1. INTRODUCTION

1.1 Background to the Study

The study area is a portion of the Strzelecki Ranges bounded approximately by Yarragon, Trafalgar, Moe, Narracan and Mirboo North as shown in Figure 1.1.

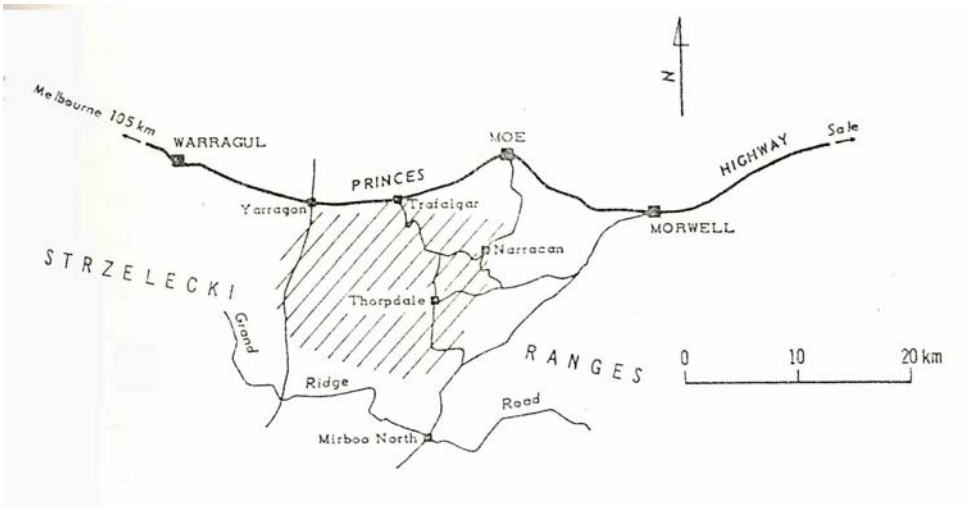

Figure 1.1 – Landslide Study Area (shaded). Part of the Southern District of the Shire of Narracan

The Shire of Narracan has a major problem in controlling landslides which intercept the numerous roads between farms and towns in the area. In a letter dated 5 September 1977 (Appendix 1.1), the Shire Engineer, Mr R D Thege, requested the Department of Minerals and Energy to undertake a study of the area with a view to establishing guidelines for achieving more effective control, prevention and avoidance of local landslide problems. The State Treasury made funds available for the project in February 1978, and field work commenced in May 1978.

Mr Thege stated that during 1975, approximately 22 landslides were active, and after the heavy winter rains in 1977 further landslides developed, some of them quite massive. Following the 1975 landslides, the cost of remedial work was estimated to be at least $286,000. The cost of the 1977 landslides is anticipated to be in the order of $200,000 with $110,000 being required to rectify a landslide on the main Trafalgar to Thorpdale road (Figure 1.2). Periodic expenditure of this magnitude on remedial work cannot be expected to eliminate the problem of roadside landslides in the Shire. Continuing improvement on some landslides required recurrent work, and will remain an ongoing cost to the Shire until long-term solutions are found and implemented.

The Shire's list of 1975 roadside landslides is attached as Appendix 1.2. Details of landslide location, nature of damage, estimated cost and proposed remedial work are tabulated. The identification number allocated to each landslide will be used throughout this report.

Figure 1.2 – Landslide in fill section of the main Trafalgar to Thorpdale road reduces width to one land. April 1978.

The economic significance of landslides is not confined to the chronic damage caused to roads in the area. Landslides also degrade the quality of farmland pastures, damage crops, destroy dams (Figure 1.3). add to the sediment load of streams and occasionally damage buildings, fences and powerlines. No cases of human death or injury due to landsliding in the area are known to the writer, but electric fences are needed to stop stock from becoming stuck in fresh earthflows and in slump fissures.

Figure 1.3 – Farm dam breached by landslide at Dingley Dell. July 1978.

The recent trend towards more intensive land use by subdividing large farms into smaller "hobby farms" and "rural retreats", increases the potential of landslide damage, and highlights the need to assess landslide susceptibility in the area. The economic cost of poorly planned changes in land use could be immense. For example, under present conditions of urban land development in landslide and landslide-prone areas of California, Alfors et al. al. (1973), estimates that losses due to landslides will total US $10 billion between 1970 and year 2000. It is suggested that the problem in the Shire of Narracan is as severe as the Californian situation – the same potential for dense urban development does not exist in the Shire. However, as in California, measures involving geological investigations, engineering practice and careful planning can greatly reduce the economic losses and inconvenience caused by landslides.

1.2 Aims of the Study

The major purposes of the study is to determine the most practical and economical means by which the Shire and landowners can mitigate the damage caused by landslides. In more detail, the aims of the investigation have been:

* To describe the major landslide types
* To determine the factors which contribute to landslide activity
* To map areas of past and present landsliding
* To suggest remedial and preventative measures for landslide control.

The investigation has focused on the nature of slope stability on a broad scale over the entire area. A number of landslides, considered representative of their type were selected for drilling and soil sampling, but a comprehensive study of any one particular landslide has not been carried out. Such a study would involve detailed geological and geochemical studies beyond the scope of this investigation. It is hoped that the present investigation will provide a valuable basis upon which detailed site investigation of selected landslides can be carried out in the future.

1.3 Investigation Methods

The study has involved the following methods of investigation:

* Initial field reconnaissance to examine the morphology and geology of the major landslide types.

* Individual landslides which have damaged roads in the area were examined in some detail noting the type of damage, possible causes of the landslide and the nature of any remedial work carried out.

* Interpretation of aerial photographs, to delineate landslide areas, to assess the causes of landslides and to study the morphology of selected landslides.

* Collection of all known data on local landslide activity, such as geological and engineering reports, Shire records, newspaper articles and historical literature.

* Analysis of daily rainfall records in relation to landslide occurrence.

* Study of the historical changes in land use, with particular emphasis on deforestation, road construction and agricultural usage.

* Drilling and soil sampling at selected roadside landslides.

* Observation of groundwater levels during and after drilling.

* Study of the surface drainage at selected landslides.

* Detailed description of the soil profile encountered in each borehole, paying particular attention to stratigraphy, lithology, soil disturbance, soil consistency, plasticity, moisture content and identification of the failure surface.

* Laboratory soil tests to determine soil substance according to the Unified Soil Classification System.

* Palynological examination of soil samples.

* Determination of clay mineralogy by X-ray diffraction methods.

* Chemical analyses of groundwater samples.

* Extensive literature search to check for appropriate remedial techniques.

The choice of investigation techniques was made within the constraints of time and available finance existing during the study. The methods are considered to be sufficiently comprehensive to provide reliable, integrated data, suitable for the nature and scale of the investigation. Numerous techniques are available for the geological investigation of landslides. Zàruba and Mencl (1969) and Varnes (1958) describe the basic techniques used in landslide investigations. More recently, emphasis has been given to field instrumentation for continuous monitoring of landslide movements. Developments in field instrumentation are described in numerous publications, such as that of the British Geotechnical Society (1974). The scope of the present study does not cover field instrumentation.