Approaches to positioning crossing structures to facilitate emu movements across a major highway

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Background

- The Emu (*Dromaius novaehollandiae)*, widespread distribution occurring in all mainland states
- Isolated population in northern NSW disjunct from other NSW populations
- Coastal Emu listed as endangered population in NSW under the Biodiversity Conservation Act 2016

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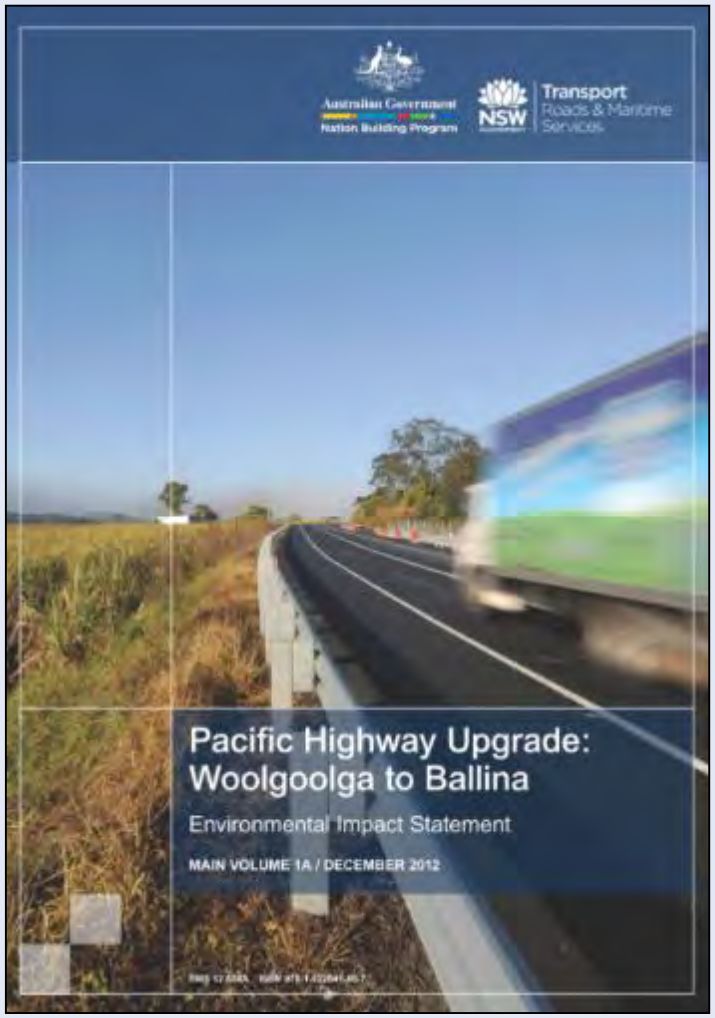
Pacific Highway upgrade

- Woolgoolga to Ballina – planning commenced 2011
- Project jointly funded by the NSW and Australian Governments
- 155 km motorway project staged over 11 sections
- Two adjoining sections intersect the range of the coastal emu population



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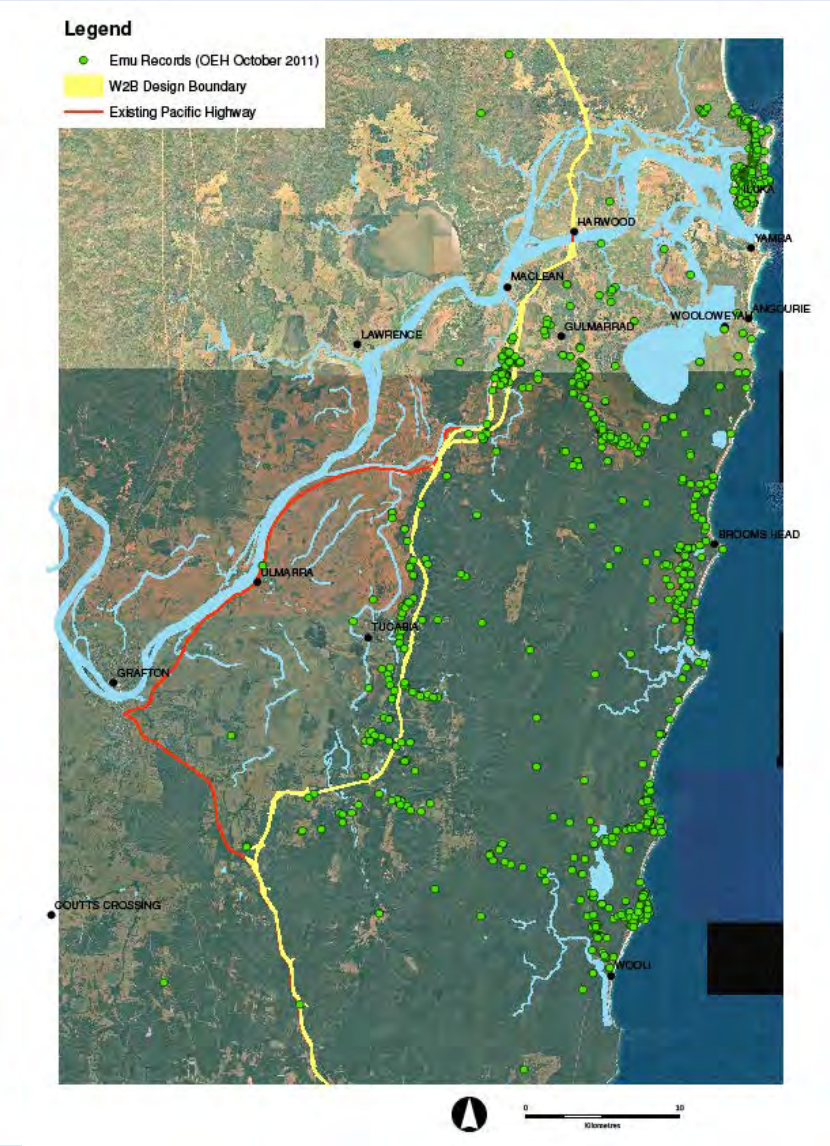
Planning for Emus

- 45 km stretch south of the Clarence River
- Planning for habitat connectivity
- Mitigating road strike
- Preliminary research
  - public records
  - citizen surveys
  - local insights and knowledge
  - Professor S.Davies



Challenges

- Limited data
  - preferred habitats and frequented areas
  - do movement pathways exist and where
  - use of crossing structures and behaviour with fauna fences
- Low numbers, restricted distribution, but widely dispersed
- Occupy mosaic of natural and modified habitats
- High mortalities on local roads

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Approaches used

NSW Roads and Maritime Services funded a number of studies as part of the W2B project

- Strategy for identifying knowledge gaps
- Information used to inform planning and mitigation decisions

Investigate road features at emu-vehicle collision sites

Plan and implement surveys to understand habitat and movements

Trial crossing zones and fence design, inform detailed design

Emu-vehicle collision study

- Identify landscape features associated with road crossings
- Identify road features associated with vehicle strike

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- Sampled 26 road-kill sites, compared with control sites
- Roadside vegetation structure
  - Tree, shrub and ground layers
  - Distance to vegetation >2 m
- Road conditions
  - Road character, surface, size & condition
  - Presence of fences and distance to fence (width of road reserve)
- Landscape features
  - Waterbodies,
  - Adjacent land-use

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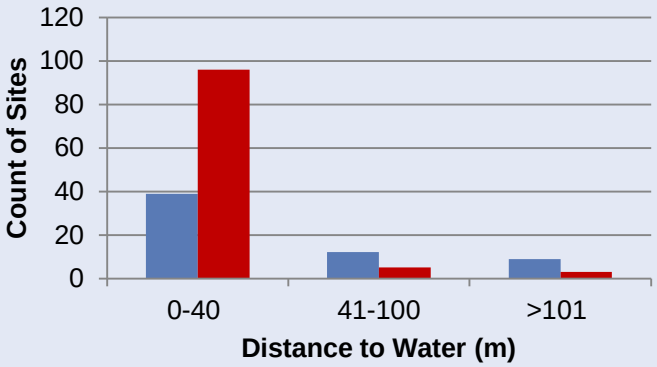
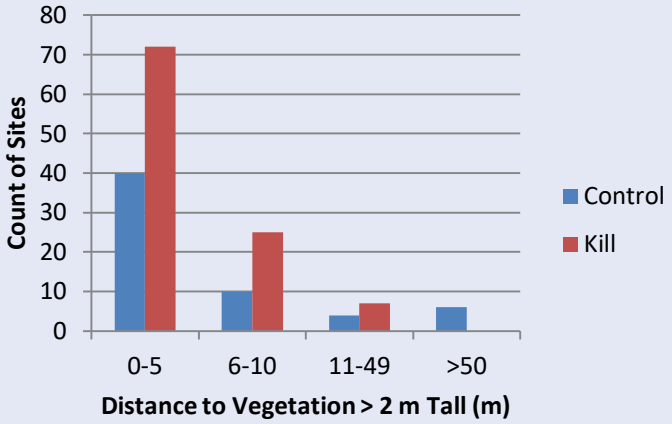
Significant associations identified with several characteristics

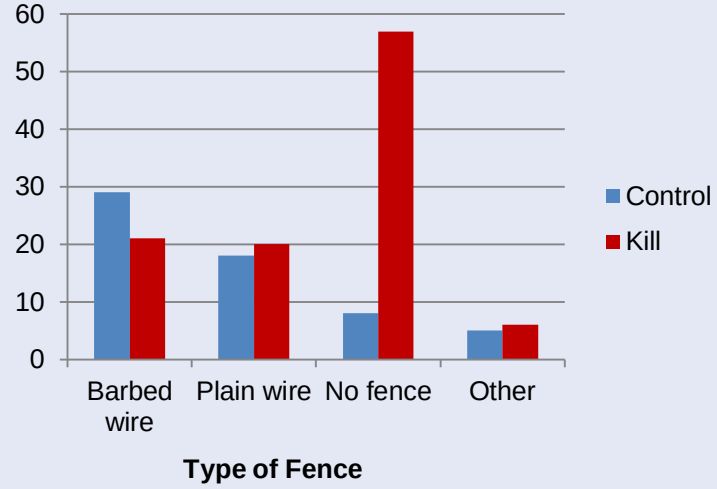
Within 40 m of waterbody



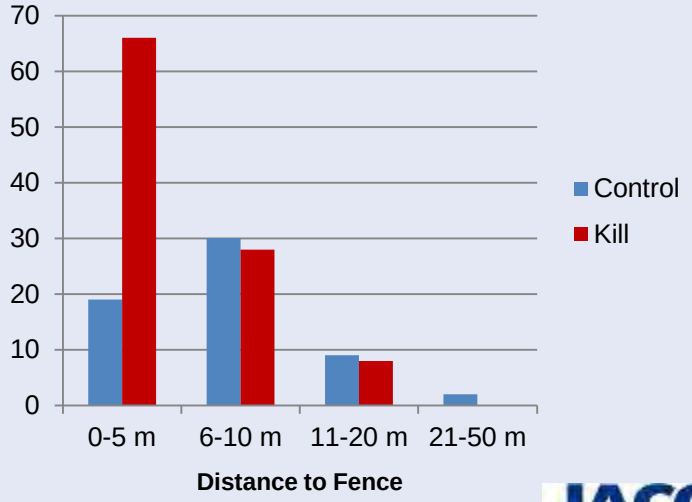
Adjacent tall forest



Fences



Distance to fence



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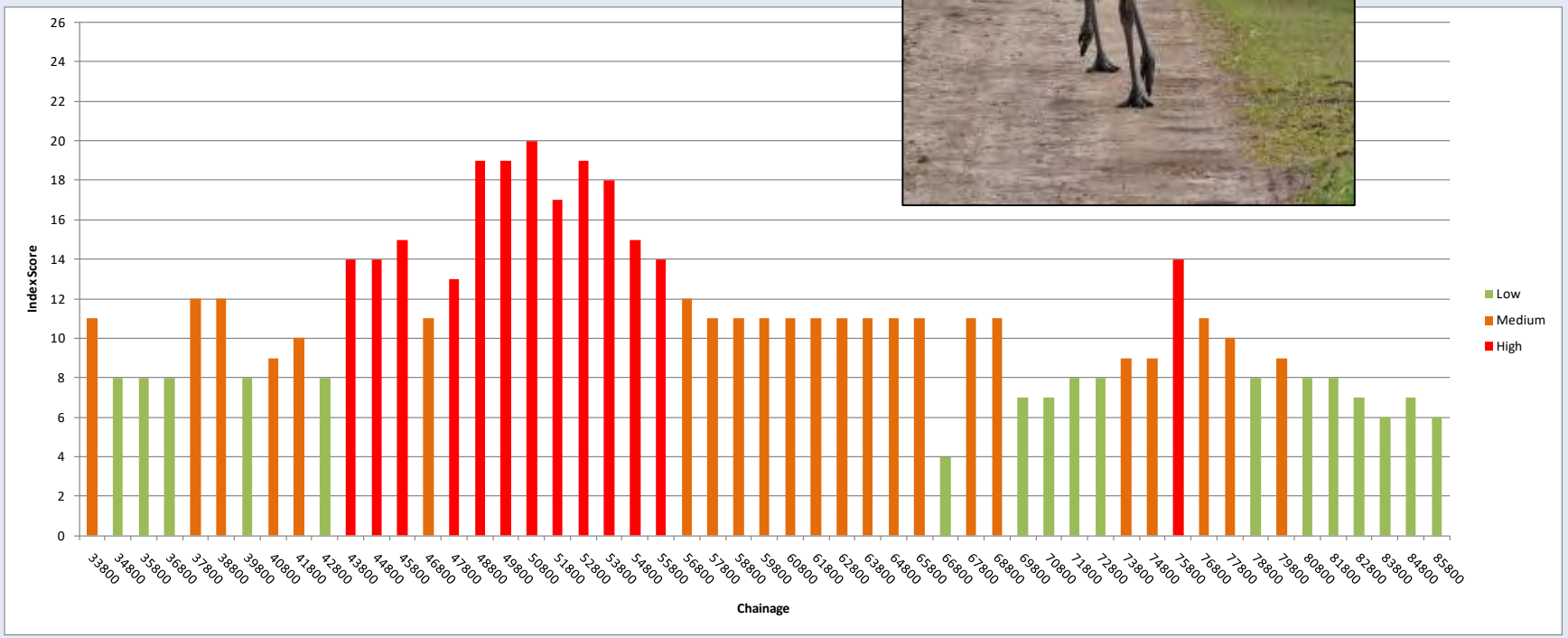
Modelled high risk areas

simplified model scenario applied to the new unconstructed road



Survey approaches

- RMS funded a number of pilot studies to build on the knowledge of the coastal emu in the study area
- Objectives
  - Understand habitat, distribution and movements to assist planning for crossing structures
  - Determine effective and cost-efficient survey methods for ongoing monitoring
- Approaches
  - Aerial survey
  - On ground search techniques

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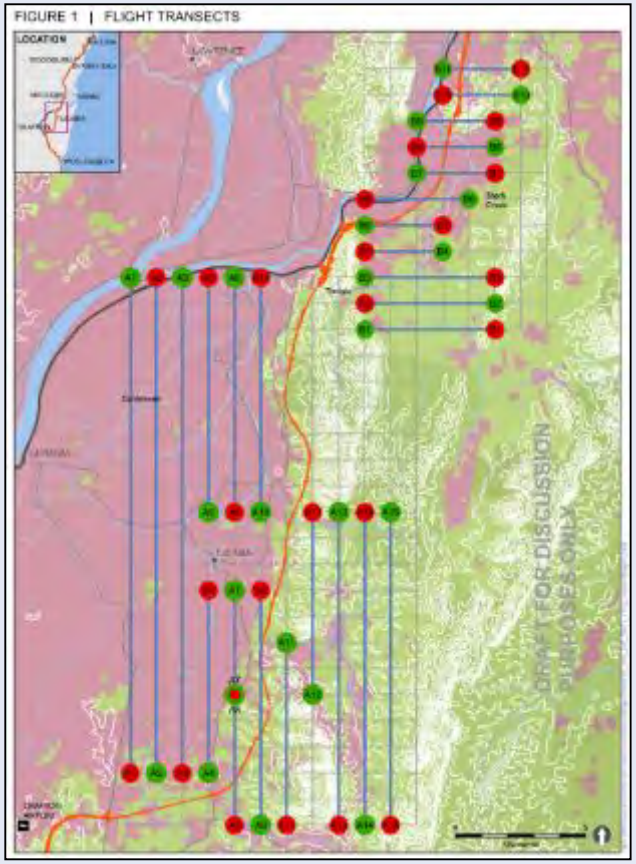
Aerial survey

- Used successfully in western NSW for kangaroos and emus
- Determine if an effective method for population counts for use in ongoing monitoring
- Means of assessing barrier effect of the road
- Trialled systematic transect sampling versus timed area searches



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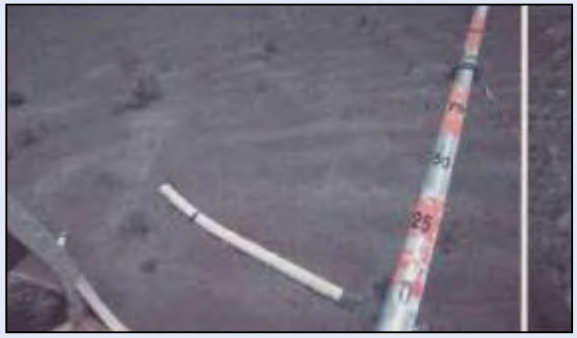
Findings

- Observability greatest in cleared land, wetlands and cropping land
- Low population density, number of emus sighted was low
- Insufficient data for robust analysis
- Not efficient or cost-effective for ongoing surveys compared with repeated ground surveys



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Camera trapping and sign surveys

- Divided study area into multiple search areas with impact and control sites
- Transect searches (signs) complimented with camera trapping
- Repeated systematic searches, signs removed from transect
- Barbed wire fences effective transects
- Good species to target using cameras, large body, slow moving and diurnal activity

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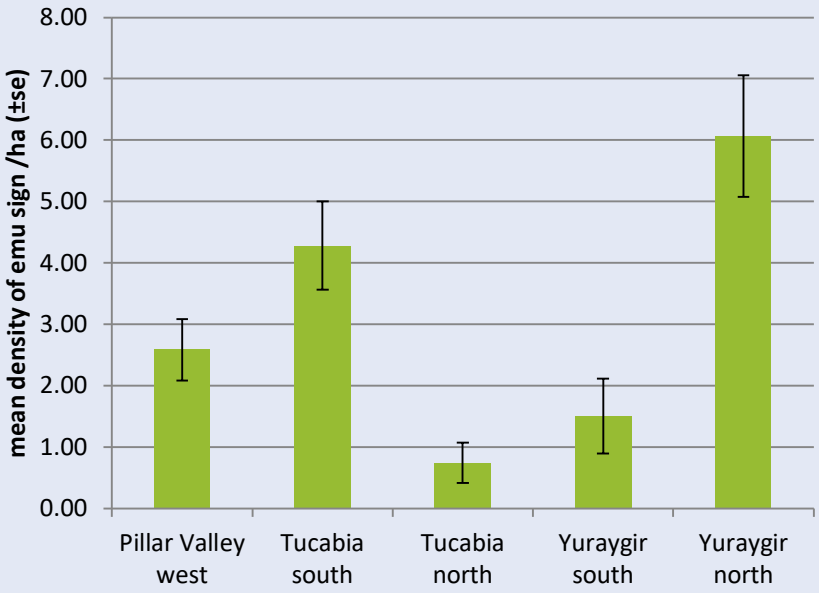
Ground surveys - findings

- Combined techniques effective at identifying site occupation over time
- Notable patterns if habitat use
- Useful for planning emu crossing zones
  - Identified frequented areas, range of habitats and preferred habitats
  - Emus revisit the same areas where food and water resources are reliable
  - Emus often use tracks to move through landscape (vehicle, cattle, wallaby)
  - Identify local plant species in the diet



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Positioning crossing zones

- Potential crossing zones were identified
- Planning for connectivity to range of habitats
- Bridge design raised and lengthened above minimum requirements for hydrology to cater for emus
- Crossing to be used with fence to direct emus and to prevent road kill

Trial Crossing Zones and Fence Design

- 10 crossing zones monitored for 17 months prior to construction
- Establish usage patterns on a daily, seasonal and annual basis
- Temporary fence constructed along future highway connecting crossing zones
- Gaps left in the fence where crossing zones would to be placed
- Camera monitoring aimed at determining presence and frequency of passes through zone
- Cameras used to observe movements along fence, directional movements towards crossing zones
- A hybrid fence was constructed to trial the exclusion of cattle but allow emus to pass through

Crossing zone	Station	Description / waterway	Fence opening monitored (m)	Camera traps
T1	46055 to 46155	Floodway adjacent to Pillar Valley Creek	100.0	5
T2	46325 to 46440	Pillar Valley Creek	115.0	5
T3	46647 to 46722	Black Snake Creek	75.5	4
T4	47070 to 47082	Floodway	12.0	1
T5	47643 to 47795	Floodway	152.0	5
T6	47900 to 47960	Un-named creek	60.0	4
T7	48400 to 48900	Emu hybrid fence trial	50.0	4
T8	48740 to 48835	Mitchells Road realignment	95.0	6
T9	49246 to 49366	Floodway	120.0	5
T10	50280 to 50325	Un-named creek	45.0	4
		TOTAL	824.5 metres	43

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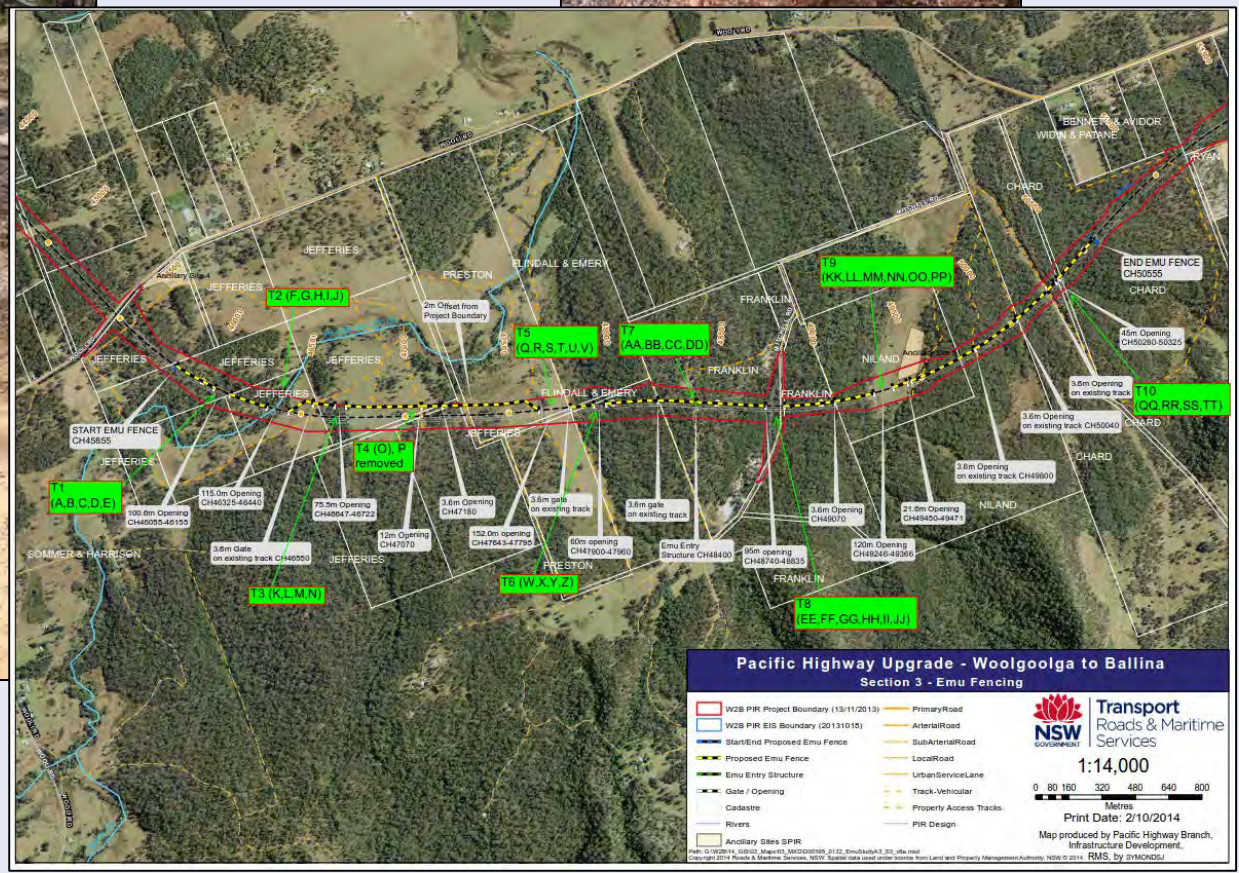
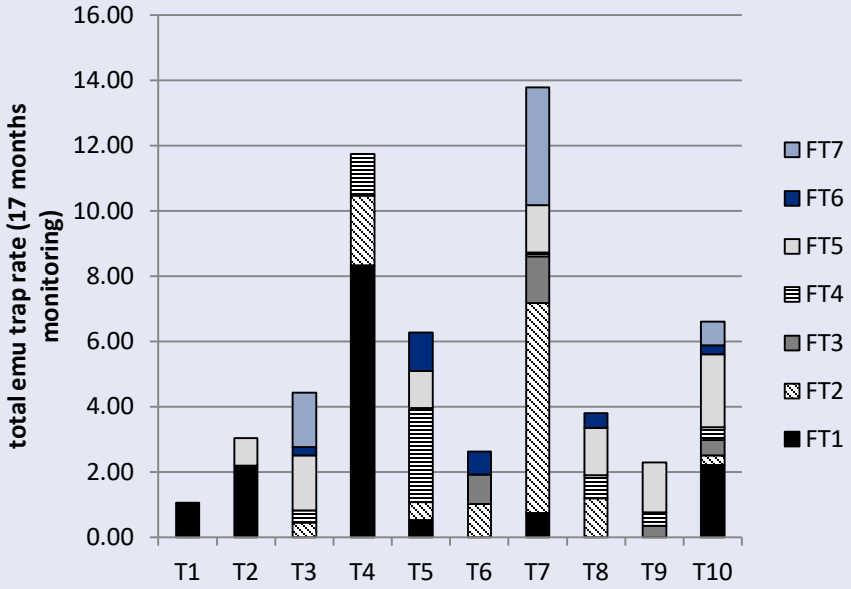
Fence and crossing zone trial



Fence gap monitoring

- Monitoring continued for 17 months to record use of zones before the construction of the road
- Emus readily adapted to finding and using the crossing zones
- Emus detected using all zones
- Repeated crossing at some zones
- Detected moving along fence to find and access crossings



Adult walking along exclusion fence towards T6 in riparian corridor

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Fence gap monitoring

- Was successful in identifying the location, width and associated habitat
- Multiple videos of emus passing through the hybrid fence

Adult male with striped chick <12 weeks old at Pillar Valley in spring using fence gap

Adult pair photographed at hybrid gate (T7) shown walking along the fence

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Fence gap monitoring

- No obvious pattern to the preference for forest, riparian or floodplain grazing habitat at crossing zones
- Results confirm that all three habitat types were used

Adult captured in dense riparian forest using fence gap T6 at Tucabia

Adult emu walking along cattle track in riparian corridor through T10

Adult crossing floodplain grazing land through T9

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Mitigation – applying the knowledge

Data used to develop a management strategy

- Provide access to a range of habitats over a wide landscape – open and closed habitats
- Fencing important adjacent to forested habitats and waterbodies as determined by vehicle-collision data
- Provide fencing that directs to crossing zones, emus able to move along fences, tracks and trails
- Maintain crossing zones during construction
- Strategic use of emu planting zones

Next steps

- Temporary crossing zones constructed and monitored for emu use
- Permanent fencing installed in high use areas
- Ongoing review of performance of the mitigation against established goals
- Adaptive management actions
- Educate emus to find crossing zones?

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