-ings				G	1	1	1	1	1	1	1	Small section of trees within clear zone			
6	Boundary Rd.(Pogues)	F	>200mm deep >900mm wide (F&G)	S				M		Moira Shire Council	(S)			F&G - Equalisation Culverts are blocked; supply channel box culvert (1200x450)	F		Unformed - F - Creek crossing (gravel placed over this section)	G	1	1	1	1	1	1	1	There are no formed table drains along the unformed road.			
6a	Boundary Rd.(Pogues)			X				X			(C2)				F			G	3	3	2	2	1	1	1				
7	Post Office Rd.	P	<200mm deep, <900mm wide				S	M		Greater Shepparton City Council	(S)			Irrigation structures - supply channel x-ing					1	1	2	1	1	1	1	1			
8	Wood Lane Lane	P	<200mm deep, <900mm wide					M		Greater Shepparton City Council	(S)	(C2)		F&G - (S); U - (C2)	Nil	Nil			1	1	2	1	1	1	1	1			
8a	Wood Lane Lane																		3	3	2	1	1	1	1				
16	Sandlands Rd.	F						M		Moira Shire Council	(S)			Farm Channel Crossing	Nil			Nil	1	1	1	2	1	1	1	1			
17	Purdies Rd.	F						M		Moira Shire Council	(S)			Nil	X			Nil	1	1	1	1	1	1	1	1			
18	Purdies Rd.	P		X				X		Moira Shire Council	(C1)		(C1) Very Windy (between trees)	Nil	X			Nil	1	1	1	1	1	1	1	1			
19	Grinters Pit Rd.	P		S				X		Moira Shire Council	(S)			Nil	X			Nil	1	1	1	1	1	1	1	1		Nil	Moderate
20	Flanners Rd.	F						X		Moira Shire Council	(S)			Nil				Nil	1	1	1	1	1	1	1	1			
21	Flanners Rd.	P		M				X		Moira Shire Council	(S)																		
22	McLellands Rd.	F						X		Moira Shire Council	(S)			Nil	Nil			Nil	1	1	1	1	1	1	1	1		Nil	Moderate
23	McLellands Rd.	P		X				X		Moira Shire Council	(C1)		(C1) Windy between trees	Nil	Nil			Nil	1	1	1	1	1	1	1	1		Nil	High
24	McLellands Rd.	P		X				X		Moira Shire Council	(C1)		(C1) Windy between trees	2 x Creek crossings (dips)	Nil			Nil	1	1	3	2	1	1	1	1		Nil	
25	Rathbones Rd.	F		M				M		Moira Shire Council	(S)			1 Creek crossing (dip)	X		X (1)	Nil	1	1	3	2	1	1	1	1			
26	Booths Rd.	F		M				M		Moira Shire Council	(S)			Nil	X		X (1); 1 x Creek crossing (dip)	Nil	1	1	2	2	1	1	1	1			
27	Griffiths Lane	P		M				M		Moira Shire Council	(S)			Nil	X	B	F	X (2); B (1); F (2)	Nil	1	1	2	2	1	1	1			
28	Kotupna-Barmah Rd.	F								Moira Shire Council	(S)			Nil	X	B	F	X (3); B (2); F (1)	Nil										
28a	Kotupna-Barmah Rd.									Moira Shire Council																			
29	Kotupna-Barmah Rd.	F						M		Moira Shire Council	(S)			Nil	F		F (1)	Nil	1	1	2	2	1	1	1	1			
30	McDonald Rd.	F	P					M		Moira Shire Council	(S)	(C2)	(S) 1.2km windy (road at its worst) (last)	Nil	Nil			Nil	1	1	2	2	1	1	1	1			
31	Fairmans Rd.	G	F	M				X		Moira Shire Council	(S)			Nil	Nil			Nil	1	1	1	1	1	1	1	1		Nil	Minimum
32	Garrys Rd.	F						X		Moira Shire Council	(S)			Nil	Nil			Nil	1	1	2	1	1	1	1	1		Nil	Moderate
33	Tucketts Lane	P		X				X		Moira Shire Council	(S)		(S) 1 Tree @ 2.0km dangerously inside road pavement	Nil	X	F	X (3); F (2) dips; No table drains		1	1	3	3	3	1	1	1	@ 5.2km road badly formed, badly graded corrugations, very loose surface. 40km safe travelling speed	Nil	Moderate
34	Brooms Rd. (ext.track)	P		X						Moira Shire Council	(C1)		(C1) Windy through trees, litter with branches	Nil	F		F (3)	Nil	1	1	1	1	3	3	3	3			
35	Brooms Rd.	P		S				X		Moira Shire Council	(S)			Nil	F		F (4)	Nil	3	2	2	2	1	1	1	1		Nil	
36	Track 2	P								Moira Shire Council	(S)		(S) Windy track - littered with branches	Nil	F		F (2)	Nil	3	3	1	1	1	1	1	1			
37	Road 3	P						M		Moira Shire Council	(S)			Nil	Nil			Nil	2	1	2	2	1	1	1	1		Average	Average
38	Golding Rd.	G						S		Moira Shire Council	(S)			Nil	Nil			Nil	3	1	1	1	1	1	1	1	Smooth Ride. Littered with a few branches. Good Track		
39	Colemans Rd.	G						S		Moira Shire Council	(S)			Nil	F		F (1)	Nil	3	1	1	1	1	1	1	1	Some branches on road.		
40	Browns Rd.	P		X				X		Moira Shire Council	(S)	(C2)	(S) Windy 2.0km	Nil	F		F (1)	Nil	1	1	3	3	3	1	1	1			
41	Hancocks Bridge Rd.	F								Moira Shire Council	(S)			Nil	Nil			Nil											
42	Hancocks Bridge Rd.	F						M		Moira Shire Council	(S)			Nil	B		B (2)	Nil	3	3	2	2	2	1	1	1		Average	
43	Eastmans Rd.	G		S				M		Moira Shire Council	(S)			Nil	Nil			Nil	3	3	3	3	2	2	2	2			
44	Eastman (1)	P								Moira Shire Council																			
45	Mitchell Lane			S				S		Moira Shire Council									3	1	1	1	1	1	1	1			
46	Hagens Lane	F						M		Moira Shire Council	(S)			Nil	Nil			Nil	3	1	1	1	1	1	1	1			
47	Amoors Rd.	F						M		Moira Shire Council	(S)			Nil	Nil			Nil	3	1	1	1	1	1	1	1			
48	Davis Lane	F						M		Moira Shire Council	(S)			Nil	Nil			Nil	2	2	1	1	1	1	1	1			
49	Road 4	G								Moira Shire Council	(S)			Nil	Nil			Nil											
50	Swantons Rd.	G						S		Moira Shire Council	(S)			Nil	Nil			Nil	3	1	1	1	1	1	1	1			
51	Swantons Rd.	P		X				S		Moira Shire Council	(S)		(S) Windy Through Trees - littered with branches	Nil	Nil	Nil		Nil	3	1	1	1	1	1	1	1			
52	O'Hanlons Rd.	F						S		Moira Shire Council	(S)			Nil	Nil			Nil	3	1	3	1	1	1	1	1			
53	Frasers Rd.	F		S				S		Moira Shire Council	(S)			Nil	Nil			Nil	3	2	1	1	1	1	1	1			
54	Hanlons Lane	F		X				M		Moira Shire Council	(S)		(S) Windy through trees (last section)	Nil	Nil			Nil	3	2	1	1	1	1	1	1			
55	Yambuna-Bridge Rd	F						M		Moira Shire Council	(S)			Nil	F		F (2)	Nil	3	3	2	1	3	2	2	2			
56	Taylor's Rd.	P		M				M		Moira Shire Council	(S)			Nil	Nil			Nil	2	1	3	2	1	1	1	1			
57	Hutchins Lane	P						M		Moira Shire Council	(S)			Nil	Nil			Nil	3	3	3	2	3	1	1	1			
58	Hutchins Lane	P						M		Moira Shire Council	(S)			Nil	Nil			Nil	3	3	3	2	3	1	1	1			
59	Stewarts Bridge Rd.	P						X		Moira Shire Council	(S)			Nil	B		B (2)	Nil	3	3	3	3	3	3	3	3			

Appendix 3 - Locality Map



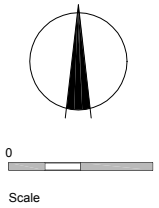
SEE SHEET 2 OF 2

ENLARGEMENT PLAN



REVISION	DATE	ZONE

- | | | | | | | | |
|---|--------------------------|----|--------------------|----|---------------------|----|-------------------------|
| 1 | - | 7 | DEBERNARDI | 13 | RUINS | 19 | GRINTER J. "BRENS BARN" |
| 2 | "MADOWLA PARK" | 8 | McKINLAY G. - SHED | 14 | EICKHOFF D. - SHED | 20 | PAMMENT C.A. |
| 3 | STRANGE R. | 9 | HALL M. - RUINS | 15 | O'TOOLE - SHED | 21 | PAMMENT C.A. |
| 4 | COTTAGE 1 "MADOWLA PARK" | 10 | CALDWELL T. | 16 | MURRELL J. | 22 | "ASCOT PARK" - SHED |
| 5 | OLORENSHAW I. | 11 | McDONALD W. | 17 | BREEN SHEARING SHED | 23 | CHESSELLS SHEARING SHED |
| 6 | | 12 | SHED | 18 | CADEL P. | 24 | HARLOW N. & M. - RUINS |
| | | | | | | 25 | HARDING |



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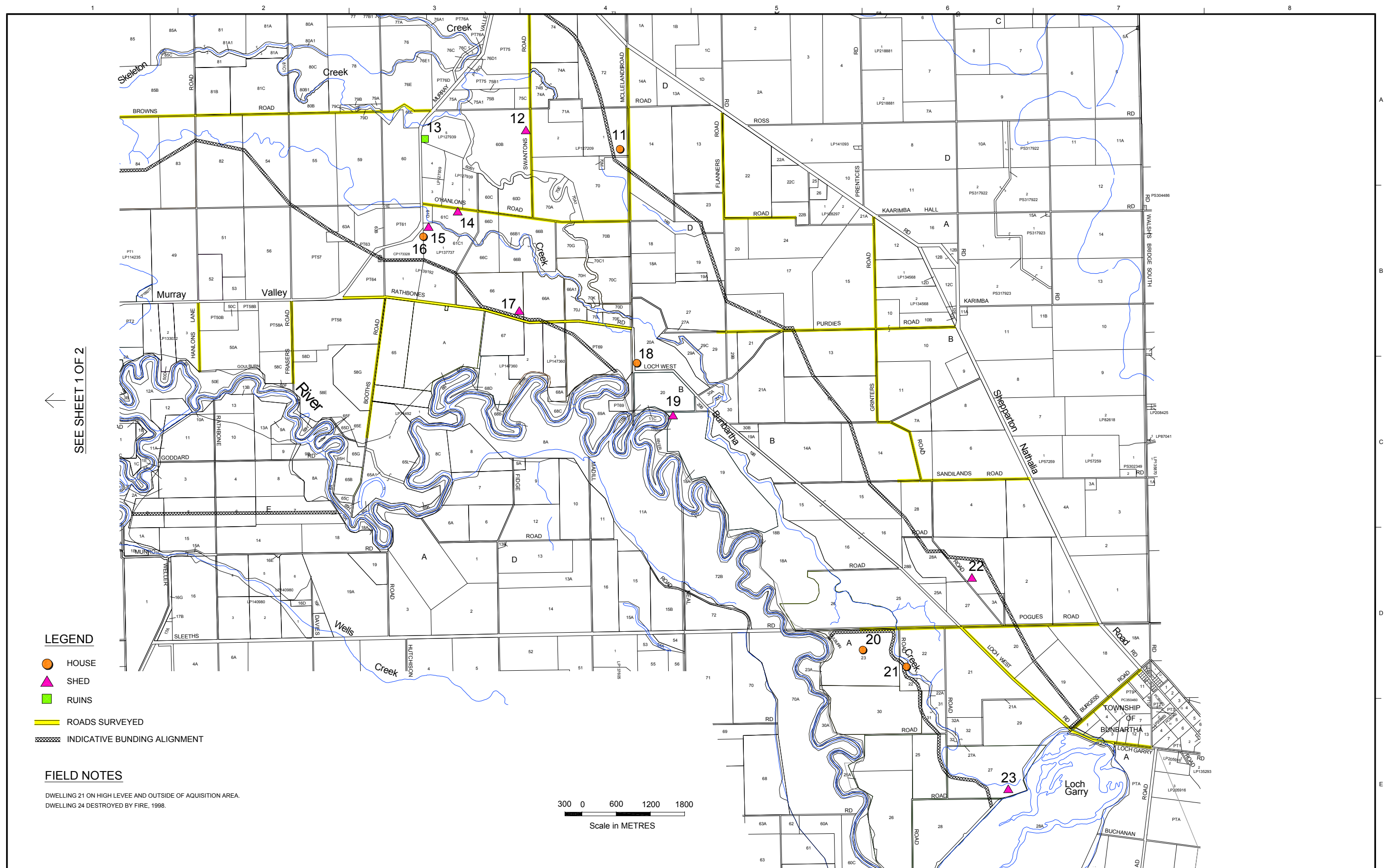
Designed
Drawn M.M.
Checked
Approved

April 02

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Sheet No. 1 of 2
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Lower Goulburn Rehabilitation
Socio Economics Issues Assessment

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LEGEND

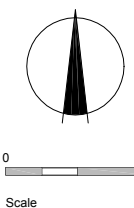
- HOUSE
- SHED
- RUINS
- ROADS SURVEYED
- INDICATIVE BUNDING ALIGNMENT

FIELD NOTES

DWELLING 21 ON HIGH LEVEE AND OUTSIDE OF AQUISITION AREA.
DWELLING 24 DESTROYED BY FIRE, 1998.

300 0 600 1200 1800
Scale in METRES

- | | | | | | | | |
|---|--------------------------|----|--------------------|----|---------------------|----|-------------------------|
| 1 | - | 7 | THORNTON B. | 13 | RUINS | 19 | GRINTER J. "BREES BARN" |
| 2 | "MADOWLA PARK" | 8 | McKINLAY G. - SHED | 14 | EICKHOFF D. - SHED | 20 | PAMMENT C.A. |
| 3 | STRANGE R. | 9 | HALL M. - RUINS | 15 | O'TOOLE - SHED | 21 | PAMMENT C.A. |
| 4 | COTTAGE 1 "MADOWLA PARK" | 10 | CALDWELL T. | 16 | MURRELL J. | 22 | "ASCOT PARK" - SHED |
| 5 | OLORENSHAW I. | 11 | McDONALD W. | 17 | BREEN SHEARING SHED | 23 | CHESSELLS |
| 6 | TAYLOR G. | 12 | SHED | 18 | CADEL P. | 24 | HARLOW N. & M. - RUINS |
| | | | | | | 25 | HARDING |



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Designed
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Approved

April 02

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Sheet No. 2 of 2
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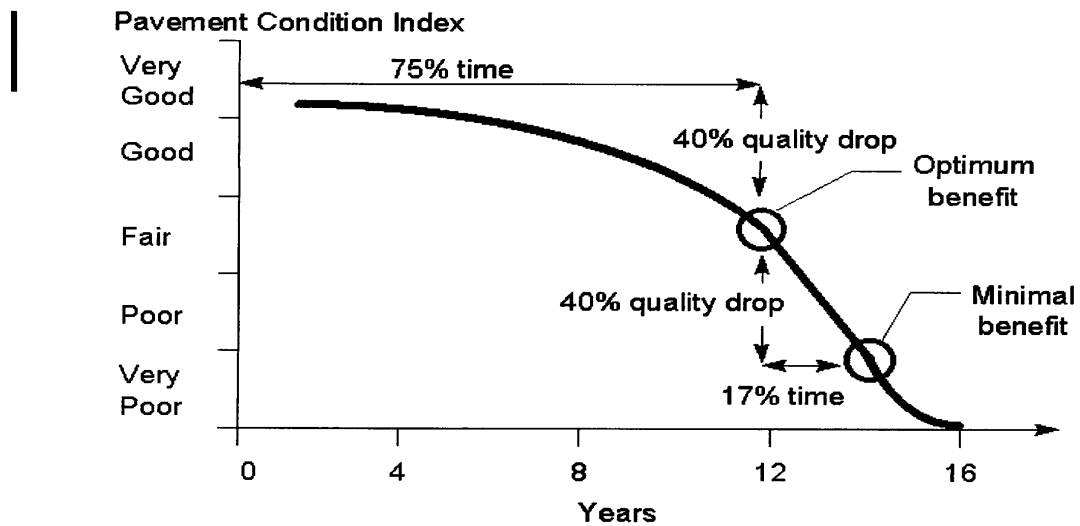
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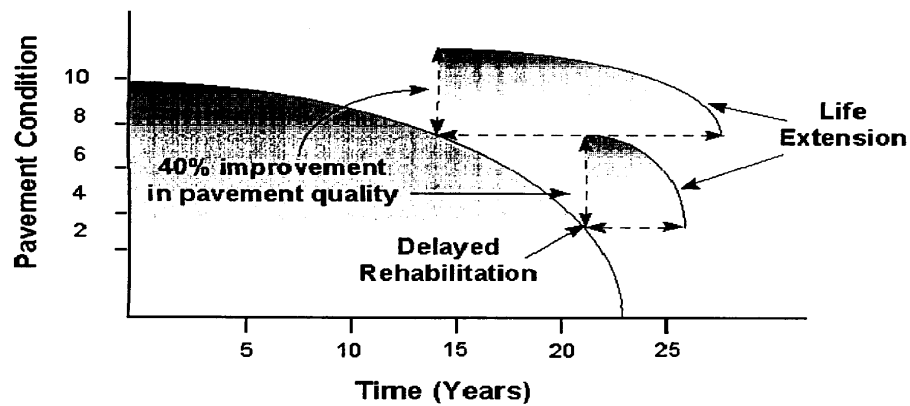
GOULBURN
BROKEN
CATCHMENT
MANAGEMENT
AUTHORITY

REVISION	DATE	ZONE

Appendix 4 - Pavement Deterioration Curve



- Typical Deterioration Curve for a Road Pavement



- Rehabilitation Options

Appendix 5 - Field Evaluation

Rd. Name	Origin	Destination	From	To	Length within Inundation Area	Pavement		Surface Types			Channelling		Loose Surface		Coarse Surface	
			(km)	(km)	(km)	Minimum Width (metres)	Type	Formed & Gravelled (km)	Formed (km)	Unformed (km)	Ext.	Sev.	Ext.	Sev.	Ext.	Sev.
Lock West	Barmah-Shepparton Rd.	Pogues	0	2.66	2.66	3.5	Hill Gravel	2.66			1	1	1	1	1	1
Lock West	Barmah-Shepparton Rd.	Pogues	2.66	4.82	0.94	2.5	Natural Material		2.16		1	1	1	1	1	1
Lock West	Barmah-Shepparton Rd.	Pogues	4.82	5.18		2.5	Hill Gravel	0.36			1	1	1	1	1	1
Lock West	Burgess Rd.	Bridge @ Lock Garry	0	1.24		2.5	Hill Gravel	1.24			1	1	2	1	1	1
Burgess	Barmah-Shepparton Rd.	Loch West Rd.	0	1.53	0.40	3.5	Hill Gravel	1.53			1	1	1	1	1	1
Boundary Rd.(Pogues)	Barmah-Shepparton Rd.	Goulburn River	0	2.77	1.00	4.5	Hill Gravel	2.77			1	1	1	1	1	1
Boundary Rd.(Pogues)	Barmah-Shepparton Rd.	Goulburn River	2.77	5.15		2.5	Natural Material			2.38	3	3	2	2	1	1
Post Office Rd.	Barmah-Shepparton Rd.	Lock West Rd.	0	1.16	1.16	3.2	Blue Metal	1.16			1	1	2	1	1	1
Wood Lane Lane	Lock West Rd.	River	0	0.51	0.51	2.5	Blue Metal	0.51			1	1	2	1	1	1
Wood Lane Lane	Lock West Rd.	River	0.51	1.06	0.55	2.5	Natural Material			0.55	3	3	2	1	1	1
Sandilands Rd.	Barmah-Shepparton	River	0	2.3	1.60	4.5	Blue Metal	2.3			1	1	1	2	1	1
Purdies Rd.	Barmah-Shepparton	River	0	1.5		3	Hill Gravel	1.5			1	1	1	1	1	1
Purdies Rd.			1.5	4.2		3	Natural Material		2.7		1	1	1	1	1	1
Grinters Pit Rd.	Barmah-Shepparton		0	3.7		4.5	Natural Material	2.5	1.2		1	1	1	1	1	1
Flanners Rd.	Barmah-Shepparton		0	1.9	1.40	3	Hill Gravel	1.9			1	1	1	1	1	1
Flanners Rd.			1.9	3.9		2	Natural Material			2						
McLellands Rd.			0	2.6	2.60	5	Hill Gravel	2.6			1	1	1	1	1	1
McLellands Rd.	Barmah-Shepparton		2.6	3.7	1.10	6	Natural Material		1.1		1	1	1	1	1	1
McLellands Rd.	Barmah-Shepparton		3.7	5	1.30	6	Natural Material		1.3		1	1	3	2	1	1
Rathbones Rd.	Murray Valley H'way		0	6.1	1.50	4.5	Blue Metal	6.1			1	1	3	2	1	1
Booths Rd.	Murray Valley H'way		0	2.5		4.5	Blue Metal	2.5			1	1	2	2	1	1
Griffiths Lane	Barmah-Shepparton		0	6.2	3.50	8	Hill Gravel	6.2			1	1	2	2	1	1
Kotupna-Barmah Rd.	Murray Valley H'way		12.4	14.4	2.00	8	Hill Gravel	2			1	1	2	2	1	1
McDonald Rd.	Barmah-Shepparton		0	4.9	2.30	4.5	Hill Gravel	4.9			1	1	2	2	1	1
Fairmans Rd.	Barmah-Shepparton		0	1.5	1.50	4.5	Hill Gravel	1.5			1	1	1	1	1	1
Garrys Rd.	Barmah-Shepparton		0	2.2	2.20	4.5	Hill Gravel	2.2			1	1	2	1	1	1
Tucketts Lane	Kotupna-Barmah Rd.		0	7	3.70	7	Natural Material		7		1	1	3	3	3	1
Brooms Rd. (ext.track)			0	2.1	2.10	3	Natural Material			2.1	1	1	1	1	3	3
Brooms Rd.	Griffith Lane		0	6.2	3.60	4.5	Hill Gravel	6.2			3	2	2	2	1	1
Track 2			0	1.8		3	Natural Material			1.8	3	3	1	1	1	1
Road 3	Barmah-Shepparton		0	2.6		3	Hill Gravel	2.6			2	1	2	2	1	1
Golding Rd.	Kotupna-Barmah Rd.		0	2.1	0.90	3	Hill Gravel	2.1			3	1	1	1	1	1
Colemans Rd.	Kotupna-Barmah Rd.		0	1.3	1.30	3	Hill Gravel	1.3			3	1	1	1	1	1
Browns Rd.	Murray Valley H'way		0	5.9	2.30	7	Natural Material		5.9		1	1	3	3	3	1
Hancocks Bridge Rd.	Murray Valley H'way		5.1	9.3		4.5	Hill Gravel	4.2			3	3	2	2	2	1
Eastmans Rd.	Hancocks Bridge Rd.		0	3.2		4.5	Hill Gravel	3.2			3	3	3	3	2	2
Eastman (1)	Hancocks Bridge Rd.		0	1.1		3	Hill Gravel	1.1								
Mitchell Lane	Hancocks Bridge Rd.		0	0.4		3	Hill Gravel			0.4	3	1	1	1	1	1
Hagens Lane			0	1.4		4	Hill Gravel	1.4			3	1	1	1	1	1
Amoors Rd.		Hancocks Bridge Rd.	0	0.8		4	Hill Gravel	0.8			3	1	1	1	1	1
Davis Lane			0	1.7		7	Hill Gravel	1.7			2	2	1	1	1	1
Road 4	Barmah-Shepparton Rd.		0	1.5		6	Sealed									
Swantons Rd.	Road 4		0	1.9	1.90	4.5	Hill Gravel	1.9			3	1	1	1	1	1
Swantons Rd.	Road 4		1.9	3.1	1.20	3	Natural Material			1.2	3	1	1	1	1	1
O'Hanlons Rd.	Murray Valley H'way		0	1.4	1.40	3.5	Hill Gravel	1.4			3	1	3	1	1	1
Frasers Rd.	Murray Valley H'way		0	1.8		5	Hill Gravel	1.8			3	2	1	1	1	1
Hanlons Lane	Murray Valley H'way		0	1.1		4.5	Hill Gravel	1.1			3	2	1	1	1	1
Yambuna-Bridge Rd.	Kotupna-Barmah Rd.		0	5.8		6	Hill Gravel	5.8			3	3	2	1	3	2
Taylors Rd.			0	0.9		4.5	Hill Gravel	0.9			2	1	3	2	1	1
Hutchins Lane			0	0.6		4.5	Hill Gravel	0.6			3	3	3	2	3	1
Hutchins Lane			0.6	3.6		3.5	Natural Material			3	3	3	3	2	3	1
Stewarts Bridge Rd.			0	10		8	Hill Gravel	10			3	3	3	3	3	3
							Totals:	94.53	21.36	13.43						

Appendix 6 - Photographic Survey of Dwellings

Lower Goulburn Rehabilitation Project
Socio-economic Issues Assessment - Photographic survey of dwellings

1. Deep Creek (Lower Moira Dwellings)

(Refer to Enlargement Plan on Sheet 2001384-1)



Lot 16 LP99852
Deep Creek (Lower Moira)



Lot 15 LP99852
Lower Moira Fitness Centre



Lot 14 LP99852
Deep Creek (Lower Moira)



Lot 13 LP99852
Deep Creek (Lower Moira)



Lot 11 LP99852
Deep Creek (Lower Moira)



Lot 10 LP99852
(House and Plastics Factory)
Deep Creek (Lower Moira)



Lot 10 LP99852
(Plastics Factory)



Lot 8 LP99852
Deep Creek (Lower Moira)



Lot 8 LP99852
Deep Creek (Lower Moira)



Lot 7 LP99852
Deep Creek (Lower Moira) (Club Mud)



Lot 3 LP99852
Deep Creek (Lower Moira)



Lot 2 LP99852
Deep Creek (Lower Moira)



Lot 5 LP 99839
Deep Creek (Lower Moira)



Lot 6 LP 99839
Deep Creek (Lower Moira)



Lot 7 LP 99839
Deep Creek (Lower Moira)



Lot 9 LP 99839
Deep Creek (Lower Moira)



Lot 12 LP 99839
Deep Creek (Lower Moira)



Lot 17 LP 99852
Deep Creek (Lower Moira)

2. Properties Directly within Rehabilitation Area
(Refer to Drawing Number 2001384-1&2)



(16) PC 73328 Parish of Kotupna

3. Properties Adjacent to Rehabilitation Area



(4) Cottage 1 Madowla Park



(11) Lot 4 LP 127939



(5) CA7A & CA15 Sec 4 Parish of Narjoka
(North of levee alignment)



(25) CA 19, CA 20 & Pt CA 16 Sec F Parish of Barwo



(10) Pt CA 75, Sec D, Parish of Kotupna & CA 21 & CA 21B,
Sec E, Parish of Barwo

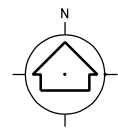


(21) CA's 22, 23, 30, 31 Sec A, Parish of
Tallygaroopna. House 1



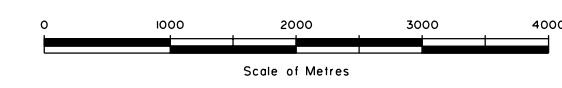
(20) CA's 22, 23, 30, 31 Sec A, Parish of Tallygaroopna.
House 2

Appendix 7 - Lower Goulburn Levees: Area proposed for Category 1 Rating - (courtesy - Sinclair Knight Merz)

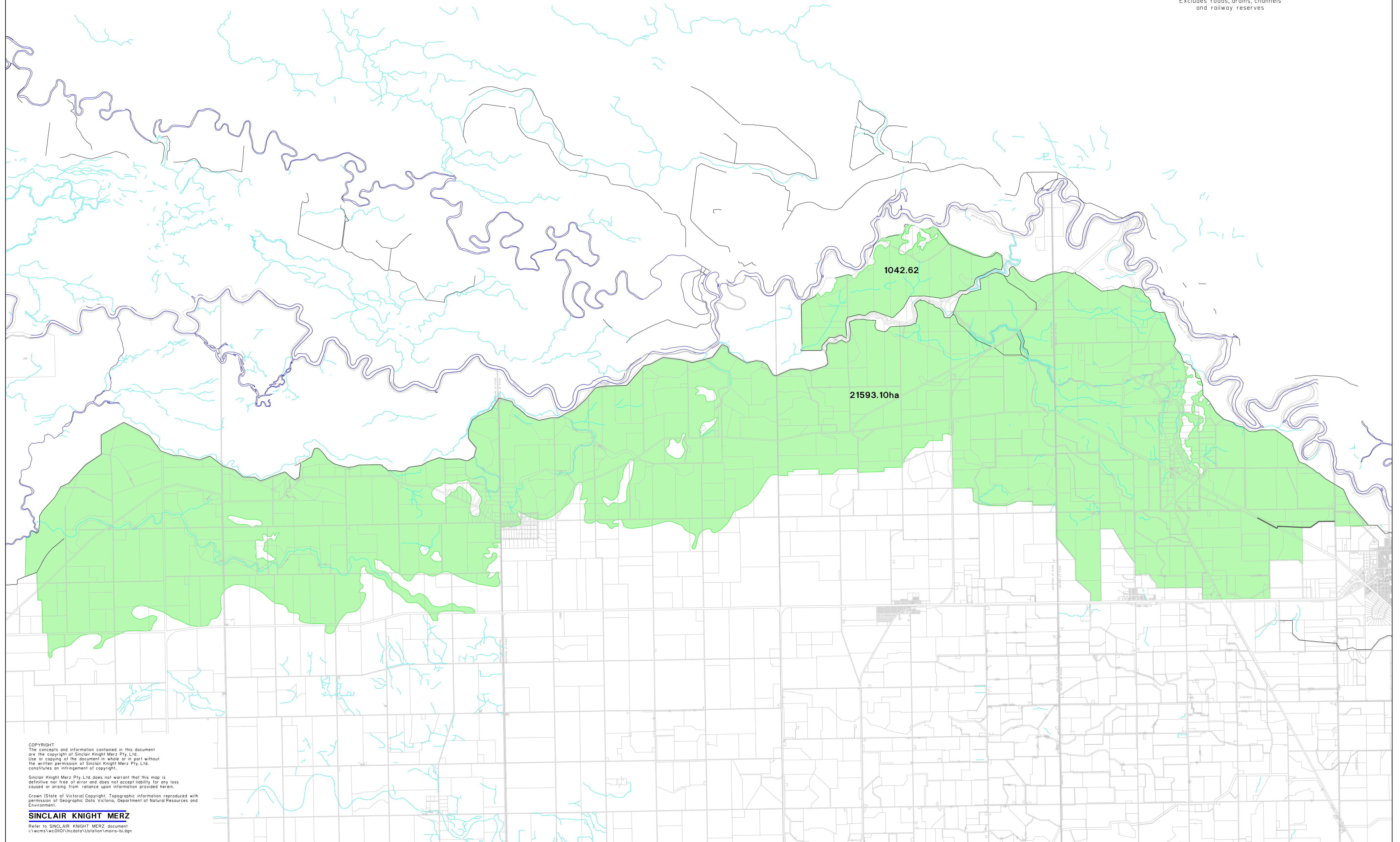


Goulburn Broken Catchment Management Authority

**FIGURE 2
PWD LEVEES
COBRAM TO PIREE CREEK
AREA PROPOSED FOR
CATEGORY 1 RATING**



Area proposed for Category 1 Rating
= 20370 ha
Excludes roads, drains, channels
and railway reserves



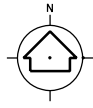
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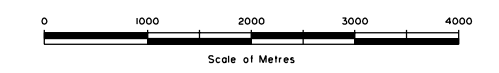
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Goulburn Broken Catchment Management Authority
FIGURE 1
LOWER GOULBURN LEVEES
AREA PROPOSED FOR
CATEGORY 1 RATING



Area proposed for Category 1 Rating
= 41000 ha
Excludes roads, channels
and drain reserves

