



**Office of
Environment & Heritage**
NSW National Parks & Wildlife Service



Wilderness horse riding trial: monitoring methods (baseline)

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1. Aims

This monitoring project seeks to establish whether horse riding on wilderness trails can occur in a sustainable way, i.e. without causing irreversible damage to key natural, cultural and social values associated with the wilderness trail.

Specifically, it aims to:

- detect impacts that may occur to key values as a result of horse riding on the pilot wilderness trails within the two-year trial period
- define thresholds for implementing management interventions to protect key values from irreversible damage and inform park managers of any threshold triggers
- detect whether interventions are successful in ensuring key values are protected from irreversible damage.

The methods detailed in this document will be used to inform when a threshold has been triggered and when management interventions should cease. An evaluation will be undertaken at the end of the trial. *Monitoring framework for wilderness horse riding trial* provides details of factors considered in the development of appropriate methods and the parameters for the development of thresholds and management interventions.

2. Timeline

Sampling of sites for the physical aspects of monitoring will occur biannually, with more frequent visits for camera maintenance as needed. Data collection was undertaken in Feb–Mar 2014 to ensure one complete set of baseline data prior to the commencement of horse riding. The timeline presented in Table 1 applies to all locations except for Curracabundi, which is yet to be confirmed.

Table 1: Proposed timeline for sampling

2014	Summer	Baseline data collection
	Autumn	Baseline data collection Commencement of horse riding
	Winter	
	Spring	Post-commencement data collection
2015	Summer	
	Autumn	Data collection
	Winter	
	Spring	Data collection
2016	Summer	
	Autumn	Final data collection End of trial

3. Location-specific issues

Horse riding wilderness trials will occur at five locations:

- Kosciuszko NP – Nine Mile Trail and Ingeegoodbee Trail
- Monga NP – Shoebridge Bridle Track
- Deua NP – Georges Pack Bridle Track and WD Tarlinton Bridle Track
- Mummel Gulf NP – Dicks Hut Fire Trail and River Road Trail
- Curracabundi NP – unnamed dozer trail/Bicentennial Trail

Each of these locations has a range of unique landscape attributes and management issues. For example:

- Kosciuszko has a large wild horse population and is also the only location for which overnight camping is proposed.
- Bridle tracks in Monga and Deua national parks are not accessible by vehicle. The Tarlinton and Georges Pack Tracks are unmaintained bridle trails and may be indistinct in places.
- Georges Pack Track includes a section of trail where riders will likely traverse along the stream bed.
- Curracabundi does not yet have a Plan of Management in place.

Location-specific protocols will be developed in consultation with local contacts. They will draw on common procedures, but factor in local issues and considerations.

4. Site selection for physical monitoring

Based on technical advice and OEH mapping, locations along the proposed trails were identified that were considered 'sensitive' in terms of erodibility and wetness and were likely to be the most vulnerable to impacts. These desktop-selected sites were ground-truthed and amended as required based on on-ground considerations.

For the purpose of consistency, the following terminology is used in these methods:

SITE: A location on a trail at which monitoring occurs.

PLOT: The area to which a specific method is applied at a site. A soil plot consists of a number of measures taken between two marker pegs at a site.

QUADRAT: A 1m x 1m square within which a subset of measures are taken.

Sites were grouped based on potential issues and impacts, e.g. soil stability, erodibility, vulnerable areas such as water crossings and likely locations of prolonged activity. Decisions around variables measured at each site were driven by these issues.

Table 2 details the site groupings and monitoring methods applied.

Table 2: Site type, definition and methods to be applied

Site type	Definition	Methods to be applied
Simple trail, on slope (SS)	Trail runs on land identified as erodible, but no other sensitivity issues are apparent	Track condition (4.1) Photo point (4.2) Weed assessment (4.5) Additional physical disturbances (4.6)
Simple trail, wet area (SW)	Trail crosses a drainage line or wet area with little opportunity for deviation from the trail	Track condition (4.1) Photo point (4.2) Weed assessment (4.5) Additional physical disturbances (4.6)
Stopping/fan-out point (F)	Trail intersects with a point where riders are likely to spend some time and/or deviate from the trail. This includes: <ul style="list-style-type: none"> • water crossings where riders may stop or 'fan out' from the trail • camping areas • natural likely rest stops 	Multiple soil quadrats, taken to obtain representation of a defined site (4.1.1) Photo point (4.2) Application of the Landscape Classification System (subset) (4.3) Weed assessment (4.5) Additional physical disturbances (4.6)
Potential trail deviation point (B)	Locations identified as potential trail deviation points where there may be risk of informal trail development	Photo point (4.2) Scoring of informal trail development (4.4) Additional physical disturbances (4.6)
Camera location (C)	Remote camera placed to monitor number and frequency of trail users and to be located at a subset of SS, SW or F points	Camera deployment (4.7)

4.1 Track condition

Recorded at trail sites and stopping/fan-out points

A soil 'plot' (Figure 1) will include the following measures:

Soil Regolith Stability Classes

Sites have been classified by Soil Regolith Stability Classes (Murphy et al. 1998) at desktop level to be ground-truthed at baseline.

Soil regolith stability is a measure of geology, landform and soil characters. It is a useful predictor of how likely a soil is to cause turbidity in surface waters and long-distance sedimentation down the catchment, if the soil is disturbed. This knowledge will help to aid the setting of thresholds that are appropriate for each site.

Regolith classes fall into a 2 x 2 matrix:

		Potential for sediment to move long distance	
		LOW (sediment is coarse)	HIGH (fine clay particles)
Potential for soil to release sediment	HIGH (low soil stability)	R2	R4
	LOW (high soil stability)	R1	R3

The Soil Regolith Classification system is summarised in Appendix 1.

Track widening

At baseline, the site will be marked on either side of the trail using pegs (pickets or stakes).

At each data collection event, the tape measure will be placed across the trail, starting at the guide peg (southern or eastern picket depending on track orientation). The distance from the guide picket to both track edges will be recorded.

Erosion

1m x 1m quadrats will be positioned between the two pegs. The quadrats will start from the southeast-most peg and will be placed between the two pegs, oriented downslope (Figure 1). This will allow any changes in characteristics of both track edge and track centre quadrats to be captured.

The following will be recorded in each quadrat, based on Qld Derm (2010):

1. Estimated percentage cover scores for

- Litter
- coarse woody debris
- rocks/stones
- vegetation
- manure (horse/other)
- bare earth
- hoof prints
- erosion-affected area.

2. Erosion depth at its deepest point (Figure 2). Multiple points will be measured in each quadrat at baseline, for reference, but only the deepest point at subsequent data collection events.

Soil compaction

Soil penetrometer readings will be taken every 30 cm along the quadrats between the pegs (Figure 1).

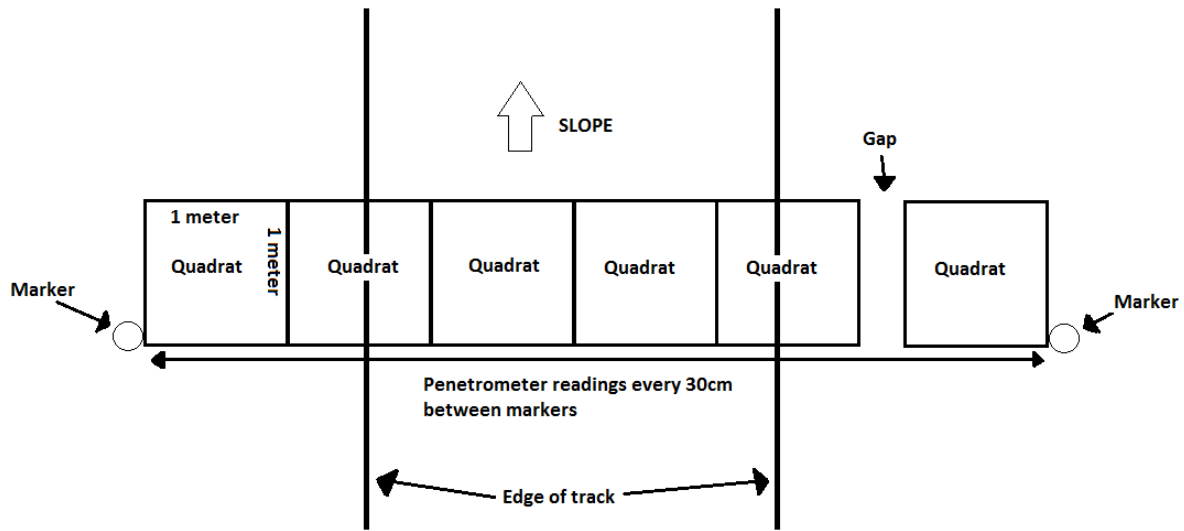


Figure 1: Schematic of a soil plot showing erosion monitoring quadrats between two trail-side markers (modification of Qld Derm 2010). The 'gap' will apply when the distance between the markers is not exactly to the metre and will be placed before the final (north-western) marker.

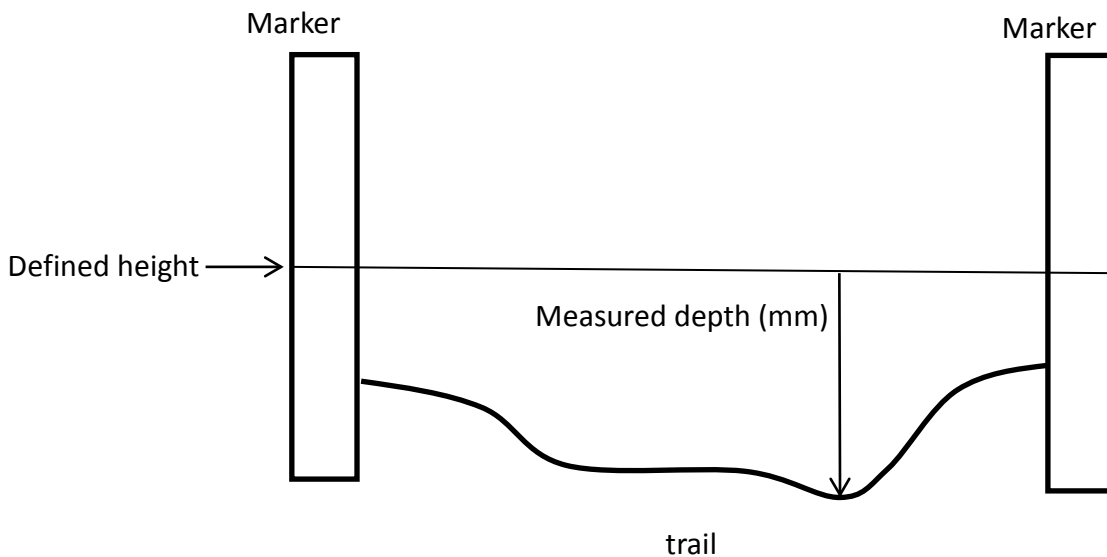


Figure 2: Cross-section of the trail showing how depth of erosion will be measured

4.1.1 Monitoring at a stopping/fan-out point

For the purpose of this trial, a stopping/fan-out point is defined as an area where riders are likely to spend some time and/or deviate from the trail.

The extent of the area (the 'plot') will be marked with pegs. Soil erosion quadrats will be placed between these plot markers (Figure 3).

Multiple soil monitoring quadrats will be placed at these sites to capture broad impact, using a 'checkerboard' of 1m x 1m quadrats. The number will be determined by the size and nature of the site. Distance and orientation from markers will be recorded to reduce the number of required marker pegs.

General guiding set-up parameters are:

- Mark the plot using marker pegs (ensuring that marker pegs are not placed on a trail).
- Place quadrats at three-metre intervals. Record the distance and orientation from plot centroid (interval may be influenced by nature of location).
- If necessary, place additional quadrats at sensitive or potential high impact points of the plot.

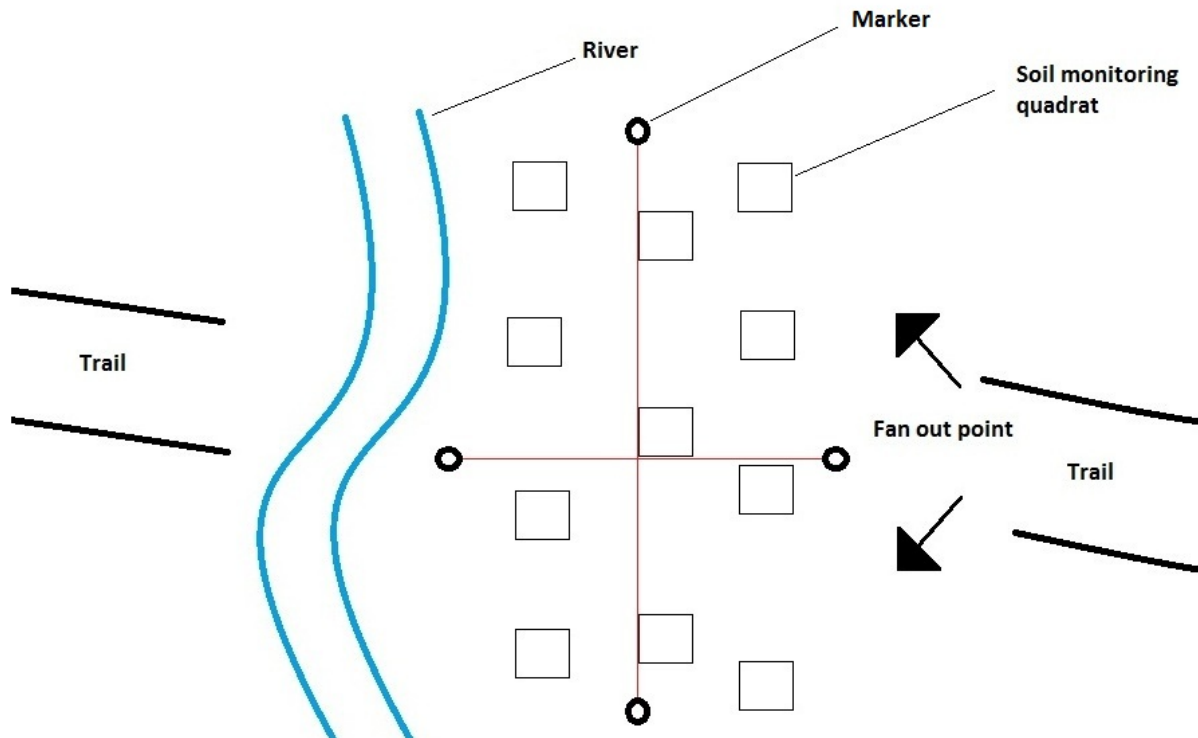


Figure 3: Diagram of a typical 'fan-out' plot

The specific measures recorded are detailed in the field sheet in Appendix 2.

4.2 Photo points

Recorded at each site

At each site, a photo point will be placed to allow a visual reference for changes over time. At each data collection event, a photo will be taken with the same focal point and field of view and at a fixed distance, height and orientation with the same model camera. Multiple photo points will be placed at fan-out/stopping points. Fields to be recorded are listed in the field sheet in Appendix 2.

Guiding parameters for the establishment of photo points are:

- Take the image on-trail, from downslope, at a height of 1.5 m.

- Use the bounding pegs as the extent of the field of view.
 - Angle the camera so that the top of the pegs align with the centre edge of the image.
- Images will be catalogued and compiled for reference at subsequent data collection events.

4.3 Landscape Classification System

Recorded at regular intervals along the trails, focused at stopping/fan-out points

The Landscape Classification System for Visitor Management (EPA Qld 2007) will be applied at a subset of sites. It is a tool for assessing a landscape setting and provides a scoring system for biophysical, managerial and social aspects. It has been used to assess the key attributes of areas for managing visitors and provides a tool to consistently score and examine change over time at a landscape level. Thresholds will be set around a change in overall score (or 'landscape class') over time.

Site factors to be scored and the criteria are listed in Appendix 3.

4.4 Informal trail scoring

At potential trail deviation point

An 'informal trail' can be defined as visibly trampled with living vegetation removed from the trail surface (Whinam & Chilcott 2003).

At each data collection event, signs of informal trail development along the main trail will be recorded. Detection will be based on visual identification of trail deviation points from the main trail. Where an informal trail is identified:

- The location will be recorded.
- A photo point will be established.
- A site plot will be placed at the deviation point and at a point along the informal trail to monitor cover and compaction (section 4.1).
- It is likely that presence of an informal trail will be a trigger for management intervention. Additional cover quadrats will be placed adjacent to the informal trail to allow monitoring post-management intervention to determine an approximate desirable state for vegetation cover and compaction.

Where possible, locations will be identified at baseline that are considered a high risk for trail deviation.

4.5 Weed assessment

Trail-length at baseline and in the first spring following baseline

A baseline assessment will be undertaken on each trail prior to and in the first spring following the commencement of horse riding. This will include an assessment of trail-side weed presence in identified sensitive locations, with potential for follow-up survey (subject to evaluation of need). The weed survey methods were guided by Weaver & Adams (1996). At each site, all weed species will be recorded within four belt transects (10m x 1m) placed parallel to the track, immediately on the track edge and at 5, 10 and 20 m from the track edge. Within each belt transect, weed species will be assigned a cover/abundance score. The locations of Weeds of National Significance and NSW noxious weeds in the vicinity of each site will be recorded as points or polygons as appropriate.

4.6 Additional physical disturbances

All sites

The following will also be recorded at sites, most particularly at stopping/fan-out points (see field sheet in Appendix 2):

- evidence of grazing/browsing
- presence and amount of rubbish
- vandalism
- evidence of tree or other damage or disturbance.

4.7 Remote camera deployment

At pre-defined points near trail entrances and junction points that coincide with simple trail or fan-out sites – all locations except for Curracabundi (subject to conditions of public access)

Remote cameras will be set for the duration of the trial at key locations on the trails to provide data on the frequency and intensity of trail use by horse riders. Where possible these will be placed at monitored sites to obtain usage intensity data that can be examined alongside monitoring data collected in the same location.

Images will be visually processed after each data collection event.

Data will be used to quantify level of trail use as well as spatial and temporal variability in trail use.

4.8 Social monitoring

The following changes will be monitored throughout the trial:

- how people use the park (changes in number of park users, where they are going in the park and what activities they are doing) and their perception of park amenity
- number of complaints or positive feedback from park users
- the level of satisfaction of horse riders.

Changes in how people use the park and their perception of park amenity will be monitored using a survey. This will be available both on-line (Survey Monkey) and hard copy. The survey is aimed at people who actually use the trails, not the broader public, and it is proposed that these people be invited to participate. Assistance of local staff involved in liaising with stakeholders will be sought to ensure appropriate dissemination. Hard copies of the survey will also be made available for distribution to area offices for use by any park visitors who inquire or make a complaint.

Changes in the number of complaints or positive feedback will be monitored by:

- tracking letters of complaint to the Minister or NPWS through TRIM
- tracking the number of complaints made in the survey under the question 'Do you wish to make any other comments?'

Changes in the level of satisfaction of horse riders will also be monitored through the survey.

Appendix 1: Soil Regolith Stability Classes

Soil Regolith Stability Class	Soil field behaviour	Soil regolith criteria	Soil types*
Class R1 High coherence soils with low sediment delivery potential	Stable soils with no appreciable erosion. Generally well-drained, permeable soils. Earth batters stable. Little or no general evidence of coarse or fine sediment movement.	Extensive rock outcrop	Lithosols (Tenosols, Rudosols)
		Very stony or very gravelly well-armoured soils, well-drained, often occurring on ridgelines and steep slopes. Variety of soils including fine-grained sediments and metasediments, fine-grained volcanic soils.	Stony soils (> 20 % stone throughout) includes Lithosols (Tenosols, Rudosols) and stony and gravelly Podzolic Soils (Kurosols), stony Red Brown Earths (e.g. Chromosols, Stony Non Calcic Brown soils)
		Strongly structured, freely draining soils, generally non-slaking and non-dispersible. Generally reddish or dark brown coloured subsoils without an A2 horizon. Includes iron-rich soils from sedimentary and mafic volcanic rocks and highly weathered granodiorites and microgranites in high rainfall areas.	Krasnozems (Red Ferrosols), Xanthozems (Dermosols), Euchrozems (Ferrosols, Dermosols) Chocolate Soils (Brown Ferrosols), Terra Rossa Soils (Dermosols), Structured Red Earths, Structured Loams (Dermosols), Prairie Soils (Dermosols)
		Highly organic soils, very resistant to erosion and generally associated with swamps	Peats and Alpine Humus Soils (Organosols)
Class R2 Low coherence soils (when wet) with low sediment delivery potential	Sandy soils which, when exposed, commonly exhibit sheet wash and evidence of coarse sediment movement such as sediment fans at drain outlets and in gutters. Little sediment transport into drainage network.	Coarse sandy soils often derived from coarse-grained and quartz-rich sandstone, conglomerate, granite, adamellite and volcanic materials. High sand content and little clay and silt content throughout profile. Sandy or earthy fabric.	Coarse grained: colon? Siliceous Sands and Calcareous Sands (Rudosols, Tenosols), Podzols (Podosols), Earthy Sands (Tenosols), some sandy Yellow Earths (Kandosols) and Yellow Podzolic Soils with deep (> 50 cm coarse sandy topsoils) and stable clay subsoils (Kurosols), Desert Loams (Rudosols)
		Unconsolidated coastal and aeolian sands and sandy colluvium	As above

Soil Regolith Stability Class	Soil field behaviour	Soil regolith criteria	Soil types*
Class R3 High coherence soils with high sediment delivery potential	Clayey and silty soils which are liable to sheet erosion. Typically slowly permeable and drainage generally impeded. Earth batters and exposed surfaces subject to minor to moderately extensive rill erosion and minor slumping. Minor gully erosion may develop in drainage lines and incision may occur along road drains. Localised films of fine sediment at drain outlets and in drainage lines.	Soils formed on fine-grained acid volcanic, metasedimentary and sedimentary rocks. Duplex soils with clay or silty B horizon, slowly permeable, weakly to moderately structured, often with a pronounced A2 horizon. B horizons usually yellow or grey to light brown colours, commonly mottled. Tendency to slake to small stable aggregates (not individual particles) and not highly dispersible.	Red, Brown, Yellow and Grey Podzolic Soils and non-dispersible Soloths (Kurosols). Black Earths (Vertosols), Red, Brown and Grey Clays (Vertosols), Humic Gleys (Hydrosols), Red Brown Earths and Non-Calcic Brown Soils (Chromosols), Rendzina (Dermosols)
		Weakly to moderately structured soils with silty to clay textures and gradational to uniform texture profiles. Tendency to slake but not highly dispersible. Hardsetting when dry but often boggy when wet. Developed on colluvial/alluvial surfaces, range of fine-grained highly weathered siliceous rocks and some basic and intermediate volcanic lithologies such as trachyte.	Some fine-grained Red Earths and Yellow Earths (Kandosols)
Class R4 Low coherence soils (when wet), with very high fine sediment delivery potential	Unstable, dispersible soils which are prone to severe sheet and rill erosion and to gully erosion. Rill erosion and/or slumping common on batters and gully erosion common in drainage lines and along road drains. Snig tracks display frequent rill erosion. Drainage lines show extensive fine sediment films.	Clay or silt-textured soils, which slake to very fine particles and/or are highly dispersible. Massive to coarsely structured, frequently sodic. Often have bleached surface horizon. May include duplex soils with sandy non-coherent surface over unstable clay subsoil. Generally found on lower slopes and low undulating terrain associated with weathered colluvium and alluvium or siliceous rocks.	Soloths, Solodic and Solodized Solonetzic (Sodosols, natric Kurosols).
* <i>Great Soil Groups</i> (Stace et al. 1972) with <i>Australian Soil Classification</i> (Isbell 1996) in brackets			

Appendix 2: Baseline field sheets for monitoring horse riding on wilderness trails

Horse riding monitoring field sheet: SIMPLE TRAIL, SLOPE (SS) OR WET AREA (WS)

LOCATION:**WEATHER:**

Park:	Start time:
Trail:	Finish time:
Site:	Date:
Person 1:	Person 2:
Southeast-most marker post (PEG 1)	
Lat:	Long:

PHOTO POINT

Photo ID:	Focal point:
Distance (m):	Height (m):
Orientation:	
Notes:	

VEG TYPE (circle most appropriate)

Alpine complex	Forested wetlands	Arid shrubland (Acacia sub-formation)	Arid shrubland (Chenopod sub-formation)
Grassy woodlands	Heathlands	Dry sclerophyll forests (shrub/grass sub-formation)	Dry sclerophyll forests (shrubby sub-formation)
	Grasslands		
Freshwater wetlands	Rainforests	Wet sclerophyll forests (grassy sub-formation)	Wet sclerophyll forests (shrubby sub-formation)
Miscellaneous ecosystems	Saline wetlands	Semi-arid woodlands (grassy sub-formation)	Semi-arid woodlands (shrubby sub-formation)

How confident are you in your assessment?

High

Medium

Low

Rubbish/Vandalism			
Evidence of Litter/Vandalism?	Yes / No	Severity*	Impacting <25% 26–49% 50–74% 75–100%
Description:		Photo Ref:	
How confident are you in your assessment?		High	Medium Low

Grazing/Browsing			
Evidence of grazing/browsing?	Yes / No	Severity	Impacting <25% 26–49% 50–74% 75–100%
Height class:		Photo Ref:	
<5 cm 5 cm–1 m 1–2 m >2 m			
How confident are you in your assessment?		High	Medium Low

Other damage/Disturbance			
Evidence of other damage?	Yes / No	Severity	Impacting <25% 26–49% 50–74% 75–100%
Proximity to site:		Photo Ref:	
Description:			
How confident are you in your assessment?		High	Medium Low

*Estimates made within a **20m x 10m** quadrat running downslope from the soil site. The long edge of the quadrat runs parallel to the road.

Soil quadrats

Soil Regolith Stability	
Desktop class:	Field classification (if different):
Distance between pegs (m):	
(SE) Peg 1 to near TRACK EDGE (m):	Peg 2 to far TRACK EDGE (m):

	% cover									
Quadrat	Litter	Coarse woody debris	Rocks/stones	Veg.	Manure	Bare earth	Hoof prints	Tread marks	Erosion area	Depth of erosion
1										
2										
3										
4										
5										
6										
7										
8										

Quadrat gap @ _____ m from SE peg Gap size (m): _____

Erosion depth

Measure	Distance from Peg 1	Depth from string
1 (track edge)		
2 (track middle)		
3 (track edge)		

Depth string to base: peg 1 (cm): _____ peg 2:

Penetrometer readings:

distance between:

1		9		17		25		33	
2		10		18		26		34	
3		11		19		27		35	
4		12		20		28		36	
5		13		21		29		37	
6		14		22		30		38	
7		15		23		31		39	
8		16		24		32		40	

***Horse riding monitoring field sheet:
STOPPING/FAN-OUT POINT***

LOCATION:

WEATHER:

Park:	Start time:
Trail:	Finish time:
Site:	Date:
Person 1:	Person 2:
Southeast-most marker post (PEG 1)	
Lat:	Long:

PHOTO POINT

Photo ID:	Focal point:
Distance (m):	Height (m):
Orientation:	
Notes:	

VEG TYPE (circle most appropriate)

Alpine complex	Forested wetlands	Arid shrubland (Acacia sub-formation)	Arid shrubland (Chenopod sub-formation)
Grassy woodlands	Heathlands	Dry sclerophyll forests (shrub/grass sub-formation)	Dry sclerophyll forests (shrubby sub-formation)
	Grasslands		
Freshwater wetlands	Rainforests	Wet sclerophyll forests (grassy sub-formation)	Wet sclerophyll forests (shrubby sub-formation)
Miscellaneous ecosystems	Saline wetlands	Semi-arid woodlands (grassy sub-formation)	Semi-arid woodlands (shrubby sub-formation)

How confident are you in your assessment?

High

Medium

Low

Rubbish/Vandalism				
Evidence of Litter/Vandalism?	Yes / No	Severity*	Impacting <25%	26–49%
Description:		Photo Ref:		
How confident are you in your assessment?		High	Medium	Low

Grazing/Browsing				
Evidence of grazing/browsing?	Yes / No	Severity	Impacting <25%	26–49%
Height class:	<5 cm	5 cm–1 m	1–2 m	>2 m
Photo Ref:				
How confident are you in your assessment?		High	Medium	Low

Other damage/Disturbance				
Evidence of other damage?	Yes / No	Severity	Impacting <25%	26–49%
Proximity to site:		Photo Ref:		
Description:				
How confident are you in your assessment?		High	Medium	Low

*Estimates made within a **20m x 10m** quadrat running downslope from the soil site. The long edge of the quadrat runs parallel to the road.

Soil quadrats

Soil Regolith Stability	
Desktop class :	Field classification (if different):
Distance between pegs (m):	
(SE) Peg 1 to near TRACK EDGE (m):	Peg 2 to far TRACK EDGE (m):

Draw mud-map showing where quadrats are located in relation to the lines between marker pegs.
Label orientation of pegs.

Quadrat	Distance reference		% cover								Depth of erosion	Penetrometer readings		
	X	Y	Litter	Coarse woody debris	Rocks/stones	Veg.	Manure	Bare earth	Hoof prints	Tread marks				
1														
2														
3														
4														
5														
6														
7														
8														

LCS scoring sheet**Date:** _____**Site:** _____**Site location:** _____

Overall Landscape Class (Category with average closest to 9)	
---	--

360° Panorama
Photo References:

Category	
Physical criteria	Score
Prevalence and permanence of visitor impacts	
Viewscape (360°)	
General landscape appearance	
Prevalence and durability of impacts from non-recreation land uses or marine uses	
Naturalness of over-storey	
Naturalness of under-storey (including aquatic vegetation)	
Naturalness of terrestrial, freshwater and marine fauna	
Water quality	
Total (sum of scores)	
Average (total divided by number of criteria scored)	

Category	
Social criteria	Score
Evidence of other people (e.g. sights, sounds and smells)	
Sense of isolation	
Interparty encounters while travelling	
Interparty encounters on-site	
Dependence upon outdoor skills	
Total (sum of scores)	
Average (total divided by number of criteria scored)	

Category	
Managerial criteria	Score
Access	
Evidence of management personnel	
Presence and extent of signage	
Rules, regulations and law enforcement	
Presence of management and visitor infrastructure	
Total (sum of scores)	
Average (total divided by number of criteria scored)	

Appendix 3: Landscape Classification System (LCS) for visitor management

Physical	1 Wild-natural-remote	2	3	4	5	6	7	8	9 Urban-commercial-industrial
Prevalence and permanence of visitor impacts: Site factor	No impact on natural condition	Minimal evidence of visitor impacts. Impacts which have occurred recover quickly (e.g. temporary loss of local native vegetation, scuffing of leaf litter, etc. in small areas which recover to pre-impact condition seasonally). Local native fauna/fish behaviour is unaffected by use.	Temporary, minor visitor impacts evident (e.g. temporary loss of local native vegetation, scuffing of leaf litter, minor soil/coral/seabed disturbance, etc.). Impacts not permanent, but recovery to pre-impact condition unlikely. No hard evidence that local native fauna/fish behaviour is affected by use.	Moderate visitor impacts evident in heavily used areas. Some permanent loss of local native vegetation (e.g. herbs and forbs), loss of leaf litter, soil/coral/seabed disturbance evident. Impacts persist at nodes and along walking tracks. Sensitive local native fauna/fish may be displaced as a result of use. Behaviour of other local native fauna/fish is occasionally modified. Native fauna/fish population changes are noticeable.	Physical changes as a result of visitor use are obvious and widespread with little chance of recovery. Some altering of vegetation characteristics/structure. A significant proportion of the local native fauna/fish displaced. Local native fauna/fish behaviour and population changes are altered.	Physical changes as a result of visitor use are obvious, widespread and permanent with little chance of recovery. Vegetation characteristics and floral structure altered. Native fauna/fish behaviour and population changes are obvious. The natural condition is unlikely to recover.	Physical changes as a result of visitor use are obvious, widespread and permanent. Vegetation characteristics and floral structure altered. A few native fauna/fish populations abnormally increased because of human interaction. Some species may display signs of aggressiveness. The natural condition exists only in very small remnant areas.	Physical changes as a result of visitor use are obvious, widespread and permanent. Vegetation characteristics and floral structure completely altered. Some native fauna/fish populations abnormally high because of human interaction. Some species may display signs of aggressiveness. The natural condition exists only in very small remnant areas.	Physical changes as a result of visitor use are obvious, widespread and permanent. Vegetation characteristics and floral structure completely altered. Many native fauna/fish populations are grossly changed (or absent) because of human interaction. Some species may display signs of aggressiveness. The natural condition is non-existent.

Wilderness horse riding trial: monitoring methods (baseline)

Physical	1	2	3	4	5	6	7	8	9
Viewscape (360°): Context factor	0% of visual landscape/ seascape modified from natural condition.	<1% of visual landscape/ seascape modified from natural condition. Little, if any, evidence of modification.	1-5% of visual landscape/ seascape modified. Minimal evidence of modification to natural condition. Some structures or moored vessels may be evident in the distance.	5-10% of visual landscape/ seascape modified. Some evidence of modification to natural condition. Some structures or moored vessels are/may be evident.	10-25% of visual landscape/ seascape modified. Modification of natural condition. Structures or moored vessels are evident.	25-50% of visual landscape/ seascape modified. Modification of natural condition is evident. Structures or moored vessels are plainly evident.	50-75% of visual landscape/ seascape is modified. Modification of natural condition is very evident. Structures or moored vessels are clearly evident in landscape/ seascape but do not dominate.	75-99% of visual landscape/ seascape modified. Modification of natural condition is plainly evident and dominates the visual landscape/ seascape.	100% of visual landscape/ seascape modified.
General landscape appearance (360°): Context factor	A wild, totally natural site or landscape/ seascape that has not been affected by post-1788 use.	An almost totally natural site or landscape/ seascape with very few modifications. Modifications are temporary, small/minor and very dispersed.	A very natural site or landscape/ seascape. Modifications are semi-permanent, small/minor and restricted to a few dispersed nodes. Natural elements dominate away from nodes.	A very natural appearing site or landscape/ seascape. Modifications are permanent, small/minor and restricted to a few dispersed nodes. Natural elements dominate outside these nodes. Built structures are very rare unobtrusive and rustic (e.g. graded walking tracks, narrow infrequently used vehicle tracks, timbered picnic tables).	A somewhat natural appearing site or landscape/ seascape. Modifications may be permanent, moderately large and obvious. Large blocks of native vegetation interspersed with small areas of cleared land. Built structures are dispersed but readily apparent (e.g. walking tracks with hardened surfaces, well maintained unsealed roads, timbered picnic areas, unobtrusive facilities).	A somewhat natural appearing site or landscape/ seascape. Natural elements just dominate over other elements in the landscape/ seascape. For example, rural areas with large areas of remnant native vegetation separated by grassland. Built structures may be obvious and quite common (e.g. roads are sealed, picnic areas paved and facilities are in harmony with surroundings).	Managed parkland with small to large areas of open space. Built structures and other modifications to the natural landscape/ seascape dominate. Natural elements exist as scattered remnants, some of which may be quite large.	Managed urban parkland with large areas of open space/ playing fields. Built structures and other modifications to the natural landscape/ seascape dominate. Natural elements exist only as small scattered remnants.	Managed urban parkland with playing fields. Built structures and other modifications to the natural landscape/ seascape dominate. Natural elements are more or less non-existent.

Wilderness horse riding trial: monitoring methods (baseline)

Physical	1	2	3	4	5	6	7	8	9
Prevalence and durability of impacts from non-recreation land or marine uses: Site factor	Totally natural landscape/ seascape. No history of post-1788 land use.	Predominantly natural landscape with some evidence of post-1788 land/sea use limited to a few isolated small sites that are regenerating. None of these land/sea uses are active.	Predominantly natural landscape/ seascape with evidence of post-1788 land use limited to small sites that are regenerating. None of these land/sea uses are active.	Regenerating natural landscape/ seascape with obvious evidence of past land/sea use (e.g. regenerating mineral exploration, selective logging, grazing, flower harvesting, commercial fishing and diving, etc.). Some of these land/sea uses may still be active (covering up to 5% of the area).	Regenerating natural landscape/ seascape with obvious evidence of past and present land/sea use. Current land/sea uses (e.g. regenerating mineral exploration, selective logging, grazing, flower harvesting, commercial fishing and diving, etc.). Currently active in a small proportion (5-20%) of the landscape.	Part natural landscape. Land uses (e.g. regenerating mineral exploration, selective logging, grazing, flower harvesting, commercial fishing and diving, etc.). currently active in a large proportion (20-50%) of the landscape.	Managed parkland with small to large areas of open space. Built structures and other modifications to the natural landscape dominate. Natural elements exist as scattered remnants, some of which may be quite large. A wide range of land uses that modify the natural landscape are active. Impacts are widespread, pervasive and permanent. Part of the natural landscape remains but most of this is modified to some extent.	Managed urban parkland with large areas of open space/ playing fields. Built structures and other modifications to the natural landscape dominate. Natural elements exist only as small scattered remnants. A wide range of land uses that modify the natural landscape are active. Impacts are widespread, pervasive and permanent. Very small areas of the natural landscape remains but most are obviously modified.	Managed urban parkland with playing fields. Built structures and other modifications to the natural landscape dominate. Natural elements are more-or-less non-existent. Impacts are widespread, pervasive and permanent. Land use has completely changed the natural landscape.
Naturalness of over-storey: Site factor	100% of natural vegetation intact.	97-100% of natural vegetation intact. <3% regenerating.	90-97% of natural vegetation intact. <10% cleared or regenerating.	85-90% intact or regenerating. Remainder cleared or non-endemic species.	70-85% intact or regenerating. Remainder cleared or non-endemic species.	50-70% intact or regenerating. Remainder cleared or non-endemic species.	25-50% intact or regenerating. Remainder cleared or non-endemic species.	10-25% intact or regenerating. Remainder cleared or non-endemic species.	<10% intact or regenerating. Remainder cleared or non-endemic species.

Wilderness horse riding trial: monitoring methods (baseline)

Physical	1	2	3	4	5	6	7	8	9
Naturalness of under-storey (including aquatic biota): Site factor	100% of natural vegetation intact. No weed species.	97-100% of natural vegetation intact. <3% cleared or regenerating. No weed species.	Ecosystem is substantially natural. 90-97% of natural vegetation intact. <10% cleared or regenerating. <3 weed species.	Ecosystem is substantially natural. 85-90% intact or regenerating. <15% cleared or dominated by non-endemic species. <5 weed species.	70-85% intact or regenerating. <30% cleared or dominated by non-endemic species.	50-70% intact or regenerating. <50% cleared or dominated by non-endemic species.	25-50% intact or regenerating. <75% cleared or dominated by non-endemic species.	10-25% intact or regenerating. <90% cleared or dominated by non-endemic species.	<10% intact or regenerating. Almost entirely cleared or dominated by non-endemic species.
Naturalness of terrestrial, freshwater and marine fauna: Site factor	100% natural fauna populations (species and structure). No feral species.	97-100% of fauna species intact. <3% recovering. No feral species.	Ecosystem is substantially natural. 90-97% of fauna species intact. <10% recovering. <3 feral species.	Ecosystem is substantially natural. 85-90% of fauna species in good health. <15% absent or recovering. <5 feral species.	70-85% of fauna species in good health. <30% absent or recovering.	50-70% of fauna species in good health. <50% absent or recovering.	25-50% of fauna species in good health. <75% absent or recovering. Some native species populations abnormally high or low.	10-25% of fauna species in good health. <90% absent or recovering. Some species populations totally abnormal.	<10% of fauna species in good health. >90% absent or recovering. Limited range of fauna.
Water quality: Site factor	Completely pure water.	No detectable effect/change in water quality.	Short-term and minor changes to natural stream/beach dynamics and/or water chemistry (e.g. increased turbidity, nutrient load or sand/sediment load).	Short to medium term moderate changes to natural stream/beach dynamics and/or water chemistry (e.g. increased turbidity, nutrient load or sand/sediment load).	Mid-term and/or moderate changes to natural stream/beach dynamics and/or water chemistry (e.g. increased turbidity, nutrient load or sand/sediment load).	Long-term and/or substantial changes to natural stream/beach dynamics and/or water chemistry (e.g. increased turbidity, nutrient load or sand/sediment load).	Long-term and/or permanent changes to natural stream/beach dynamics, structures and/or water chemistry (e.g. increased turbidity, nutrient load, channelling or sand/sediment load).	Permanent changes to natural stream/beach dynamics, structures and/or water chemistry (e.g. increased turbidity, nutrient load, channelling or sand/sediment load).	Permanent changes to natural stream/beach dynamics, structures and water chemistry (e.g. increased turbidity, nutrient load, channelling or sand/sediment load).

Wilderness horse riding trial: monitoring methods (baseline)

Social	1	2	3	4	5	6	7	8	9
Evidence of other people (e.g. sights, sounds and smells): Context factor	Non-existent. No evidence present.	Short-term and insignificant evidence at nodes and along main routes. Nodes are small, low impact and dispersed. No evidence (sights, sounds, smells) elsewhere.	Some permanent evidence at nodes and along main routes. Nodes are small, low impact and dispersed. Negligible evidence (sights, sounds, smells) of use elsewhere.	Significant permanent evidence at nodes and along main routes. Nodes may be moderate in size and concentrate activities and people. Some evidence (sights, sounds, smells of people) elsewhere.	Apparent evidence of use (i.e. sights, sounds, and smells) pervades nodes, main routes and their surrounds. Nodes may be extensive with occasional concentrations of people and activities.	Apparent evidence of use (i.e. sights, sounds, and smells) pervades nodes, main routes and their surrounds. Nodes may be extensive with frequent and significant concentrations of people and activities.	Clearly apparent evidence of other people at nodes, along main routes and their surrounds except in relatively small remnant areas. Open areas may be extensive with heavy concentrations of people and activities.	Widespread, all-encompassing and permanent.	Widespread, pervasive and permanent.
Sense of isolation: Context factor	Total. No evidence of human habitation, visitation or use. Communications with other parties extremely rare.	High	Moderate	Moderate to low	Low	Very low	Extremely low	None	None. Site dominated by human habitation, visitation or use. Voice communication with other parties is possible.
Interparty encounters while travelling: Context factor	Very few. <1 group** a day	Low. <5 groups a day	Low to Moderate. <10 groups a day	Moderate. <25 groups a day.	Moderate to high. <40 groups a day	High. <50 groups a day	Very high. >50 groups a day	Usually constant	Always constant
Interparty encounters on-site: Context factor	Non-existent. Chance encounters with others are rare and usually avoidable.	Low. Users are most often alone and should be surprised to have to share locations with others.	Low to moderate. Frequent opportunities for solitude. Contact with others should be expected, but it may be avoided.	Moderate to high. Frequent opportunities for solitude. Contact should be expected and usually cannot be avoided.	High. Infrequent opportunity for solitude during the day. Frequent contact should be expected and unlikely to be avoided.	Very high. Almost no opportunity for solitude during the day. Frequent and unavoidable contacts should be expected.	No opportunity for solitude during the day. Frequent and unavoidable contacts should be expected.	Continuous and unavoidable contacts should be expected.	Continuous and unavoidable contacts should be expected.

Wilderness horse riding trial: monitoring methods (baseline)

Social	1	2	3	4	5	6	7	8	9
Dependence upon outdoor skills: Site factor (but includes access routes)	Total. Persons visiting must be very well prepared, experienced and highly trained to ensure their safety.	Very high	High	Moderate. Persons visiting this site need some preparation, knowledge of the site or specialist training to ensure their safety.	Moderate to low	Low. Persons visiting this site need little or no preparation, knowledge of the site or training to ensure their safety.	Very low	N/A	<ul style="list-style-type: none"> N/A. Persons visiting this site need no preparation or knowledge to ensure their safety.
Managerial	1	2	3	4	5	6	7	8	9
Access: Site factor (but includes access routes)	No motorised access whatsoever. No tracks, roads, channel or hazard markers or buoys. Some unmarked trails may exist. Maps/charts may be unreliable.	Trails exist. Some marked unformed maintained trails may exist. Some evidence of vehicle tracks may exist but these are regenerating. Small unpowered or electric motor powered (e.g. outboards) craft may be evident (canoes, small sail boats, kayaks, etc.). Maps/charts may be unreliable.	Rough, unsurfaced and infrequently maintained vehicle roads may exist. Some formed but not hardened trails present. Reliable maps/charts available.	Well-maintained roads and tracks. Gravel roads following natural features with some steep grades and tight corners. Some formed tracks may be present. Reliable maps/ charts available. Some channel markers, all significant hazards marked, mooring buoys may be present, natural surface boat launching points, small landings. Roads/ marked channels blend with environment.	Unsealed roads with engineered and modified alignments. Mostly one lane, although some two-lane sections may exist. Some narrow sealed roads may be present. Formed and hardened tracks may be present (boardwalk/ sealed track sections). Reliable maps/ charts available. Channels marked, all significant hazards marked, mooring buoys present, hardened boat ramps, landings, small jetties/ pontoons.	Most roads and tracks are sealed and regularly maintained. Two lane roads are common. Channels marked, all significant hazards marked, mooring buoys present, hardened boat ramps, substantial jetties/pontoons.	Roads and tracks are usually sealed. Some use of paving may be present. Unsealed roads and tracks are maintained at a high standard. Two lane roads are common. Channel markers may be lit, lighthouses visible, all significant hazards marked, mooring buoys present, hardened/sealed boat ramps, swing basins, large jetties/ pontoons.	All roads, tracks, and paths are sealed or paved. All marine launch, navigation and mooring services available.	All roads, tracks, and paths are sealed or paved. All marine launch, navigation and mooring services available.

Wilderness horse riding trial: monitoring methods (baseline)

Managerial	1	2	3	4	5	6	7	8	9
Evidence of management personnel: Site factor	Infrequent, usually only to monitor resource conditions.	Minimum management presence, only to achieve minimum necessary management obligations.	Minimum management presence. Infrequent construction and maintenance activity. Infrequent patrols by enforcement staff.	Some management presence. Occasional construction and maintenance activity. Occasional patrol by enforcement staff.	Active management presence. Common construction and regular maintenance activities. Regular infrequent patrol by enforcement staff.	A strong and visible management presence. Users commonly aware of management activities.	Management presence active. Frequent and regular construction and maintenance activity. Frequent and regular patrol by enforcement staff.	Management and enforcement personnel are obvious and semi-permanent.	Management and enforcement personnel are obvious and permanent.
Presence and extent of signage: Site factor (but includes access routes)	None	Unlikely, although a few, dispersed signs may be present for resource protection.	Minimal road/ track/beach names, regulatory notices and directional signage.	Regulatory and directional signs located at key points. Minimum interpretation signage.	Interpretation, regulatory notices, boundary and directional signs sufficient to orientate and inform all visitors. Signage blends into natural background.	Comprehensive interpretation, regulatory notices, boundary, and directional signs sufficient to orientate, educate and inform all visitors. Signage can be large and apparent.	Interpretation signs and regulatory notices common. Boundary and directional signs at all intersections and along roads and tracks. Some advertising signs may be present. Signage is obvious and may be a focus of activity.	Interpretation signs and regulatory notices frequently encountered. Boundary and directional signs at all intersections and along roads and tracks. Advertising signs may be present.	Unlimited
Rules, regulation and law enforcement: Site factor (but includes access routes)	Communicated off-site. Users unaware of management.	Communicated off-site. Infrequent patrol for sustainability monitoring and life preservation. Users mostly unaware of management.	Predominantly communicated off-site. Sporadic patrol for sustainability monitoring and life preservation. Users occasionally aware of management.	Some on-site communication. Signage and supervision as required for safety and sustainability. Users occasionally aware of management.	An occasional and visible management presence. Frequent on-site communication. Users commonly aware of management.	A regular and visible management presence. Frequent on-site communication. Users commonly aware of management.	An active management presence. Frequent and regular on-site communication. Users commonly aware of management, rules and regulations.	Frequent and regular education, reinforcement or enforcement.	Constant education, reinforcement or enforcement

Wilderness horse riding trial: monitoring methods (baseline)

Managerial	1	2	3	4	5	6	7	8	9
Presence of management and visitor infrastructure: Site factor (but includes access routes and site service facilities)	None	Only constructed where no other alternative can be found (e.g. communication towers). Structures are inconspicuous and widely dispersed.	Only constructed where no other alternative can be found (e.g. communication towers).	Structures are small but apparent. However, they are dispersed and blend into the natural background.	Structures are somewhat apparent, can be quite large but blend into the natural background.	Structures are readily apparent. They may be designed to blend into their surroundings although some may stand out.	Built structures are large and readily apparent. Some infrastructure may be provided as a focus for visitor activity.	Built structures are readily apparent and often designed to stand out. Infrastructure is usually provided in all public spaces and may be the focus of visitor activity.	Large, obvious and attention grabbing. Built structures dominate all senses. Unavoidable.

* Site factors are those present on the actual site being assessed. Context factors are elements of the broader landscape that relate to the site being assessed.

**A group constitutes the number of people belonging to one party (it could be a tour group, family or group of hikers or a large group broken into parties).

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