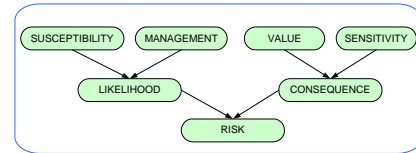


# West Gippsland Region Soil Erosion Management Plan



## Mapping the potential extent of soil erosion in the WGCMA region

A soil erosion management plan was developed as an implementation tool for the West Gippsland CMA Regional Catchment Strategy (RCS). The regional extent and severity of erosion had not been mapped and so a risk assessment using the LUIM was appropriate. The LUIM outputs were used to identify areas most prone to soil erosion processes, the area of land at risk from erosion under current land management, and the priority on-site assets for protection and remediation works. The off-site 'down catchment' impacts (sedimentation of streams and rivers) were also addressed.

### Key achievements

Key achievements include:

- Good engagement with the CMA staff and other regional stakeholders
- Assessment of the on-site and off-site impacts of erosion
- Provided information for the development of a soil erosion management plan

An expansion from previous applications was the assessment of risk to both on-site and off-site assets. Linkages between the likelihood of occurrence of soil erosion in a sub catchment and the potential for loss of river health was developed, and water assets (priority river reaches identified in the West Gippsland River Health Strategy (RHS) (WGCMA 2005) at risk from sedimentation resulting from soil erosion, were identified. The off-site risk information was used to prioritise sub catchments in the region for protection in the soil erosion management plan.

### Elements

Six erosion processes were assessed:

1. Sheet erosion.
2. Rill erosion.
3. Gully erosion.
4. Tunnel erosion.
5. Landslips.
6. Wind erosion.

No revisions to the LUIM or the risk assessment framework were necessary for this project.

### Process

The risk assessment method was comprised the following components:

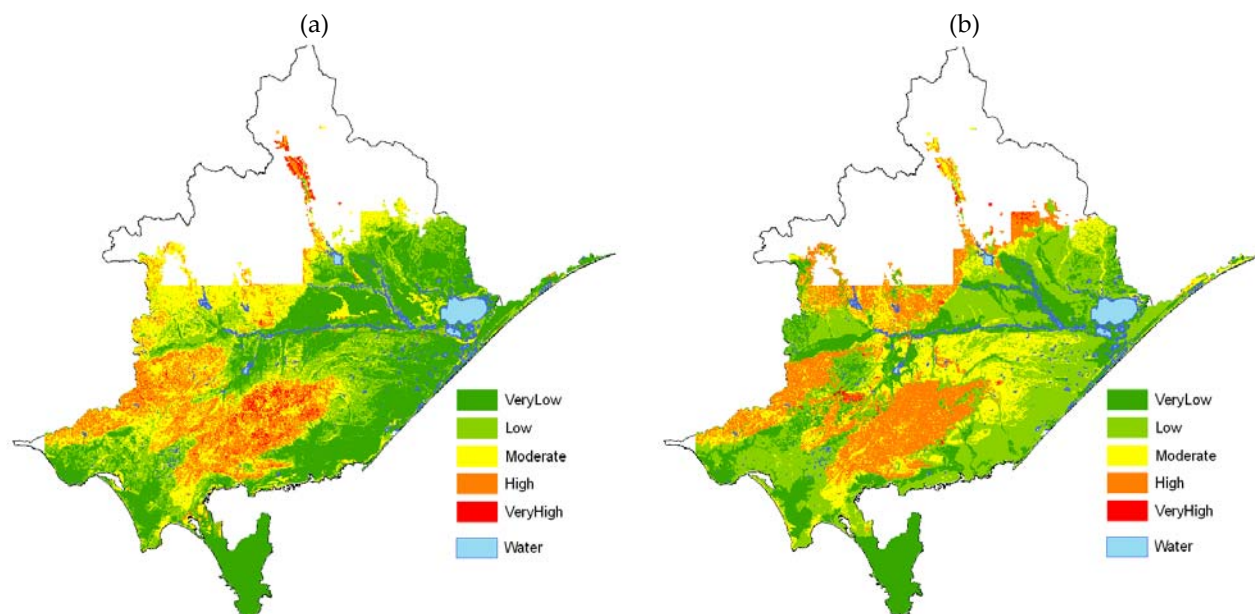
- Development of map units and attribute data
- Rating map units for susceptibility to erosion
- Rating map units for sensitivity to erosion
- Classification of asset value
- Collection of land use and land management information
- On-site risk assessment
- Off-site risk assessment

The primary map units used in the risk analysis for the WGCMA were formed by intersecting three digital spatial data sets: soil and landform, digital elevation model (DEM), and land use. The combination of these data sets created a single polygonal layer in which each MU had a set of associated attribute information on soil type, slope and current land use.

The soil information was sourced from a previously mapped 1:100 000 scale land resource assessment of the region (Sargeant and Imhof, 2006). This layer was not available for public land areas of the region and so the

assessment was carried out for private (largely agricultural land) only. The DEM was sourced from a state wide raster data set represented at 1:25 000 scale. A five-class slope polygonal layer was derived from the DEM for the region. Land use information was sourced from a previously mapped 1:100 000 scale land use map (Sposito, Abuzar and Morris 2000).

Map units were classified (very low, low, moderate, high, or very high) for their inherent susceptibility to each of the threatening processes (apart from wind erosion and land slips) using rule tables modified from Elliott and Leys (1991), van Gool and Moore (1998), and Baxter *et al.* (1997). Susceptibility to land slips and wind erosion were assessed using an expert classification by Ian Sargeant, the regional soils and landscapes expert. Figure 27(a) and (b) show the susceptibility maps for sheet or rill erosion and gully or tunnel erosion. The white areas on the maps represent areas in the region where primary soil data were not available and were excluded from the assessment.



**Figure 27 (a) Susceptibility of MUs to sheet or rill erosion, and (b) susceptibility to gully or tunnel erosion for the WGCMA soil erosion management plan**

Inherent sensitivity was assessed using rules derived in a workshop with regional soil specialists. Topsoil depth was chosen as the key attribute as soils with thin topsoils are less resilient to erosion. Topsoil depth was grouped into three classes and rated low, moderate or high (Table 11). Such a simple method for assessing sensitivity was felt to be appropriate to the scale of the assessment and soil data available.

**Table 11 Topsoil depth classes and sensitivity ratings used in the WGCMA soil erosion management plan.**

Top soil depth (cm)	Sensitivity rating
>40	Low
20-40	Moderate
<20	High

Land use type was used to define the on-site asset to be assessed for erosion risk. Each land use category mapped for the region was assigned an asset value rating by regional stakeholders. Each land use was given a score based on a set of economic, environmental and social criteria adapted from Heislors and Clifton (2004). The results are presented in Table 12. The total scores were grouped into three classes (low, moderate, high) and used in the risk assessment. Off-site assets, such as rivers, streams and wetlands, were rated for value using scores from the WGCMA River Health Strategy.

**Table 12 Land uses and their assigned value as assets (according to economic, environmental and social criteria adapted from Heislars and Clifton 2004) for the WGCMA soil erosion management plan.**

Land Assets	Economic			<sup>1</sup> Environmental				Social			Total score
	Economic activity	Capital value	Facilitate economic activity	S	C	R	Heritage value	Maintain community	Visual amenity	Social amenity	
Cropping- cereals, oils and fodder crops	2	1	1	0	0	0	2	1	1	0	8
Horticulture - Flowers	2	2	1	0	0	0	1	1	2	0	9
Low rainfall beef and sheep grazing (<750 mm)	1	1	1	1	0	1	2	1	2	0	10
Horticulture - fruit	2	3	1	0	0	0	1	1	2	0	10
Mining - quarries, gravel pits	3	2	2	0	0	0	2	1	0	0	10
Rural residential- up to 2 ha	0	3	2	1	0	0	1	2	2	0	11
Farm forestry	1	2	1	1	1	1	1	1	2	0	11
Lifestyle farms >2 ha	1	2	1	1	1	1	1	1	2	0	11
Irrigated grazing	2	2	2	1	0	0	1	1	2	0	11
Permanent irrigated cropping (potatoes)	2	3	2	0	0	0	2	2	2	0	13
Potatoes (irrigated crop pasture rotation)	2	3	2	0	0	0	2	2	2	0	13
Horticulture - irrigated vegetables	3	3	2	0	0	0	1	2	2	0	13
Commercial pine plantations	2	2	3	1	0	0	1	3	1	1	14
High rainfall beef and sheep grazing (>750 mm)	2	2	2	1	0	1	2	2	3	0	15
Rural infrastructure - bridges roads etc	2	3	3	0	0	0	2	2	1	2	15

<sup>1</sup> Environmental categories: S = significance; C = condition; R = rarity. 0 = no value; 1 = low; 2 = moderate; 3 = high.

**Table 12 (continued) Land uses and their assigned value as assets (according to economic, environmental and social criteria adapted from Heislars and Clifton 2004) for the WGCMA soil erosion management plan.**

Land Assets	Economic			<sup>2</sup> Environmental				Social			Total score
	Economic activity	Capital value	Facilitate economic activity	S	C	R	Heritage value	Maintain community	Visual amenity	Social amenity	
Energy mines	3	3	3	0	0	0	3	3	0	0	15
Irrigated Dairy - Macallister	3	3	3	1	0	0	1	3	1	0	15
Irrigated Dairy - Yarram/	3	3	3	1	0	0	1	3	1	0	15
Grazing in native grasses	1	1	1	3	1	3	3	0	2	0	15
Private native vegetation (non commercial)	0	1	1	3	2	3	3	0	3	1	17
Dryland Dairy	3	3	3	1	0	1	2	3	2	0	18
Urban infrastructure - recreation areas, housing (other)	3	3	3	1	1	1	2	3	2	2	21
Marine and coastal park	1	1	2	3	3	3	2	1	3	2	21
Ski reserves	2	2	2	3	1	3	1	2	3	3	22
State Park	1	1	2	3	3	3	3	1	3	3	23
Public land forestry	2	2	3	2	2	2	3	3	2	2	23
Road and rail reserves cemetery	2	3	3	3	2	3	2	1	2	2	23
National Park, nature conservation	1	1	3	3	3	3	3	2	3	3	25
Coastal reserves	2	3	3	3	3	3	3	2	3	3	28

<sup>2</sup> Environmental categories: S = significance; C = condition; R = rarity. 0 = no value; 1 = low; 2 = moderate; 3 = high.

Fifteen land uses were included in the assessment (Table 13). Land use categories excluded from the risk assessment were urban land, infrastructure, mining, and quarries, services and other non-agricultural land uses. National parks, state forests and other parks and reservations were excluded from the assessment due to the lack of soil information for public land. Using local expert knowledge, the land use map was augmented from the BRS nomenclature to identify specific uses (Table 13). It really enhanced the quality of the risk outputs, by being able to drill down from general land use categories, such as grazing non-irrigated and irrigated improved and fertilised pastures to specific land use information such as high rainfall dairy, and mixed dairy and beef.

**Table 13 Land use categories assessed for risk and the original land use categories for the WGCMA soil erosion management plan**

BRS land use nomenclature	Land use categories in the WGCMA risk assessment
Grazing improved and fertilised pastures	High rainfall mixed dairy and beef Low rainfall mixed beef and sheep High rainfall dairy
Cropping, Permanent cropping	Permanent cropping
Grazing of native pasture	Grazing of native vegetation
Hardwood plantations	Hardwood plantations
Horticulture	Horticulture
Irrigated crop/pasture rotations	Irrigated crop-pasture rotations (potatoes)
Irrigated improved and fertilised pastures	Irrigated improved and fertilised pastures Irrigated dairy
Irrigated permanent cropping	Irrigated permanent cropping (potatoes)
Production forests	Production forests
Softwood plantations	Softwood plantations

Regional experts, in a series of industry based workshops:

1. identified management practices that could influence the occurrence of erosion,
2. estimated the distribution of each of the practices for the region, and
3. assigned ratings to combinations of practices for their influence, positive or negative, on the potential for erosion.

Examples of the practices, their distribution and ratings for high rainfall dairy are given in Table 14 and Table 15.

**Table 14 High rainfall dairy management practices assessed for sheet and rill erosion and estimated distribution for the WGCMA soil erosion management plan.**

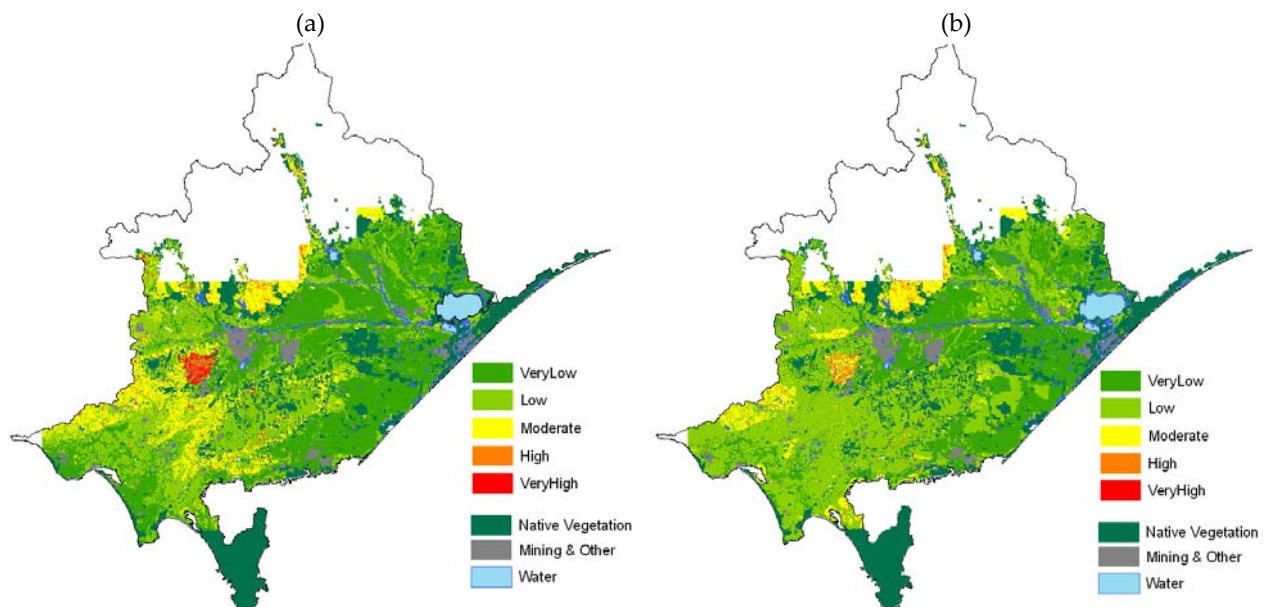
Practice category	Practice options	Estimated distribution (% dairy area)
Grazing rotation:	graze and spell	70
	set stock	30
Pasture composition:	perennial	80
	sown annual	5
	annual	25
Renovation method	direct drill	35
	cultivation	65

**Table 15 High rainfall dairy management practices classified for influence on occurrence of sheet and rill erosion for the WGCMA soil erosion management plan**

Grazing rotation	Pasture composition	Renovation method	Influence on sheet or rill erosion
Graze and spell	Perennial	Direct drill	Beneficial
Graze and spell	Perennial	Cultivation	Weakly negative
Graze and spell	Sown annual	Direct drill	Weakly negative
Graze and spell	Sown annual	Cultivation	Weakly negative
Graze and spell	Annual	Direct drill	Weakly negative
Graze and spell	Annual	Cultivation	Weakly negative
Set stock	Perennial	Direct drill	Weakly negative
Set stock	Perennial	Cultivation	Weakly negative
Set stock	Sown annual	Direct drill	Weakly negative
Set stock	Sown annual	Cultivation	Moderately negative
Set stock	Annual	Direct drill	Moderately negative
Set stock	Annual	Cultivation	Moderately negative

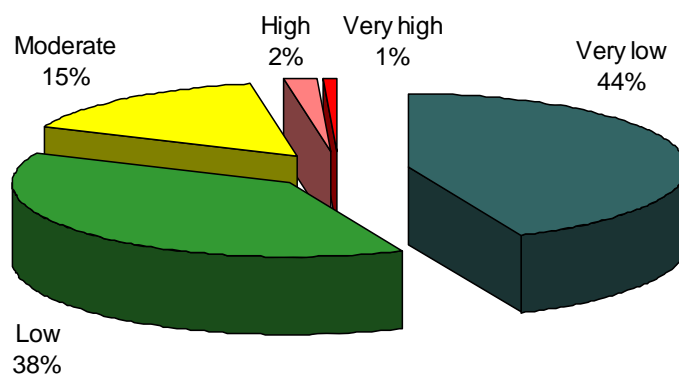
## Results

On-site and off-site risk results were produced. On-site results showed where erosion was likely. Likelihood and risk maps for each of the erosion issues were produced using the LUIM (Figure 28). A panel of regional soil and industry experts reviewed the LUIM outputs. With some revisions, there was agreement that the likelihood maps correlated quite strongly with the panel’s knowledge of areas that are actively eroding in the region. The risk maps were harder to review, being a more qualitative product. However, the panel accepted the risk results as useful for prioritising high value assets likely to experience soil erosion. Field validation of the results would increase user confidence in the outputs.



**Figure 28 Example output: (a) Likelihood of occurrence of sheet or rill erosion, (b) risk of sheet or rill erosion for the WGCMA soil erosion management plan**

Area statements were also produced to summarise the total area with each class for likelihood. The likelihood results were collated to identify the total area within each likelihood class for each erosion process, providing a summary of the potential extent of the erosion issues in the region (Figure 29).



**Figure 29 Area within each likelihood category for sheet and rill erosion for 2006 for the WGCMA soil erosion management plan**

Table 16 summarises the area rated as high to very high erosion risk for each sub-catchment. This information was used in conjunction with River Health Strategy (RHS) information to prioritise actions in the soil health management plan. These will be targeted at sub catchments with large areas of high to very high erosion risk and high value in the RHS.

**Table 16 An example of the summary of erosion risk for sub catchments in the WGCMA region.**

Sub Catchment Name	RHS sub catchment Number	Total area (ha) at high to very high risk of erosion				Declared Water Supply catchment	River health Strategy management program
		Gully & Tunnel	Sheet & Rill	Landslips	Wind		
Upper Macalister River	1	1250	700	0	0	Yes	N
Middle Macalister River	3	3690	1530	45	0		A
Lower Macalister River	4	1230	0	0	0		A
Perry River	5	1160	0	0	0		N
Upper Avon River	6	800	60	0	0		N
Lower Avon	7	1536	20	0	0		N
Upper Thomson	8	700	930	0	0	Yes	A
Lower Thomson	9	510	50	0	0		C
Lake Wellington	10	20	30	0	0		A
Upper La Trobe River	11	4400	580	0	0	Partly	B
Moe River & Narracan Creek	12	7880	3090	0	0	Partly	C

River Health Strategy management program definitions – N = No program, A = Protection of highest environmental, social, economic value sub-catchments, B = maintenance and enhancement of ecologically healthy and representative rivers, C = Produce an overall improvement in the environmental condition of our rivers.

Reducing the off-site impacts of erosion, such as down stream sedimentation of high value rivers and streams leading into the Gippsland Lakes system, is a higher priority for the region than the on-site impacts of erosion. The off-site risk assessment used likelihood results from the on-site assessment in conjunction with River Health Strategy information, to highlight the sections of rivers that were most at risk from erosion occurring within their sub-catchments.