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# 9. Hoskinstown Hydrogeological Landscape

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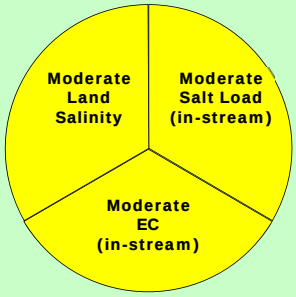
|---|---|---|
| **LOCALITIES** | **Kings Highway, Sonza, Thullande, Dairy Station Creek** |  |
| **MAP SHEET** | **Canberra 1:100 000** | |
| **CONFIDENCE LEVEL** | **Moderate** | |

## OVERVIEW

The Hoskinstown Hydrogeological Landscape (HGL) extends either side of the Kings Highway on the eastern margin of the ACT in the locales of Sonza and Thullande (Figure 1). The HGL covers an area of 4 km$^2$ and receives 650 to 750 mm of rain per annum.

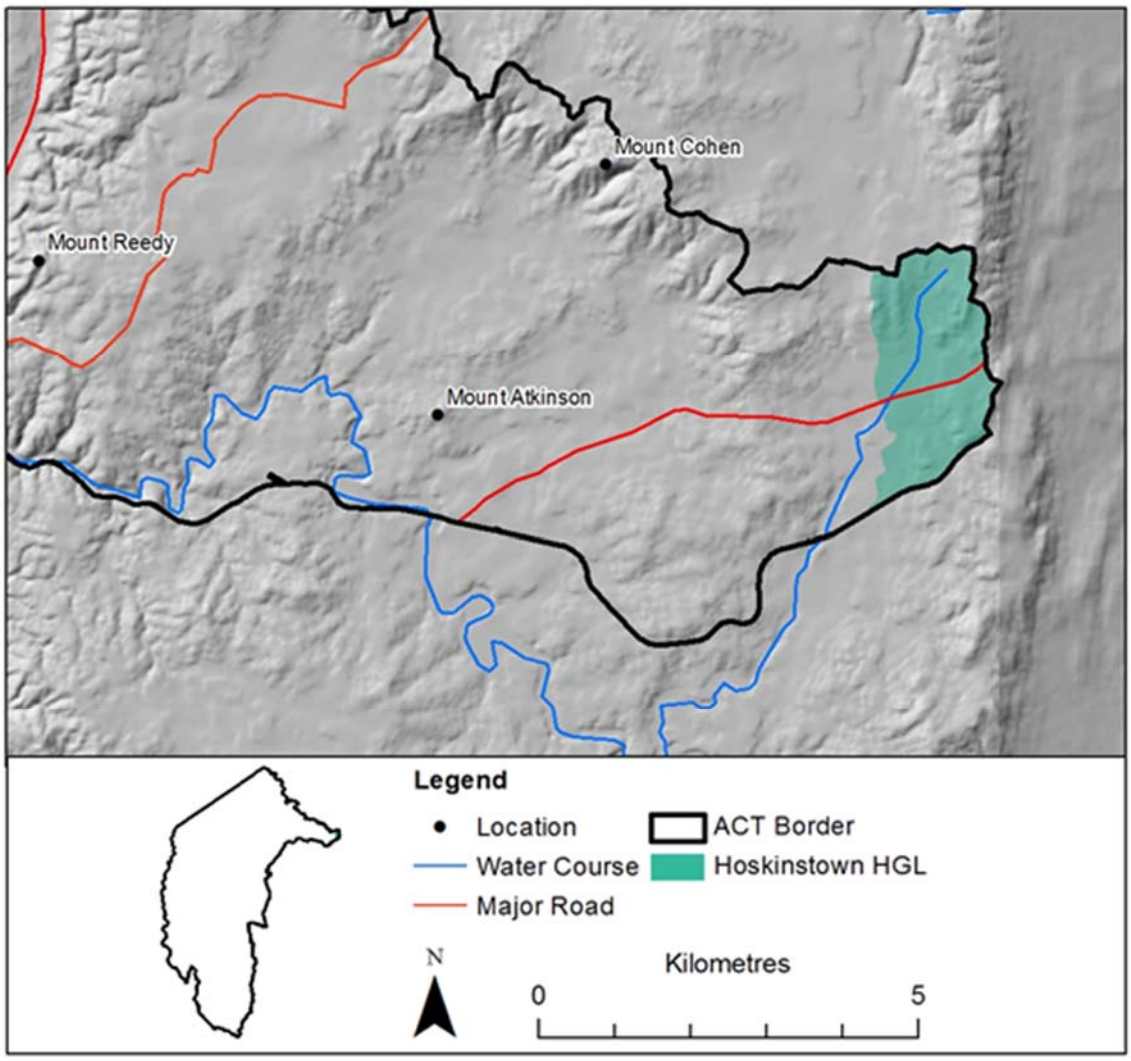



**Figure 1: Hoskinstown HGL distribution map.**

The Hoskinstown HGL boundary is based on soil landscapes – Hoskinstown, Bennison and Bollara (Figure 2). Some hills are covered with commercial forestry, with the lower slopes cleared for grazing.

There are considerable waterlogged areas adjacent to streams and in other landform units and salt sites with species change occur on the lower landform units. The soils are highly dispersive, sodic and erodible, with noticeable gully and sheet erosion in the lower landform areas.

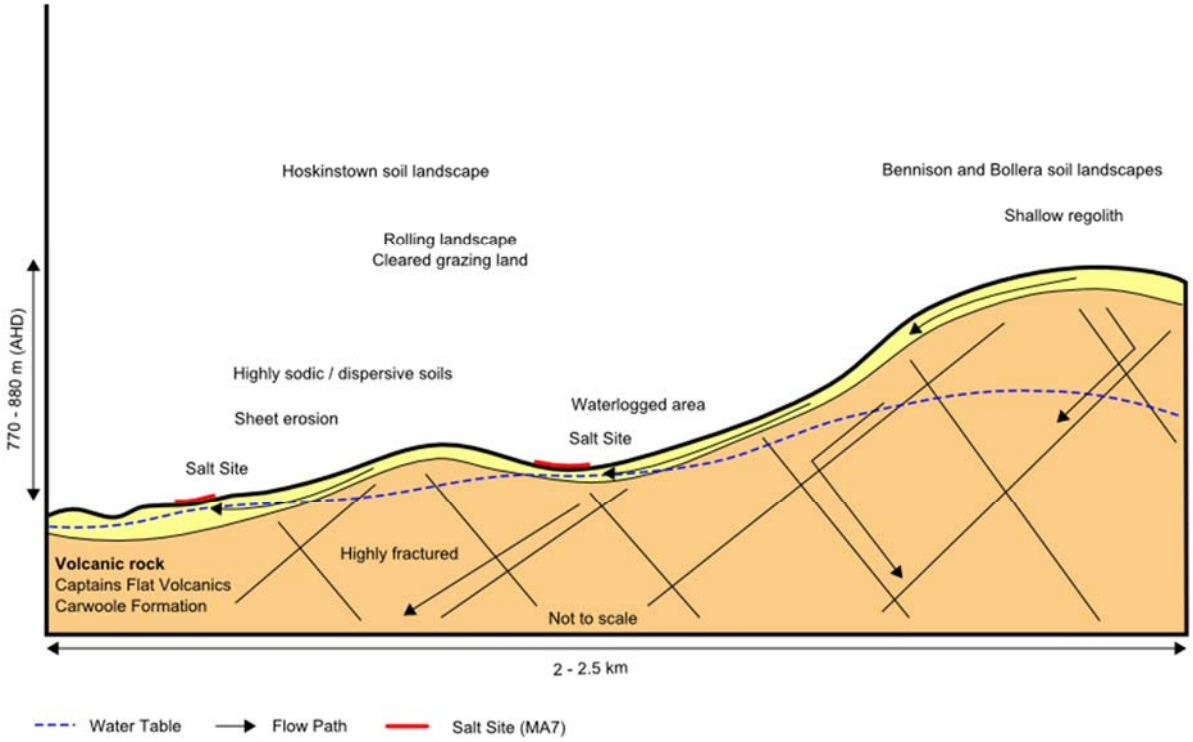



**Figure 2: Conceptual cross-section for Hoskinstown HGL showing the distribution of regolith and landforms, salt sites if present, and flow paths of water infiltrating the system.**

Salinity expression in this HGL is in the form of land salinity and stream salt load and EC (Table 1).

**Table 1: Hoskinstown HGL salinity expression.**

| SALINITY EXPRESSION | |
|---|---|
| **Land Salinity (Occurrence)** | Moderate – observed salt land symptoms are evident in the lower landscape with areas of waterlogging. The sites have species change to more salt tolerant species. |
| **Salt Load (Export)** | Moderate – stream EC is moderate |
| **EC (Water Quality)** | Moderate – moderate load in perennial stream. |

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 Hoskinstown HGL

has moderate mobility. There is a moderate salt store that has moderate availability (Table 2).

**Table 2: Hoskinstown HGL salt store and availability.**

| SALT MOBILITY | | | |
|---|---|---|---|
| | **Low** availability | **Moderate** availability | **High** availability |
| **High** salt store | | | |
| **Moderate** salt store | | **Hoskinstown** | |
| **Low** salt store | | | |

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

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

| OVERALL SALINITY HAZARD | | | |
|---|---|---|---|
| | **Limited** potential impact | **Significant** potential impact | **Severe** potential impact |
| **High** likelihood of occurrence | | | |
| **Moderate** likelihood of occurrence | | **Hoskinstown** | |
| **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: Kings Highway running east-west through Hoskinstown landscape (Photo: DPI / A Nicholson).**

**Photo 2: Landscape looking north–east from Brooks Hill Reserve adjacent to Hoskinstown HGL, showing typical slopes and landforms (Photo: DPI / A Nicholson).**

**Photo 3: Cutting at Brooks Hill Reserve looking south (Photo: DPI / A Nicholson).**

**Photo 4: View from Kings Highway looking north on the western margin of the HGL (Photo: DPI / A Nicholson).**

**Photo 5: View from Kings Highway looking towards the southern margin of the HGL (Photo: DPI / A Nicholson).**

**Table 4: Summary of information used to define Hoskinstown HGL.**

| | |
|---|---|
| **Lithology** *(Raymond et al. 2007; Geoscience Australia 2015)* | This HGL comprises mixed felsic Silurian volcanics<br>Key lithologies include:<br>• Captains Flat Formation<br>• Carwoola Formation |
| **Annual Rainfall** | 650–750mm |
| **Regolith and Landforms** | Soil generally <1 m higher in the landscape and >1 m in drainage lines. Clay loam soil and imperfect drainage in the lower landscape provide moderate potential for salt store.<br>Slopes generally 10–32%; 0–3% in valley bottom<br>Elevation range is 750–850 m |
| **Soil Landscapes** *(Jenkins 1993; Jenkins 2000; Cook & Jenkins in prep)* | The following soil landscapes are dominant in this HGL:<br>• Hoskinstown<br>• Bollara<br>• Bennison<br>Well drained Clastic Rudosols or Leptic Tenosols (Lithosols) on crests and upper slopes. Moderately well drained Red Kurosols and Red Chromosols (Red Podzolic Soils) occur on mid slopes. Yellow Chromosols (Yellow Podzolic Soils) on better drained lower slopes. Sodosols (Solodic Soils) in drainage lines, poorer drained lower slopes and adjacent to scalds. |
| **Land and Soil Capability** | Class 6 |
| **Land Use** | • grazing<br>• forestry (pines) on ridges |

| | |
|---|---|
| **Key Land Degradation Issues** | • water erosion (sheet and gully)<br>• waterlogging<br>• salinity |
| **Native Vegetation** *(Keith 2004; Gellie 2005; Dept. of Environment 2012)* | This HGL is situated within the IBRA7 South Eastern Highlands (Monaro subregion)<br>The HGL has been extensively cleared with remaining vegetation formations comprising Dry Sclerophyll Forest and Grassy Woodland<br>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 Hoskinstown HGL.**

| | |
|---|---|
| **Aquifer Type** | Unconfined to semi-confined in fractured rock and saprolite<br>Lateral flow through unconsolidated colluvial sediments on slopes and in flow lines |
| **Hydraulic Conductivity** | Low<br>Range: $<10^{-2}$ m/day |
| **Aquifer Transmissivity** | Low<br>Range: $<2$ $m^2$/day |
| **Specific Yield** | Low<br>Range: <5% |
| **Hydraulic Gradient** | Gentle to moderate<br>Range: <10–30% |
| **Groundwater Salinity** | Fresh to marginal<br>Range: <800–1600 µS/cm |
| **Depth to Watertable** | Shallow to intermediate<br>Range: <2–8 m |
| **Typical Sub-Catchment Size** | Small (<100 ha) |
| **Scale (Flow Length)** | Local<br>Flow length: <5 km (short) |
| **Recharge Estimate** | Moderate |
| **Residence Time** | Medium (years) |
| **Responsiveness to Change** | Medium (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 – Hoskinstown HGL

Functions this landscape provides within a catchment scale salinity context:

- **A.** The landscape provides fresh water runoff as an **important water source**.
- **D.** The landscape generates salt loads which enter the streams and are redistributed in the catchment.
- **H.** The landscape contains high hazard for generating sodic and saline sediments.

### Landscape Management Strategies – Hoskinstown HGL

Appropriate strategies pertinent to this landscape:

- **Buffer the salt store – keep it dry and immobile (1)**: There are stores of salt in particular parts of the landscape that vegetation can buffer, limiting the salinity impact. They are generally in the depositional elements of the middle to lower landscape. They comprise a significant percentage of this HGL.
- **Discharge rehabilitation and management (4)**: Discharge sites appear in the landscape during wet climate cycles. Improved management of these saline areas can reduce the impact of salinisation and prevent large negative impacts during wet cycles. Discharge management will also limit on-site land degradation.
- **Dry out the landscape with diffuse actions over most of the landscape (6)**: Encourage plant growth and increase plant water use in order to use excess soil moisture and shallow groundwater. Healthy, actively growing vegetation will also buffer groundwater accessions in wet seasonal conditions.

### Key Management Focus – Hoskinstown HGL

This landscape shows erosion and soil decline, along with waterlogging and salinity. Forestry is a significant land use, and has the potential to expand across the landscape. The key management focus should be to introduce perennial components into the landscape and farming systems should recognise limitations due to soil conditions.

### Specific Land Management Opportunities

Specific opportunities for this HGL:

- forestry industry is in the landscape
- waterlogged areas provide opportunity for waterlogging/salinity tolerant species to be introduced (e.g. strawberry clover).

## Specific Land Management Constraints

Constraints on land management in this HGL include:

- soil limitations – dispersion, soil sodicity
- soil erodibility
- boggy waterlogged areas limiting access.

## 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.

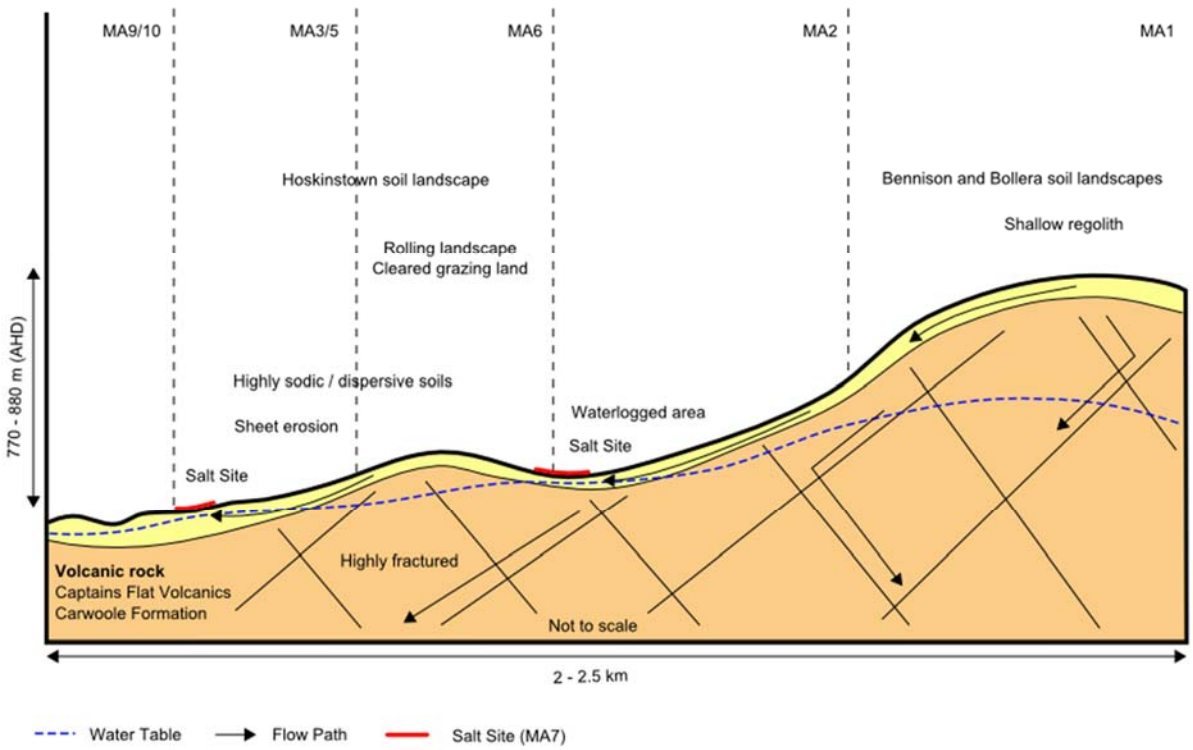



**Figure 3: Management cross-section for Hoskinstown HGL showing defined management areas.**

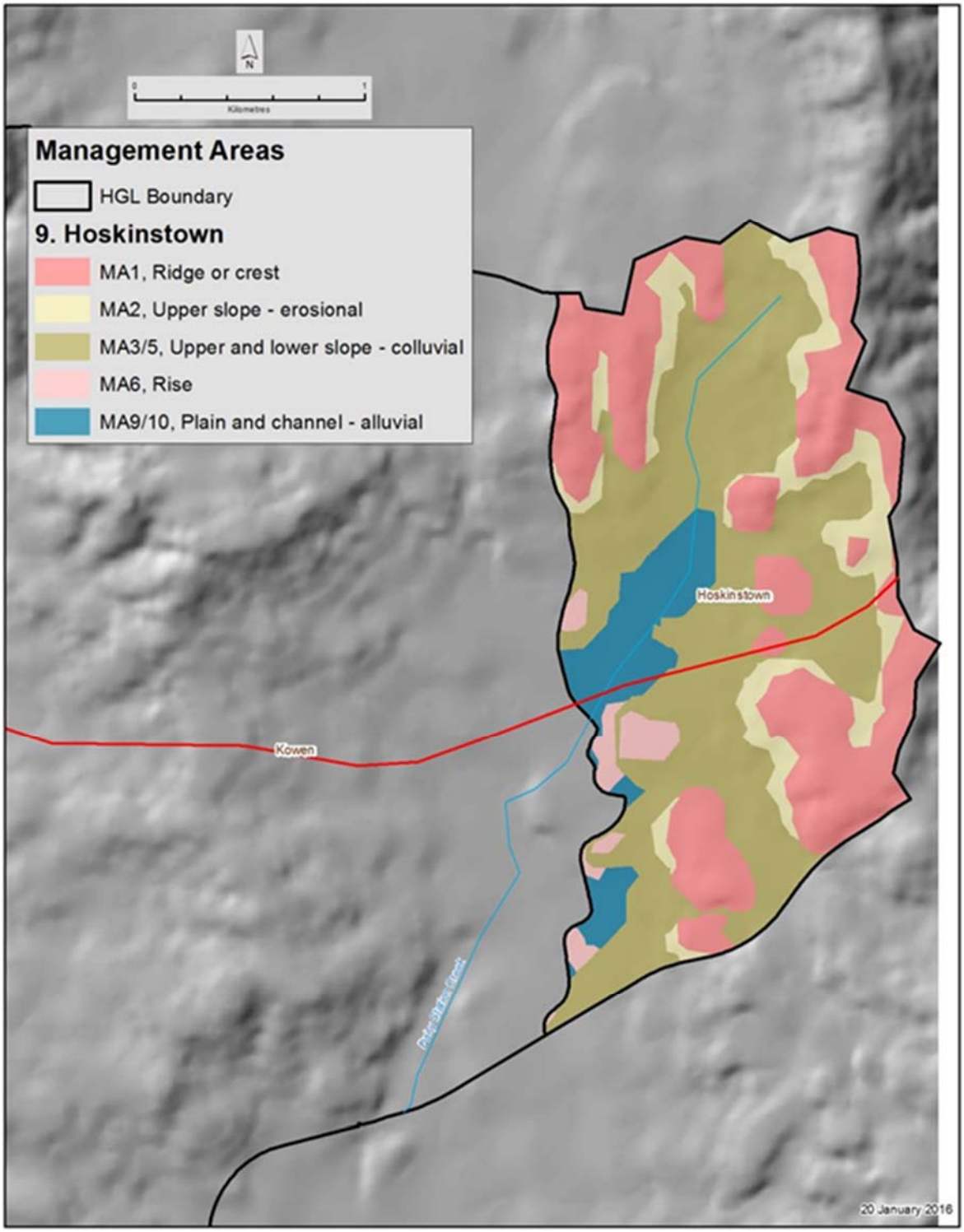



**Figure 4: Spatial distribution of management areas for Hoskinstown HGL.**

**Table 6: Specific management actions for management areas within Hoskinstown HGL.**

| Management Area (MA) | Action |
|---|---|

| Management Area (MA) | Action |
|---|---|
| MA 1<br>(RIDGE) | **Vegetation for ecosystem function**<br>Maintain and improve existing native woody vegetation to reduce discharge **(VE3)**<br>**Vegetation for production**<br>Improve grazing management of existing perennial pastures to manage recharge **(VP1)**<br>Improve grazing management to improve or maintain native pastures to manage recharge **(VP5)**<br>Establish commercial forestry to manage recharge **(VP7)** |
| MA 2<br>(UPPER SLOPES – EROSIONAL) | **Vegetation for production**<br>Improve grazing management of existing perennial pastures to manage recharge **(VP1)**<br>Improve grazing management to improve or maintain native pastures to manage recharge **(VP5)**<br>Establish commercial forestry to manage recharge **(VP7)** |
| MA 6<br>(RISE) | **Vegetation for production**<br>Improve grazing management of existing perennial pastures to manage recharge **(VP1)**<br>Improve grazing management to improve or maintain native pastures to manage recharge **(VP5)**<br>Establish commercial forestry to manage recharge **(VP7)** |
| MA 3/5<br>(UPPER & LOWER SLOPES– COLLUVIAL)<br><br>NB INCLUDES MA7 – SALTLAND | **Vegetation for production**<br>Improve grazing management of existing perennial pastures to manage recharge **(VP1)**<br>Improve grazing management to improve or maintain native pastures to manage recharge **(VP5)**<br>Establish and manage perennial pastures to manage recharge **(VP2)**<br>**Salt Land Rehabilitation**<br>Rehabilitation of salt land to minimise onsite and offsite degradation **(SR4)**<br>Establish and manage salt land pasture for productive use of salt land **(SR2)** |
| MA 9/10<br>(FLOWLINES)<br><br>NB: INCLUDES MA7 – SALTLAND | **Vegetation for ecosystem function**<br>Maintain and improve riparian native vegetation to reduce discharge to streams **(VE4)**<br>**Salt Land Rehabilitation**<br>Rehabilitation of salt land to minimise onsite and offsite degradation **(SR4)**<br>Establish and manage salt land pasture for productive use of salt land **(SR2)** |

## 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 Hoskinstown HGL.**

| At Risk Management Areas | Action |
|---|---|
| MA 1, 2 | Poor management of grazing pastures **(DLU2)**<br>Clearing and poor management of native vegetation **(DLU4)**<br>Deep ripping of soils to maximise water infiltration to subsoil **(DLU11)** |
| MA 3, 5, 6 | Poor management of grazing pastures **(DLU2)**<br>Clearing and poor management of native vegetation **(DLU4)**<br>Deep ripping of soils to maximise water infiltration to subsoil **(DLU11)**<br>Poor soil management and loss of surface soil layers **(DLU10**)<br>Annual cropping **(DLU3)** |
| MA 9/10 | Poor management of grazing pastures **(DLU2)**<br>Clearing and poor management of native vegetation **(DLU4)**<br>Deep ripping of soils to maximise water infiltration to subsoil **(DLU11)** |

## 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 Office of Environment and Heritage, Sydney, NSW [Accessed: 20 June 2015] http://www.environment.nsw.gov.au/resources/salinity/150241-HGL-salinity-rural.pdf