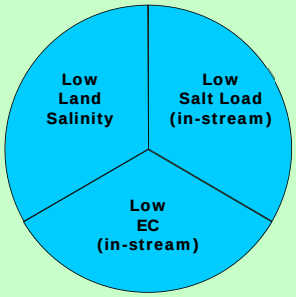
17. Orroral Hydrogeological Landscape

LOCALITIES	**Orroral Valley**	
MAP SHEET	**Tantangara 1:100 000** **Michelago 1:100 000**	
CONFIDENCE LEVEL	**Moderate**	

OVERVIEW

The Orroral Hydrogeological Landscape (HGL) extends to the south within the Namadgi National Park in low lying, wet drainage areas (Figure 1). The HGL covers an area of 51 km^2 and receives 650 to 900 mm of rain per annum.

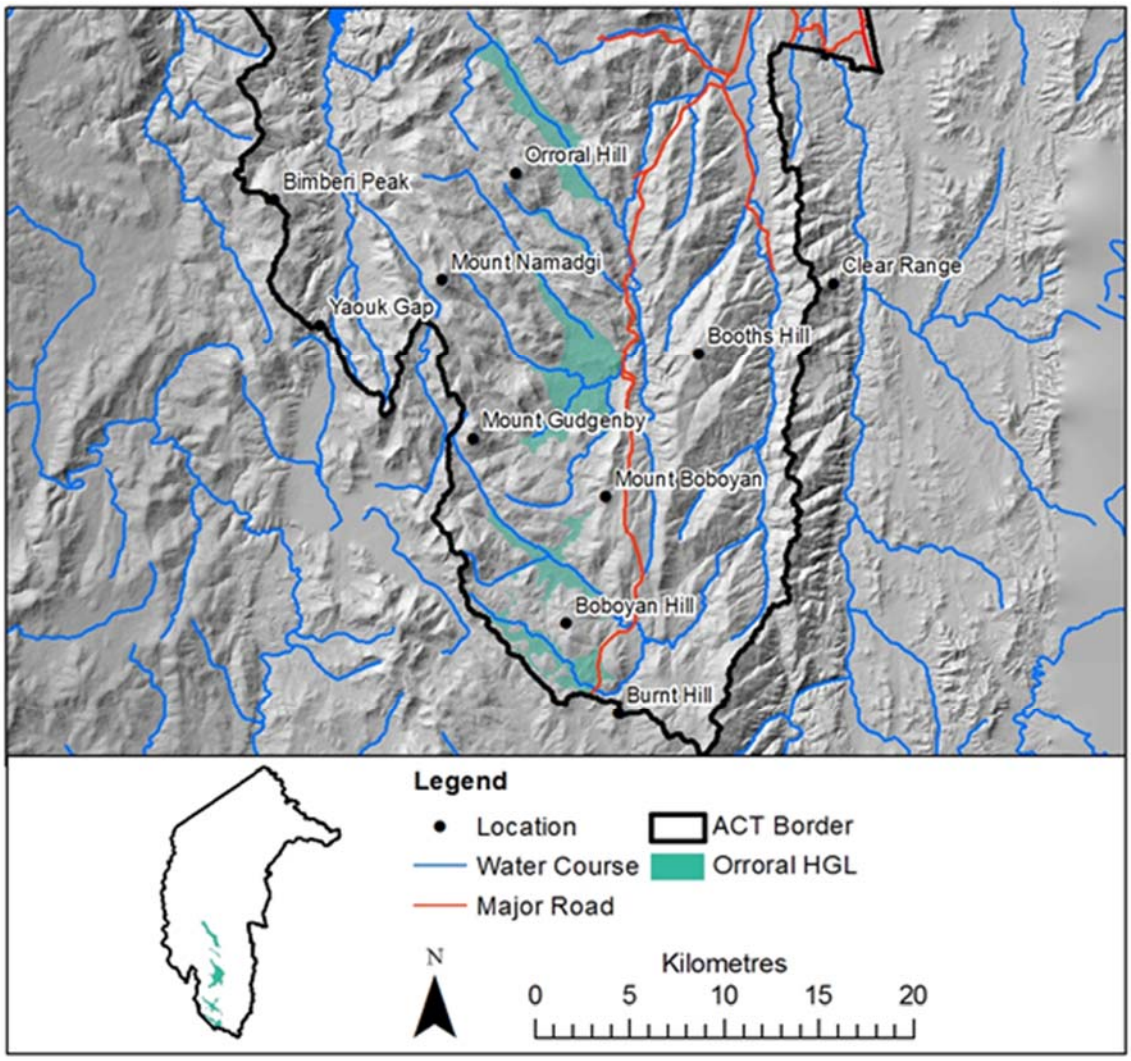


Figure 1: Orroral HGL distribution map.

Orroral HGL is defined by altitude and the soil landscape boundary of the cleared Orroral Valley (Figure 2). The area has wet floodplains, large gully erosion areas and significant areas of waterlogging in the lower landscape. There is also seasonal soil profile waterlogging on the mid slopes, indicated by pin rush plants.

The flow lines have been cleared for grazing, which may have impacted streams. Flow lines are either defined or braided and there are a number of uncontrolled gully heads with significant undercutting and associated gully erosion. Gully lines are often boulder strewn, caused by high energy runoff events.

Orroral HGL adjoins Namadgi HGL, with springs at the colluvial break of slope. High runoff contributes to the spring flow, producing a very waterlogged and extensive wetland environment. Frost pockets impact on vegetation type.

There are some sandy soils associated with rises in the lower landscape.

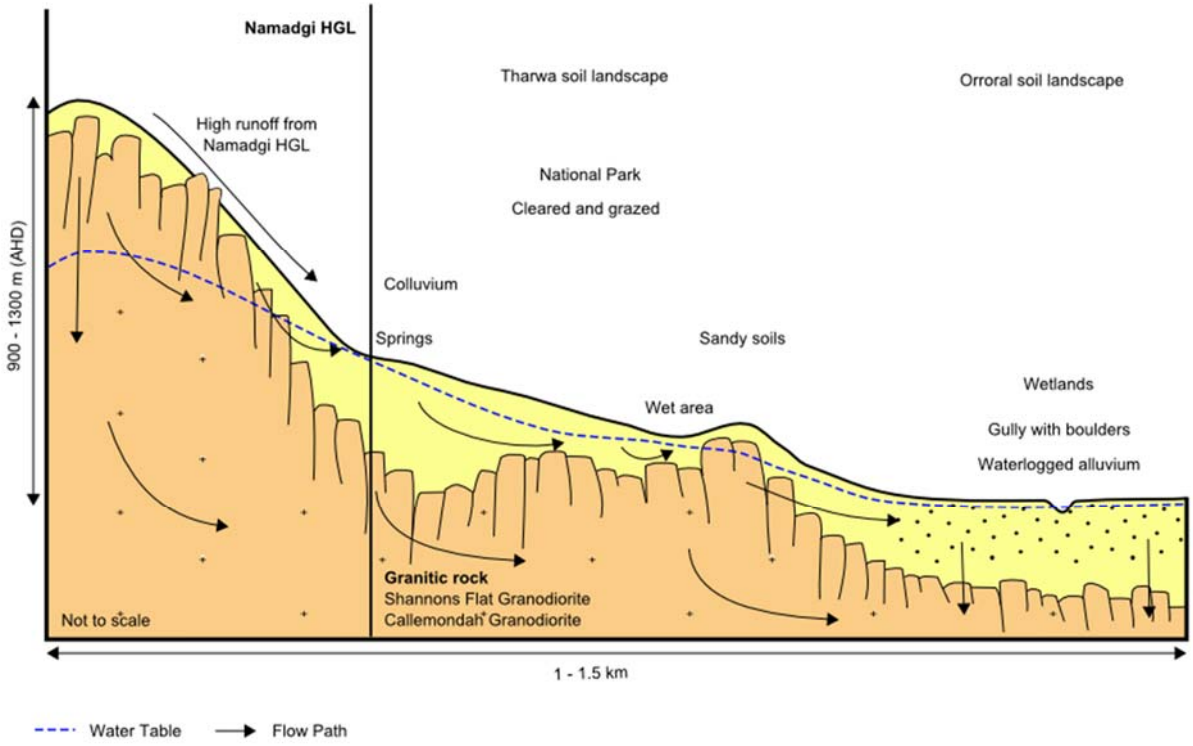


Figure 2: Conceptual cross-section for Orroral HGL showing the distribution of regolith and landforms, salt sites if present, and flow paths of water infiltrating the system.

There is minor evidence of salinity in this HGL (Table 1).

Table 1: Orroral HGL salinity expression.

SALINITY EXPRESSION	
Land Salinity (Occurrence)	Low – no evidence of salinity
Salt Load (Export)	Low – net dilution landscape
EC (Water Quality)	Low – fresh water, but high sediment load at times

Salt store refers to the amount of salt stored in soil and geology materials. Salt availability refers to how easily this salt can be moved by water. Salt stored within Orroral HGL has moderate mobility. There is a moderate salt store that has moderate availability (Table 2).

Table 2: Orroral HGL salt store and availability.

SALT MOBILITY			
	Low availability	**Moderate** availability	**High** availability
High salt store			
Moderate salt store		**Orroral**	
Low salt store			

Overall salinity hazard is based on the likelihood of salinity occurring and how much impact it will have. The overall salinity hazard in Orroral HGL is low. This is due to the moderate likelihood that salinity issues will occur and that they would have potentially limited impacts (Table 3).

Table 3: Likelihood of salinity occurrence, potential impact and overall hazard of salinity for Orroral HGL.

OVERALL SALINITY HAZARD			
	Limited potential impact	**Significant** potential impact	**Severe** potential impact
High likelihood of occurrence			
Moderate likelihood of occurrence	**Orroral**		
Low likelihood of occurrence			

LANDSCAPE FEATURES

The following photographs illustrate landscapes and specific features observed in this HGL. Information used to define the HGL is summarised in Table 4.

Photo 1: Wet flowlines of Orroral HGL with Namadgi HGL in background (Photo: OEH / W Cook).

Photo 2: Landscape view across Orroral HGL with granite boulders on rises in foreground (Photo: OEH / W Cook).

Photo 3: Boulder strewn drainage lines of Orroral HGL (Photo: OEH / W Cook).

Photo 4: Wetland area within creek line in Orroral HGL (Photo: OEH / W Cook).

Photo 5: Colluvial slope element above drainage line in Orroral HGL (Photo: OEH / W Cook).

Table 4: Summary of information used to define Orroral HGL

Lithology *(Raymond et al. 2007; Geoscience Australia 2015)*	This HGL comprises granitic rocks. Key lithologies include: • Shannons Flat Granodiorite • Callemondah Granodiorite
Annual Rainfall	650–900 mm
Regolith and Landforms	Soil generally <1m deep with deeper pockets associated with areas of saprolite along fractures and in flow lines. Deeper soil in drainage lines and constricted valleys provides moderate potential for salt store. Slopes generally 0–10% in valley bottoms; 10–32% in some lower slope areas Elevation range is 900–1300 m

Soil Landscapes *(Jenkins 1993; Jenkins 2000; Cook & Jenkins in prep)*	The following soil landscapes are dominant in this HGL: • Tharwa • Orroral Soils depth is variable. On steeper margins or anywhere within the HGL where rock outcrop nears the surface, Leptic Rudosols (Lithosols) and Tenosols (Earth Sands and Siliceous Sands) are common. On gentle slopes situated above the floodplain Brown Chromosols (Non-calcic Brown Soils) are found. Yellow and Brown Chromosols (Yellow Podzolic Soils) occur throughout the landscape except for the drainage depressions where Sodosols (Solodic Soils) and Stratic Rudosols (Alluvial Soils) are common. The Sodosols are fragile soils, prone to erosion and delivery of sediment to waterways.
Land and Soil Capability	Class 5
Land Use	• national park • grazing • native forest
Key Land Degradation Issues	• waterlogging • gully erosion – water erosion
Native Vegetation *(Keith 2004; Gellie 2005; Dept. of Environment 2012)*	This HGL is situated predominantly within the IBRA7 South Eastern Highlands (Murrumbateman subregion), with small higher elevations areas in the Australian Alps The HGL is partially cleared with vegetation formations comprising Grassy Woodlands and Dry Sclerophyll Forest. Grasslands and Freshwater Wetlands are common features as well as minor areas of Wet Sclerophyll Forest. Local vegetation is described by Gellie (2005)

HYDROGEOLOGY

Typical values for the hydrogeological parameters of this HGL are summarised in Table 5.

Table 5: Summary of values for typical hydrogeological parameters of Orroral HGL.

Aquifer Type	Unconfined in fractured rock and saprolite Lateral flow through unconsolidated colluvial and alluvial sediments on slopes and in flow lines
Hydraulic Conductivity	Moderate Range: 10^{-2}–10 m/day
Aquifer Transmissivity	Low Range: 2–100 m^2/day
Specific Yield	Moderate Range: 5–15%

Hydraulic Gradient	Moderate Range: 10–30%
Groundwater Salinity	Fresh Range: <800 µS/cm
Depth to Watertable	Locally shallow to intermediate Range: <2–8 m
Typical Sub-Catchment Size	Small (<100 ha)
Scale (Flow Length)	Local Flow length: <5 km (short)
Recharge Estimate	Moderate
Residence Time	Short to medium (months to years)
Responsiveness to Change	Fast to medium (months to years)

MANAGEMENT OPTIONS

Overarching salinity management strategies have specific biophysical outcomes. These are achieved by implementing a series of targeted land management actions that take into account the opportunities and constraints of the particular HGL. The actions recognise the need for diffuse and specific activities within the landscape to impact on salinity. Further explanation of land management functions, strategies and actions can be found in Wooldridge *et al.* (2015).

Salinity is driven by interactions between water-use capacity of vegetation, physical soil properties and hydrogeological processes within the HGL.

Actions that influence the way water is used by vegetation or stored in the soil profile will have impacts on recharge. The influence of both continual and episodic recharge and the impacts of extreme weather events should be considered when deciding on appropriate management actions. Short and long-term climate cycles also should be considered as they have a bearing on salinity processes, particularly salt load and land salinity.

Landscape Functions – Orroral HGL

Functions this landscape provides within a catchment scale salinity context:

- **A.** The landscape provides fresh water runoff as an **important water source.**
- **B.** The landscape provides fresh water runoff as an **important dilution flow source.**

Landscape Management Strategies – Orroral HGL

Appropriate strategies pertinent to this landscape:

- **Maintain or maximise runoff (10)**
- **Maintain current hydrology (11)**

Key Management Focus – Orroral HGL

Managing water within a national park for both water quality and water quantity is a major focus. The former grazing landscape is now national park; it has areas of high value and unique situations that need to be maintained, especially without disturbance. The area is unique in terms of the valley bottom wetlands, but gully erosion threatens the functioning of the system. Improvement in onsite and offsite NRM outcomes can be achieved through better grazing management and riparian zone management.

Fire, feral animal control and access tracks, all form part of NRM plans for national parks. Total grazing pressure is also an issue.

Specific Land Management Opportunities

Specific opportunities for this HGL:

- existing native pasture base in former grazing areas
- national park areas are public land
- wetland in drainage lines.

Specific Land Management Constraints

Constraints on land management in this HGL include:

- waterlogging and management of wetlands
- erosion (gullying) can have a very fast impact, with gully head migration leading to rapid dewatering of streams.

Specific Targeted Actions

Management areas for this HGL are illustrated in Figures 3 and 4. The specific management actions for these areas are described in Table 6.

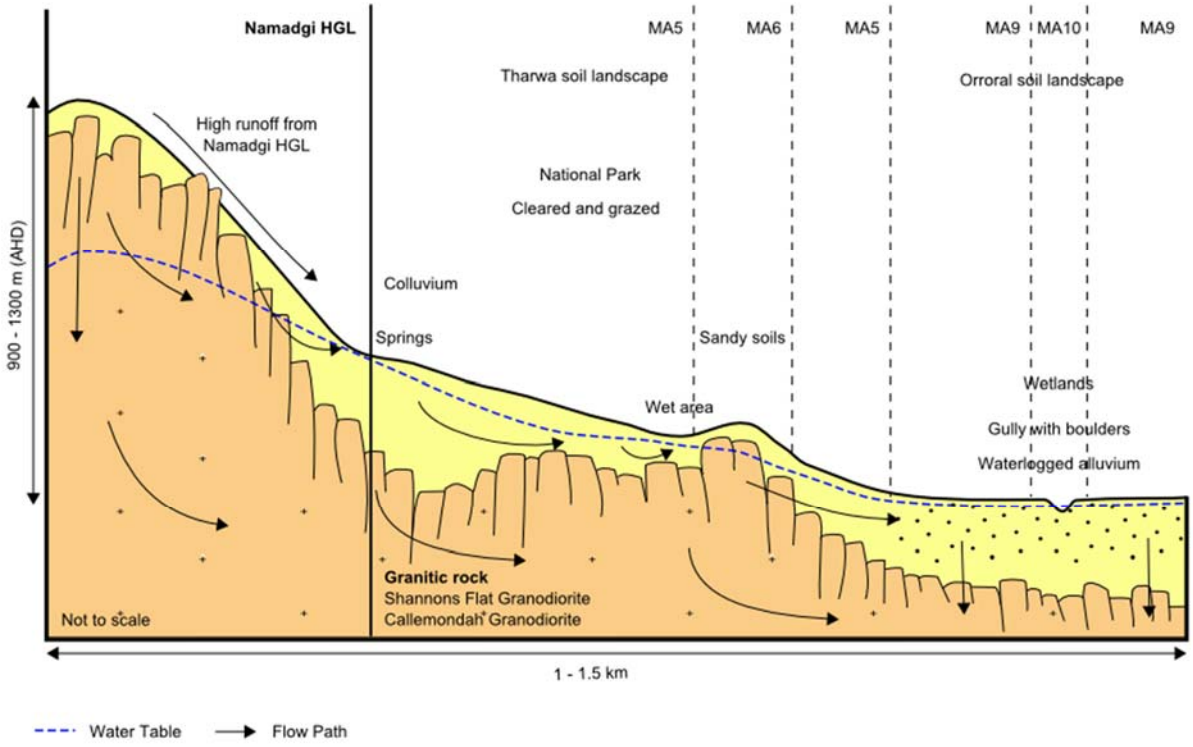


Figure 3: Management cross-section for Orroral HGL showing defined management areas.

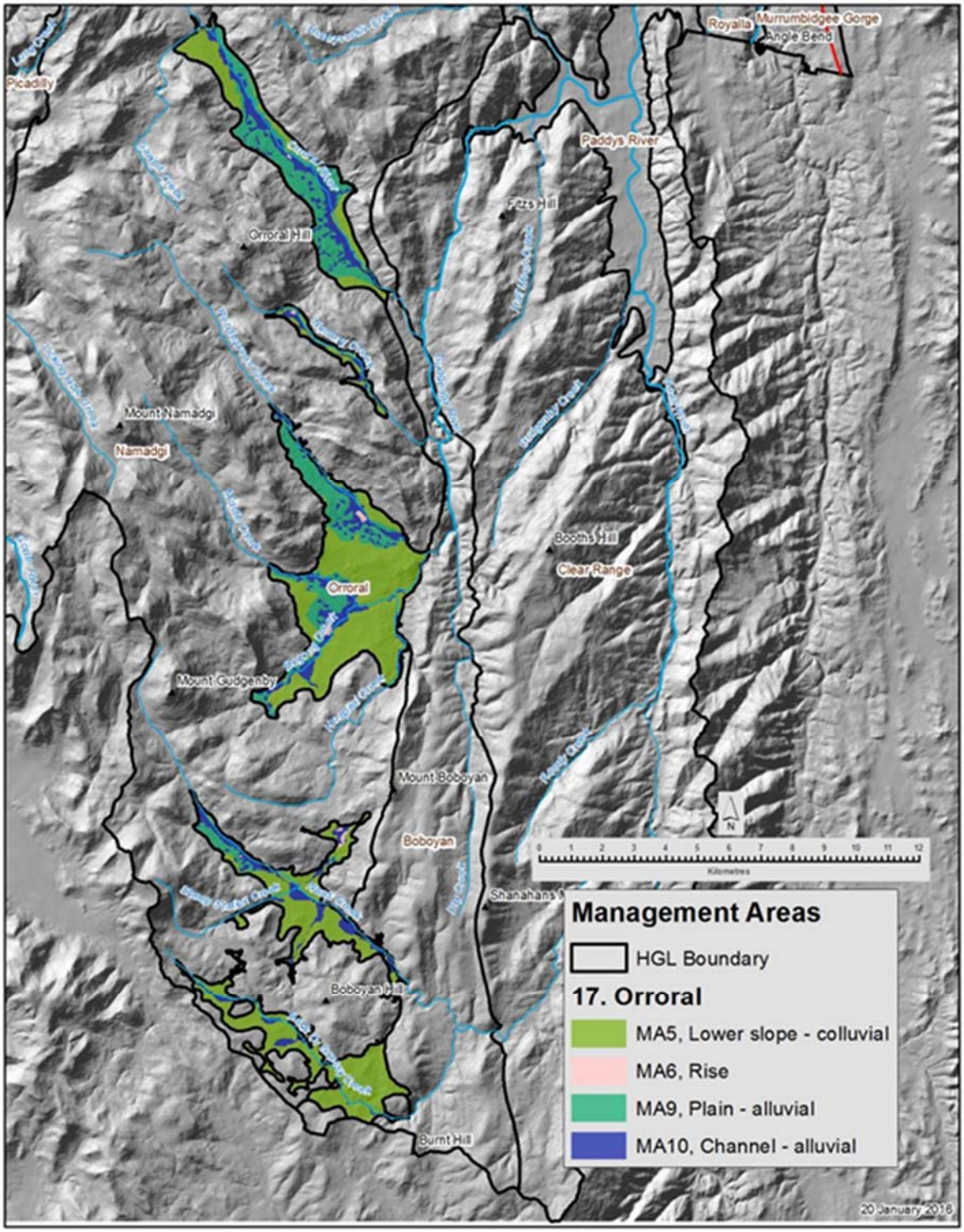


Figure 4: Spatial distribution of management areas for Orroral HGL.

Table 6: Specific management actions for management areas within Orroral HGL.

Management Area (MA)	Action
MA 5 (LOWER SLOPE – COLLUVIAL)	**Vegetation for ecosystem function** Interception planting of native woody species to target shallow groundwater **(VE2)** Maintain and improve existing native vegetation to protect current landscape hydrology **(VE8)**
MA 6 (RISES)	**Vegetation for ecosystem function** Maintain and improve existing native vegetation to protect current landscape hydrology **(VE8)**
MA 9 (ALLUVIAL FLOODPLAIN)	**Vegetation for ecosystem function** Maintain and improve existing native woody vegetation to reduce discharge **(VE3)** Maintain and improve riparian native vegetation to reduce discharge to streams **(VE4)** Maintain and improve existing native vegetation to protect current landscape hydrology **(VE8)** Manage animal impact on sensitive areas for hydrology outcomes **(VE10)**
MA 10	**Vegetation for ecosystem function** Maintain and improve existing native woody vegetation to reduce discharge **(VE3)** Maintain and improve riparian native vegetation to reduce discharge to streams **(VE4)**

High Hazard Land Use

There are some management actions that should be discouraged in this HGL as they will have negative impacts on salinity (Table 7).

Table 7: Management actions having negative salinity impacts in Orroral HGL.

At Risk Management Areas	Action
MA 5, 6, 9, 10	Clearing and poor management of native vegetation **(DLU4)** Reducing runoff from fresh surface water catchments **(DLU 6)** Poor soil management and loss of surface soil layers **(DLU 10)** Structures in creek lines Hard hoofed animals in wetlands Inappropriate burning regime

REFERENCES

Department of the Environment 2012, *Interim Biogeographic Regionalisation for Australia (IBRA), Version 7 (Regions),* Australian Government, Department of the Environment, Canberra, ACT

Gellie, N.J.H. 2005, Native vegetation of the Southern Forests: South-east Highlands, Australian Alps, South-west Slopes and SE Corner bioregions, *Cunninghamia 9(2)*, pp 219–253

Geoscience Australia, 2015, *Australian stratigraphic units database*, Canberra, ACT, (Accessed: 20 June 2015) http://dbforms.ga.gov.au/www/geodx.strat_units.int

Jenkins B.R. 1993, *Soil Landscapes of the Michelago 1:100 000 Sheet map and report*, Department of Conservation and Land Management, Sydney, NSW

Jenkins B.R. 2000, *Soil Landscapes of the Canberra 1:100 000 Sheet map and report*, Department of Land and Water Conservation, Sydney, NSW

Keith, D. A. 2004, *Ocean shores to desert dunes: the native vegetation of New South Wales and the ACT*, NSW Department of Environment and Conservation, Hurstville, NSW

Raymond, O.L., Lui, S., Kilgour, P., Retter, A.J., Stewart, A.J. and Stewart, G. 2007, *Surface geology of Australia 1:1,000,000 scale, New South Wales – 2nd edition*, Geoscience Australia, Canberra, ACT

Wooldridge, A., Nicholson, A., Muller R., Jenkins, B. R., Wilford, J. and Winkler, M. 2015, *Guidelines for managing salinity in rural areas*, NSW OEH, Sydney, NSW [Accessed: 20 June 2015] http://www.environment.nsw.gov.au/resources/salinity/150241-HGL-salinity-rural.pdf