TWEED SHIRE COUNCIL

Tweed Shire Roadside Vegetation Management Plan

March 2013

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Cover photo: Bryens Road, Nobbys Creek

This Plan supplements the Tweed Roadside Vegetation Guidelines (2013) and the Vegetation database (2012).

Acknowledgement is due to:

John Turnbull, Steve Paff, Tony Clarke (Tweed Shire Council) for the provision of data, general direction and discussions on the content of this document.

RTA and Greening Australia for the precursor *Roadside Management Guidelines Book 1 Main Road 55 Lithgow-Mudgee-Dunedoo*(1996) designed and written by Venita Kulinskis and the Model Guidelines, The NSW Roadside Environment Committee (REC),funded by the RTA and Vic Roads *An Environmental Guide for Road Construction and Maintenance 2006.*

Tweed Shire Council (2008) Draft Standard Operating Procedure

Applied Ecology (2011) Mid-Western regional Council Roadside Management Guidelines prepared for Mid-Western Regional Council

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for

TWEED SHIRE COUNCIL

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1 Introduction

1.1 Background

Bushland Restoration Services in association with Landmark Ecological Services were contracted in April 2012 to prepare a Roadside Vegetation Management Plan (RVMP), which will include Roadside Management Guidelines for use by field staff.

Under the *Roads Act 1993,* Tweed Shire Council (TSC) is responsible for maintaining the local road network, including roadside vegetation. Tweed Shire Council intends to incorporate a roadside vegetation management component into its existing Works Unit rural road management strategy.

The RVMP is guided by the NSW Roadside Environment Committee documents *Managing Roadsides* and the *Roadside Handbook* (NSW REC 1996).

1.2 Project Aim and Objectives

The RVMP aims to provide best practice management guidelines for areas of remnant native vegetation and individual species within road reserves. The Plan focuses on identification and protection of:

- Native vegetation of high conservation significance, including Endangered Ecological Communities (EECs), other mature native vegetation in good condition and fauna habitat;
- Threatened flora species; and
- Features of cultural significance.

Special management areas such as restoration plantings and 'no spray' areas will be identified.

Strategies to maintain and enhance biodiversity values will recognise sometimes conflicting requirements for maintenance and management of rural roads and roadside assets.

The objectives of the Tweed Roadside Vegetation Management Plan are:

- Survey, assess and map the conservation values of native vegetation along Council maintained rural roadsides in the Tweed Local Government Area (LGA);
- Create a GIS database to store all key survey information and facilitate production of maps to identify management zones;
- Develop specific management responses for works and activities by management zone;
- Prepare a set of guidelines for use by in-field staff that incorporates the specific management responses for works activities and management zone maps;
- Determine priorities for habitat restoration and revegetation of road reserves; and
- Identify priorities for noxious weed control.

1.3 The Study Area and its Values

The study area (**Figure 1** below) includes all rural roads in the LGA that are maintained by TSC (approximately 750 km).

The Tweed LGA is located in the Border Ranges biodiversity hotspot, one of Australia's most diverse biological regions. The subtropical rainforest, wet sclerophyll forest, mountain headlands, rocky outcrops and transition zones between forests found in the region support an extensive variety of bird and macropod species and a rich variety of primitive plant species. http://www.environment.gov.au/biodiversity/hotspots/national-hotspots.html#hotspot3.

LGA-wide mapping (Kingston *et al.* 2004) demonstrates the diversity of vegetation types in the Tweed Shire. The 2004 typing uses ten broad vegetation communities and fifty six vegetation types**.** Some of the native vegetation has particular conservation significance, including communities listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act) as EECs. As the rural road network penetrates most of the physical environments within the Shire, a wide range of EECs, native vegetation types and flora species of conservation significance occur along roadsides.

The Tweed LGA environments provide known and potential habitat for flora and fauna species listed as threatened (endangered or vulnerable) on schedules of the federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the TSC Act.

A list of threatened flora species known to occur in Tweed LGA (H. James personal compilation) includes 90 species (**Table 1**).

Table 1 - Number of threatened flora species known from Tweed Shire

SOURCE	TSC Act 1995	EPBC Act 1999	EPBC not TSC
STATUS			
Endangered	57	19	
Vulnerable	33	36	1

Many roadside specimens of threatened flora were previously documented and permanently marked (timber bollard with plaque naming the species) by TSC.

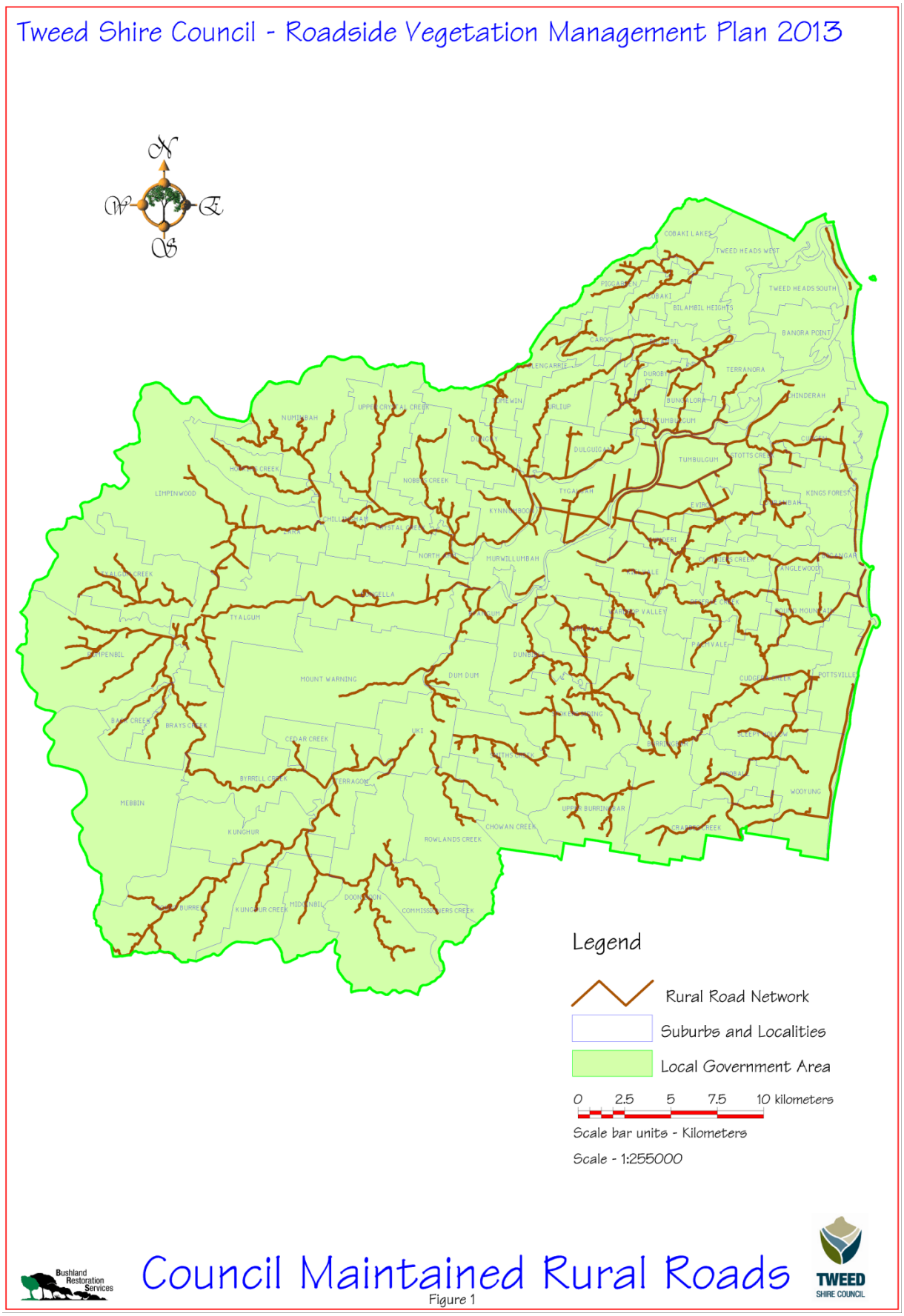

Figure 1 - Study Area

The linear configuration and high edge to area ratio of roadside vegetation remnants limits their biodiversity values. A narrow strip of vegetation with cleared land adjacent (pasture, cane fields) can, however, support fauna and flora habitat, for example small ground-dwelling fauna species can utilise logs, hollows and ground cover if retained. Such areas may also have particular importance as the only local remnant of a vegetation community, providing a store of genetic flora and fauna resources and seeds for revegetation projects. Where roads traverse large vegetated areas, roadside vegetation as part of a larger habitat block is more likely to support high biodiversity.

Roadside vegetation can provide habitat resources (forage, blossom) and connectivity for mobile fauna such as Grey-headed Flying Fox, even where this vegetation is narrow. Where the forest canopy meets across a road, exclusively arboreal animals, especially gliders, can cross. Koalas *Phascolarctos cinereus* also prefer to move through the canopy where they are less vulnerable to predators and in so doing avoid the dangers inherent in crossing roads. The ecology of fauna species and the nature and extent of the habitat gap determine the extent that roads form barriers to movement - small, narrow country roads with little traffic permit safer movement than main arterial roads with high traffic volumes.

Roadsides may have cultural significance e.g. Aboriginal sites, heritage features including historic landmarks and cemeteries as well as community tree plantings. A green roadside corridor can be highly valued scenically, especially if in good structural condition with large trees and attractive features such as rainforest palms and epiphytes. Roadside vegetation also stabilises soil and reduces wind and water erosion.

2 Roadside Management Considerations

Roadside vegetation poses a number of management challenges as the area of vegetation is often small, its edge subject to ongoing disturbance and user safety must be prioritised and balanced with conservation objectives. Problems also arise from a lack of information provided to roadside managers and operators, turnover of staff and contractors, an absence of clear guidelines and changing roadside conditions.

2.1 Vegetation Management

Management of roadsides to provide safety to road users, such as maintaining clear sight lines, frequently requires the clearing of vegetation. Clearing reduces the area of vegetation and may reduce its width, creates new edges and may diminish connectivity. Edges are prone to natural and unnatural disturbances, light and wind penetration and invasion by weed species, combining to threaten biodiversity values.

Specimens of threatened flora species may be directly damaged or removed. Even lopping and pruning can have considerable impact.

Machinery used in clearing or maintaining roads can cause damage to regenerating native plants, damage to roots and trunks of established trees, result in soil compaction, siltation of drains and waterways and loss of fauna habitat. Machinery can also act as a dispersal vector for weed propagules as well as indirectly favouring weed expansion by creating disturbed environments.

2.2 Roadside Maintenance

Activities to ensure that roadsides are maintained in good condition include clearing of table drains and culverts, replacing table drains, filling potholes and grading road surfaces.

Maintenance activities can have an adverse impact on native vegetation by removing or damaging vegetation and spreading or exacerbating weed infestation (see **Section 2.1** above). In addition, earthworks can move soil containing weed seeds. Graded gravel and road base is sometimes piled against roadside tree trunks, or pushed off the formed road into downslope native vegetation or drainage lines.

2.3 Stockpiling

Stockpiles within the roadside reserve are often created during road construction, maintenance and other infrastructure activities. There are some designated stockpile sites within the LGA, which are generally on cleared sites. Machinery associated with road maintenance is often parked within the road reserve overnight.

Stockpiles and/or parked machinery can smother native plants and damage tree roots and provide a source for the introduction and spread of weeds.

2.4 Service Provision and Infrastructure

Infrastructure such as power and telecommunication lines is commonly located in road reserves. The installation of these services can cause disturbances similar to those caused during road maintenance. The ongoing maintenance of the lines also requires the removal or trimming of vegetation in the road reserve to ensure the continued safe provision of services and that the infrastructure components are maintained in good condition.

Service providers generally have vegetation management guidelines for the protection of threatened species where practical while managing for continued and safe service provision. For instance, where power line corridors contain threatened species, non-threatened tall growing species will generally be trimmed or removed while tall-growing threatened species will be trimmed to the minimal amount necessary or other management options considered (Essential Energy 2011).

2.5 Weed Management

Noxious and environmental weeds are widespread throughout the Tweed LGA. The dominant canopy weed, Camphor Laurel, is well established along roadsides and distributed by birds, including native fruit-eating pigeons. Less common canopy weeds such as Coral Tree, Yellow Bells, Golden Rain Tree and Jacaranda have escaped from garden plantings in rural and rural residential areas and have volunteered within the road reserve. Mid storey and groundcover weeds have also spread along roadsides from rural gardens and abandoned agricultural land. Adjoining landholders have often deliberately planted inappropriate flora species, such as Singapore Daisy and Kahili Ginger, in the road reserve, often without being aware of potential consequences.

The control of declared noxious weeds on roadsides is the responsibility of the Far North Coast County Council, trading as Far North Coast Weeds (FNCW). The County Council is the Local Control Authority responsible for administering the *Noxious Weeds Act 1993* in six far north coast shires, including Tweed. Public authorities and private landholders are required to control noxious weeds declared under the *Noxious Weeds Act1993* according to the Class of weed (see **Table 2**).

Table 2 - Noxious weed control Classes

Class 1: Plants that pose a potentially serious threat to primary production or the environment and are not present in the State or are present only to a limited extent. The plant must be eradicated from the land and the land must be kept free of the plant. The weeds are also ‘notifiable’ and a range of restrictions on their sale and movement exist.
Class 2: Plants that pose a potentially serious threat to primary production or the environment of a region to which the order applies and are not present in the region or are present only to a limited extent. The plant must be eradicated from the land and the land must be kept free of the plant. The weeds are also “notifiable” and a range of restrictions on their sale and movement exist.

Class 3: Plants that pose a potentially serious threat to primary production or the environment of a region to which the order applies, are not widely distributed in the area and are likely to spread in the area or to another area. The plant must be fully and continuously suppressed and destroyed.
Class 4: Plants that pose a threat to primary production, the environment or human health, are widely distributed in an area to which the order applies and are likely to spread in the area or to another area.
Class 5: Plants that are likely, by their sale or the sale of their seeds or movement within the State or an area of the State, to spread in the State or outside the State. The weeds are also 'notifiable'.

In recent times due to restricted funding FNCW has focused control works at higher class weeds (Classes 1 and 2 primarily) and new and emerging weed threats where a positive outcome is more likely than the lower classification weeds which are not prioritised for control programs.

Slashing and the use of slope mowers are widely employed mechanical methods of controlling weeds and removing native regrowth to keep sightlines clear. Fine control of machinery is difficult and operators without botanical training often do not fully discriminate between native and exotic vegetation, especially in difficult operating conditions. Machinery can spreads noxious weeds and many slashed weeds regrow vegetatively.

Herbicide is also used for weed control, along roadsides this includes keeping drains clear of growth that may impede water flow, ensuring visibility of signs and guideposts and by managing weeds growing where machinery cannot manoeuvre (guard rails, header walls, etc). Herbicide spraying causes less disturbance than mechanical weed management methods and has the potential to contain or eradicate weed species, as part of a planned and targeted control program. Off target damage to native vegetation is highly likely unless the spray application is carefully constrained, weather conditions are suitable and operators are able to discriminate between natives and exotics.

Chemical sprays can adversely affect landholders and land uses adjacent to roadsides. This Plan builds on TSC's "Do Not Spray" register that includes landholders engaged in organic farming, chemical sensitive landholders, areas of native vegetation and plantings and household and stock water supply locations. When a "Do Not Spray" location is notified, Council records the property and landholder details and informs any machinery and plant operators working at these locations (details are currently available to Council staff but not available as a mapped layer).

2.5.1 Significant Weeds

Comprehensive species-based weed management is beyond the scope of this Plan. General weed management and management of a subset of weed species – *Significant Weeds* – are addressed in Section 1.2.2 of **Appendix 1**.

Significant weeds included weed species that are:

- Scheduled in control classes 1, 2 or 3 under the provisions of the Noxious Weeds Act (1993); and/or
- Environmental weeds of particular relevance to roadside management, primarily those commonly spread by machinery.

2.6 Revegetation and Restoration

Roadside restoration projects, whether confined to the road reserve or an extension of works on adjacent land, can conflict with roadside management or introduce inappropriate plant species (e.g. ornamental environmental weeds or non-local natives in high conservation value vegetation).

Weeds are often dispersed by machinery spread from roadsides onto adjacent private land. Landholders prepared to invest in managing roadside vegetation will be discouraged if re-infestation is ongoing. Adjacent landholders are sometimes keen to remove exotic trees such as Camphor and Coral Trees, but cannot deal with the safety problems of felling or injecting trees on roadsides.

3 Assessment for Management

The Plan commenced with a survey and data collection phase as the basis for management planning. Management zones (linear roadside segments) and point data for threatened species and small occurrences of EECs were the starting point for framing management actions.

Appendix 1 details information sources, methods and results for field surveys, and allocation of roadside segments to management zones. "Windscreen" surveys conducted between 19th June and 14th August 2012 provided most of the data used to inform management. Linear segments of the roadside were delineated according to vegetation attributes. The project brief prescribed a minimum length of 500m for each management zone to allow for practical representation on the maps prepared for the Project (see Roadside Management Guidelines 2013). Locations of threatened flora species, small occurrences of EECs, management issues and significant weeds were recorded as point locations.

3.1 Management Zones

At the conclusion of the roadside survey, the line data were interrogated to determine management zones see **Figures 2** and **3** below and Section 3 of **Appendix 1**.

The management zones determined during survey are:

Zone 1 High Conservation Value (HCV)

High conservation value roadsides include native vegetation in a near-natural state or, if in a lesser condition, possessing additional values such as low levels of weed infestation, threatened species, high levels of regeneration and/or good connectivity. All vegetation with a large proportion of an EEC vegetation type is included in this category. As a minimum road-length of 500m was employed, heterogeneity was inevitable and these roadsides may include small sections of vegetation of lower value.

Zone 2 Medium Conservation Value (MCV)

Medium conservation value vegetation areas may include EEC vegetation and other native vegetation with intermediate habitat or biodiversity values, on average. The vegetation may include moderate components of woody weeds. Heterogeneity within these zones has lead to the inclusion of sections of higher conservation value vegetation as well as patches of open and degraded vegetation. These zones usually have the potential to be returned to near-natural condition following restoration works.

Zone 3 Low Conservation Value (LCV)

Low conservation value management zones include lower conservation value native vegetation and areas that are substantially cleared. Any vegetation in these zones is often degraded, but may include small sections of higher value vegetation. Typically these zones possess moderate to high densities of woody weeds and open areas dominated by exotic grasses and herbs with high requirements for maintenance (e.g. mowing, slashing). Small plantings of native and exotic species may occur - usually

garden plantings rather than plantings for restoration purposes and often adjacent to residential housing.

Table 3 - Extent of roadside segments in each management zone

Management zone	Length (km)	% of total
1. High Conservation Value	271.45	18.04
2. Medium Conservation Value	194.75	12.94
3. Low Conservation Value	1038.72	69.02
Total	**1,504.92**	**100.00**

Approximately 30% of surveyed roadsides were placed in HCV and MCV (**Table 3**). These management zones are displayed on the maps produced for the Roadside Management Guidelines 2013 (for examples see **Figures 2** and **3** below).

3.2 Threatened Species and Endangered Ecological Communities

A high proportion of road reserves in the Tweed LGA contain threatened plants as well as EECs. Point locations identifying threatened species and EECs are found in all management zones. As EECs will be managed in the same way as HCV vegetation zones the EEC point locations located in this zone have not been displayed on the maps.

EECs occur within 184 km of the surveyed roadsides and 568 EEC point locations were recorded (see Section 2.2 of **Appendix 1**).

Five hundred and eighty five records of 30 different threatened species were also recorded (see Section 2.3 of **Appendix 1**).

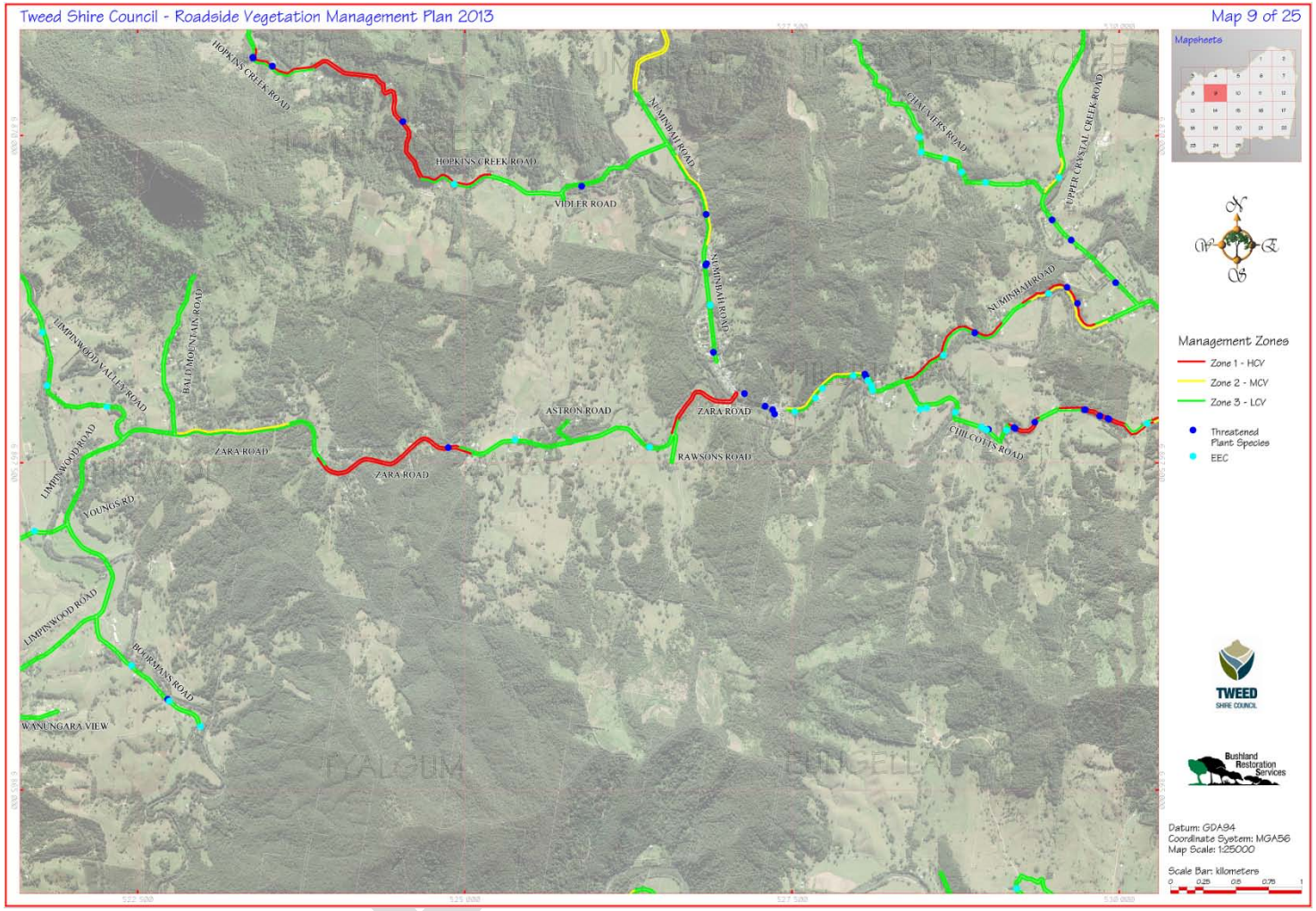

Figure 2 - Example map sheet

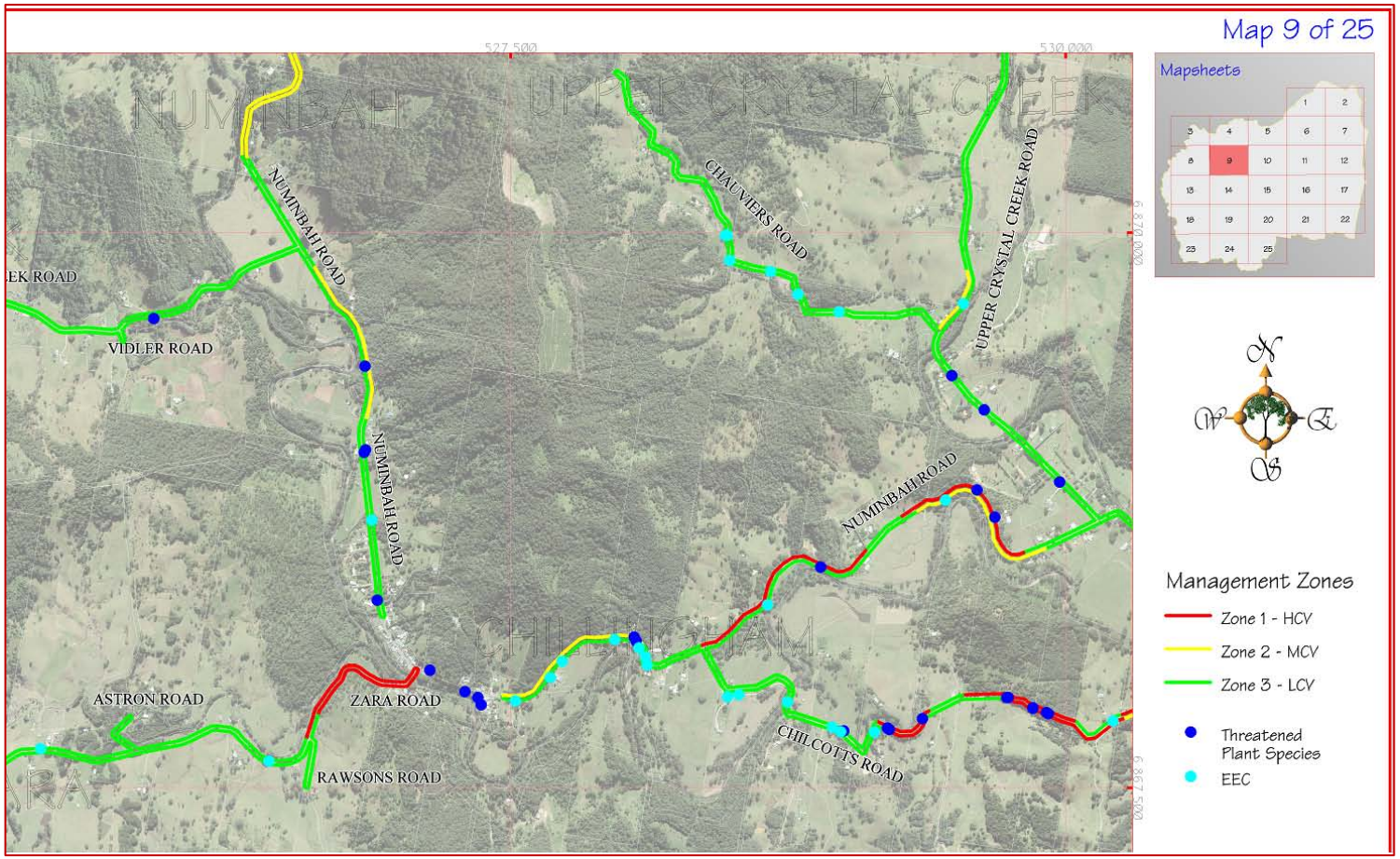

Figure 3 - Detail of example map sheet

4 Management of Roadsides

4.1 General Management Guidelines

The following general guidelines apply to all three management zones. Specific actions for each zone are addressed in **Section 4.2** and in the Roadside Management Guidelines 2013**.**

4.1.1 Identifying roadside vegetation management zones

A combination of maps and roadside markers will assist in the on-ground identification of each management zone, and locations of threatened species and EECs.

- Colour-coded roadside markers will be installed at the boundaries of HCV and MCV management zones. The extent of the management zone will be indicated on the markers by arrows located at the start and end of each section. Roadside marker posts are shown in Figs **4** & **5**.

Figure 4 - HCV roadside marker post

Figure 5 - MCV roadside marker post

- Colour-coded roadside markers will also be installed to identify threatened species and isolated endangered ecological community locations.

- A series of 25 maps has been prepared that show the location and extent of management zone boundaries and the locations of threatened species; in addition the locations of EECs where they occur within MCV and LCV zones are also displayed. This map series will form part of the Roadside Management Guidelines 2013 for roadside managers. The locations of significant weed infestations and other management issues have also been provided in digital format.

4.1.2 Protecting native vegetation

- Do not disturb native vegetation. Disturbance encourages weed growth which requires additional maintenance and increases costs.
- Remove native vegetation by mowing or spraying only where necessary for road and fire safety. Mow regrowth only in LCV or clear zones.
- Mow only to the back of the table drain
- Clear to a maximum of 5.5m in height from the edge of the road shoulder (see **Figures 6** & **7**).
- Tree lopping or felling of native species to follow best practice pruning methods (see **Figure 8**).
- Where mowing is undertaken avoid groups of young native trees and shrubs.
- Native grasses can be mown, but should be left until after seeding or flowering if possible. Regular mowing removes young plants and causes soil compaction. When young trees, shrubs and groundcovers become established, they will shade out grasses and reduce the need for mowing.
- Refer to **Figures 6** & **7** for best practice management to identify the vegetation clearing zones to reduce damage to native vegetation.

4.1.3 Protecting Natural Regeneration

Natural regeneration is the unaided establishment of native plants from seed-fall or suckering. It costs nothing and ensures local roadside vegetation will continue to survive by being replaced over time by the young plants.

Do not disturb natural regeneration. Disturbance encourages weed growth which competes with young plants.

Regenerating areas may not be obvious (e.g. could comprise small seedlings or eucalypt saplings amongst grass).

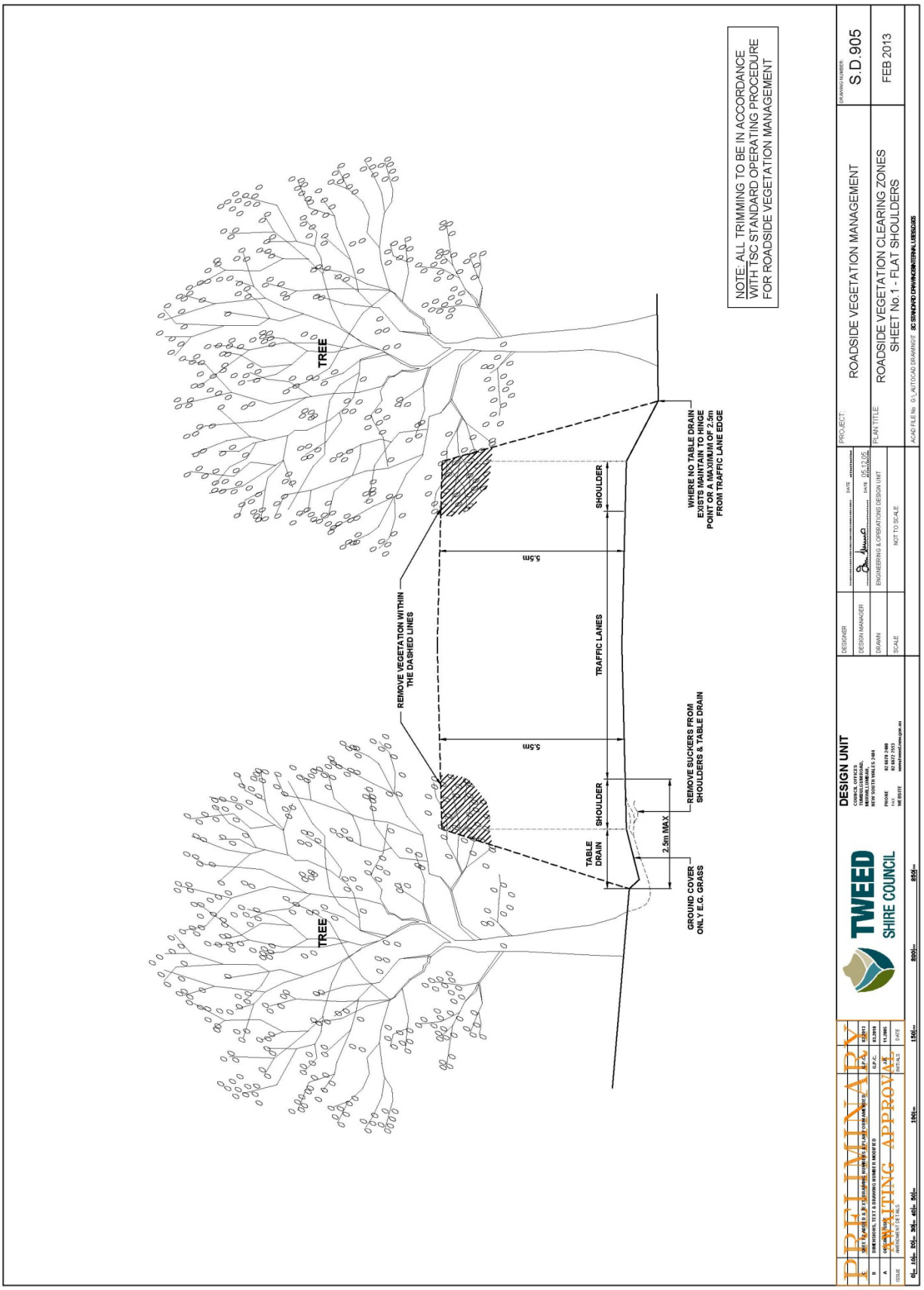

Figure 6 - Roadside Vegetation Management Clearing Zones - Flat Shoulders

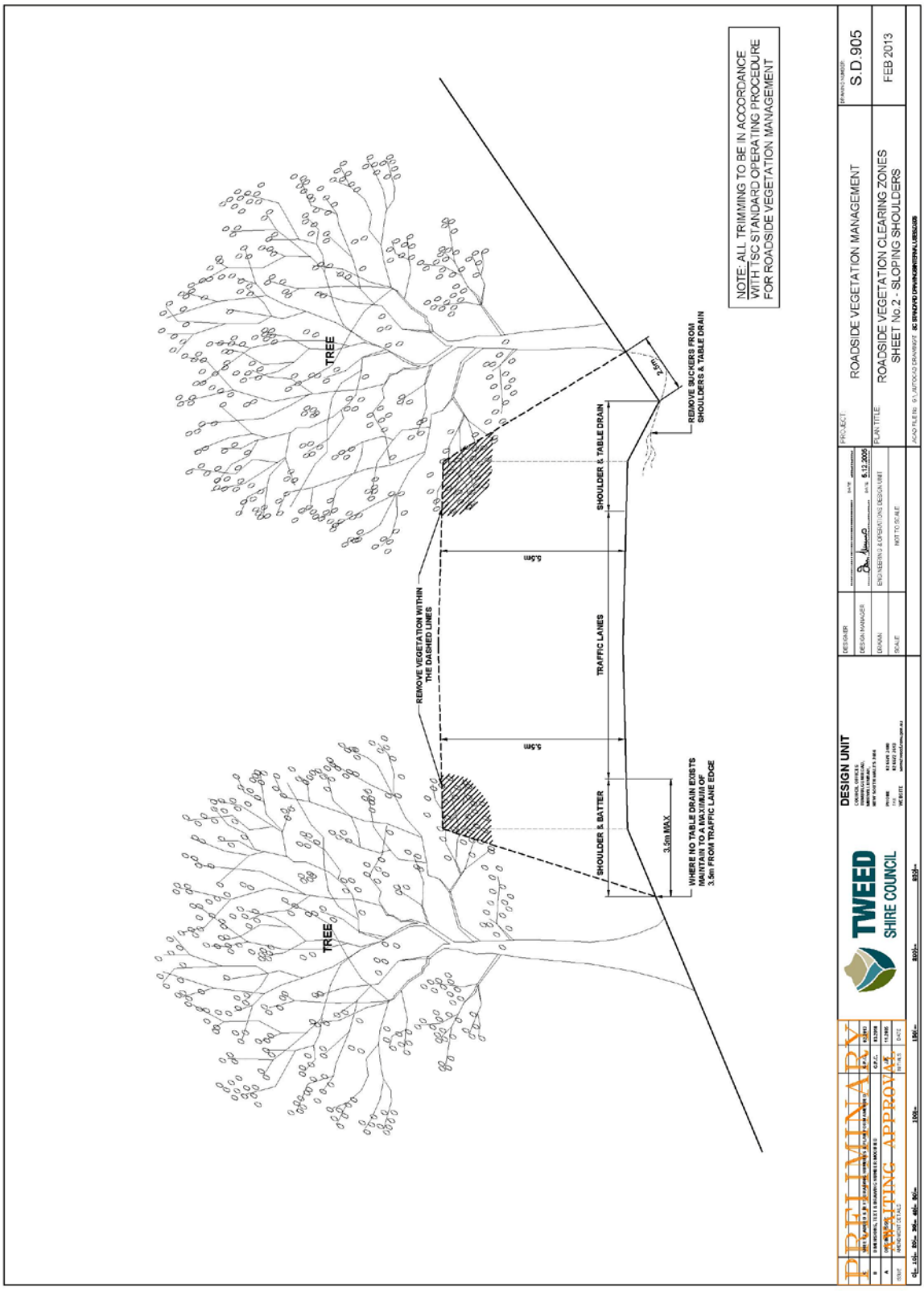

Figure 7 - Roadside Vegetation Management Clearing Zones - Sloping Shoulders

4.1.4 Avoid windrowing drain material and graded road base into roadside areas

Exposed earth and drain spoil provides an ideal bed for weed establishment and can contribute to sedimentation in adjoining waterways. A layer of soil or gravel may smother native seedlings and damage tree trunks if piled over or against them.

- When removing drain spoil, collect and dispose of it in an area that will not cause a weed or sediment problem prior to removal from the site.
- When grading roads avoid pushing excess soil around base of trees or over embankments.
- Rake back graded road base material from adjoining vegetation to the formed road.

4.1.5 Avoid 'tidying up'

Shrubs, logs, old or dead trees and low-growing native plants are valuable habitat for wildlife and should be retained wherever possible unless they are a threat to safety or services. Even areas that have been highly modified may provide significant habitat e.g. isolated trees with hollows or dead standing trees.

4.1.6 Remove and prune trees carefully

Trees and other plants on roadsides should be preserved wherever possible. Where trees must be felled, drop into cleared areas or to the (closed) roadway and avoid falling onto native vegetation. Careful pruning of over-hanging branches can often reduce the need for tree removal. Use the three-cut method shown in **Figure 8** below:

Consider the following before any action is taken:

- The environmental significance of the tree (e.g. is it a threatened species?).
- The safety of staff, property and road users.
- The potential for damage to surrounding vegetation.
- Any historical significance of the tree (check with your supervisor).
- The effect of the tree removal on the appearance of the roadside.

The three-cut method will reduce the frequency of future pruning and allow the tree to heal. Incorrect pruning can result in problems such as disease or borer attack and lead to a hazardous tree and further maintenance.

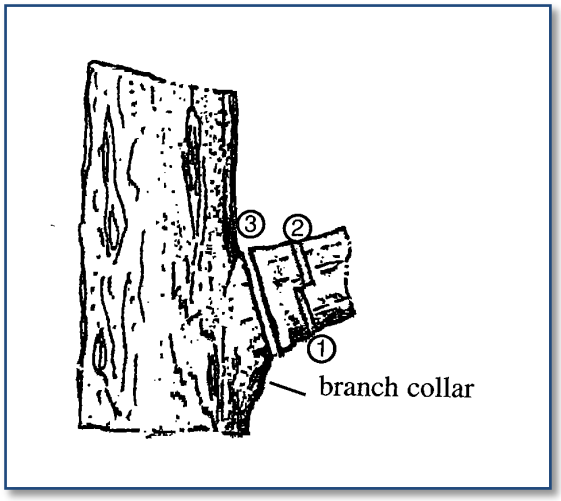

Figure 8 - Three-cut pruning Method

1. ***The undercut:* -** Make a cut on the underside of the branch being removed. This reduces the risk of the branch breaking off and damaging the bark and wood.
2. ***The upper cut:* -** To remove the branch.
3. ***The final cut:* -** Cut close to but not flush with the main trunk or limb. Always cut on the outside of the branch collar – this assists the tree in wound healing (callusing) and provides a protective barrier against decay.

4.1.7 Avoid spreading weeds

Many weed invasions can be kept under control by maintaining or creating conditions that favour native vegetation instead of introduced species. This can be achieved by preserving a healthy cover of native vegetation and avoiding excessive disturbance to limit opportunities for invasive plants to establish. Unfortunately, many serious weeds are shade-tolerant and can establish and spread under a forest canopy, especially on disturbed edges.

Weed seeds or vegetative sections can become attached to mowers and other machinery during operation and then ‘drop off’ down the road to infest other sites. Strategies for preventing spread of weeds during roadside management should be complemented by control programs that will contain or locally eradicate problematic weed species.

Particular attention should be paid to the “Significant Weeds” (Section 2.5.1 above and section 2.4.2 of **Appendix 1**) identified during the 2012 roadside surveys (which includes some noxious weeds and other environmental weeds commonly spread by machinery).

Weed management should incorporate the following:

- Noxious weeds to be reported to and controlled by FNCW.

- Be familiar with locations of significant weeds along roadsides. Report to supervisor if notifiable noxious weeds such as Parramatta Grass, Giant Rats Tail Grass or Coolatai Grass are observed. Supervisor to notify Far North Coast Weeds.
- Carry out a visual inspection of mowing and slashing machinery at regular intervals and remove any seeds/cuttings or soil.
- Remove weed material from vehicles and machinery away from creeks and drainage lines and preferably on grassy areas or identified clean down sites. Vegetative material from significant weeds will require removal to Council waste depot.
- Be familiar with the locations of remnant vegetation along roadsides.
- Where possible, avoid slashing weeds that are easily spread along roadsides.
- Where possible, plan to mow areas of environmental weeds as the last job of the day (i.e. to minimise the likelihood of spreading the weeds along the entire mowing site).
- Plan weed control programs for implementation at optimum treatment times. This will vary for different weed species, considering flowering or seeding times and periods of susceptibility to herbicide, as appropriate to the biology and physiology of the species.
- Plan to implement weed control programs jointly with adjacent landholders and other public land managers e.g. FNCW and OEH.
- Prioritise areas of high conservation value for weed management.
- Treat small outbreaks and isolated patches first.
- Isolate the major infestation and work towards the centre.
- Give consideration to undertaking a revegetation program, including short and long term revegetation to prevent weeds invading.
- Monitor and apply follow up treatment as required.

4.2 Management Activities

Three roadside vegetation management zones have been identified: High Conservation Value (HCV), Medium Conservation Value (MCV) and Low Conservation Value (LCV).

Each roadside vegetation management zone requires specific management actions according to the type of activity being undertaken. These actions are intended to minimize impacts on roadside native vegetation during routine roadside and roads maintenance activities.

The roadside activities and actions permitted within each management zone are summarised in **Table 4** below.

Table 4 - Summary of roadside activities

Activity	1 HCV	2 MCV	3 LCV
Slope mower	Yes - Limited to table drain as per Figs 4 & 5	Yes - Limited to table drain as per Figs 4 & 5	Yes - Limited to table drain as per Figs 4 & 5
Slasher	Yes - limited to grassed gaps in vegetation; one slasher width; and avoid native vegetation	Yes - avoid native vegetation	Yes - avoid native vegetation
Weed Spray	Spray only directed at table drain; roadside markers, guardrails, culverts, header walls, etc	Spray only directed at table drain; roadside markers, guardrails, culverts, header walls, etc	Spray only directed at table drain; roadside markers, guardrails, culverts, header walls, etc
Stockpiles and Parking	No - Not permitted	Restricted to cleared gaps lacking native vegetation	Yes - avoid native vegetation
Road works and Drain maintenance	No pushing graded material onto vegetation or over embankment; No damage to roots and trunks of native trees; Dispose of drain spoil off site	No pushing graded material onto vegetation or over embankment; No damage to roots and trunks of native trees; Dispose of drain spoil off site	Yes - avoid native vegetation
Tree Prune - general	Within 'clearing' zones only see Figs 4, 5 & 6	Within 'clearing' zones only see Figs 4, 5 & 6	Within 'clearing' zones only see Figs 4, 5 & 6
Tree Prune - Threatened Species	Consult Council ecologist	Consult Council ecologist	Consult Council ecologist
Tree Removal	Consult Council ecologist	Consult Council ecologist	Consult Council ecologist

1. High Conservation Value

HCV zones are likely to include:

- healthy mature trees;
- low weed abundance (most remnants contain some weeds);
- tree and shrub regeneration (seedlings and saplings);
- connectivity with or close proximity to other remnant vegetation;
- fallen timber, rocks and logs on ground; and
- no obvious signs of erosion

Threatened flora species may be present and will be marked.

Ideally, vegetation in this management zone should not be disturbed, and rehabilitation of some sections will be desirable, especially where opportunities and resources permit weed management and improved connectivity with other areas of HCV. Overall, these areas are the easiest and cheapest roads to manage in the long term. This zone often contains important fauna habitat features such as tree hollows, structural complexity, a diversity of flora species, rock outcrops and riparian areas.

Management of HCV zone roadsides should incorporate the following actions:

Slashing and slope mowing

- Slope mowing restricted to the extent of the table drain and embankments where required. Avoid mowing branches of native trees and shrubs. Avoid damage to roots and main trunks of native trees.
- Slashing to be limited to one slasher width in grassed areas, subject to road safety and bushfire management requirements.

Spraying and weed management

- Spot spraying to be restricted to roadside table drain; roadside markers, guardrails, culverts, header walls, grasses extending on to road surface or kerb and gutter.
- No blanket or over spraying (power spraying); any spraying from vehicles to be calibrated and directed to target areas (as outlined above) to avoid off target damage to native vegetation.
- Where possible, maintain groundcover vegetation within table drains.
- Control of weeds which impact on the native vegetation to be undertaken by bush regenerators as funding permits.

Road works and Drain maintenance

- No pushing graded material onto vegetation or over embankment.
- No damage to roots and trunks of native trees.
- Dispose of drain spoil off site.

Stockpiling and Parking

- Not permitted

Tree works

- Removal of native trees or pruning of threatened species only on advice of ecologist.
- Pruning must follow best practice guidelines (see **Figure 8)**.
- In areas where native vegetation needs to be pruned or felled, any hollow logs or limbs should be left on site as fauna habitat, where possible. If circumstances allow mulch this material onsite and apply to bare areas, avoiding native vegetation and areas where there is potential runoff into waterways.

General works

- Do not “tidy up”; retain natural features such as logs, leaf litter, fallen timber and rocks.
- Restoration at locations where weeds threaten native vegetation should use bush regeneration techniques according to a 3-5 year plan. Revegetation works, if required, will use appropriate species and local provenance stock. High priority if funding available.
- Restore any degraded sections using bush regeneration techniques and improve connectivity. High priority when funding available.

2. Medium Conservation Value

MCV zones provide an opportunity for revegetation and to create linkages to HCV areas. These areas usually have the potential to be returned to a near-natural state, which will in the long-term, decrease the need for maintenance and suppress weed growth. If resources permit, active management (e.g. weed control and revegetation) is desirable.

MCV zones will usually:

- Be in a near natural condition.
- Have been modified, with weed incursion and loss or depletion of one or more layers of vegetation.
- Contain trees that are often scattered or in clumps and there may be limited recruitment of native seedlings.
- Have some habitat diversity such as logs, rocks and leaf litter and areas of bare earth.

MCV's may contain small sections of EEC’s and threatened flora species which will be marked.

Management of MCV roadside zones should incorporate the following actions:

Slashing and slope mowing

- Slope mowing restricted to the extent of the table drain and embankments where required.
- Slashing to avoid native trees, shrubs and native regrowth if not obstructing clear view.

Spraying and weed management

- Spot spraying to be restricted to roadside table drain; roadside markers, guardrails, culverts, header walls, grasses extending on to road surface or kerb and gutter.
- Blanket or over spraying (power spraying) only in open areas taking care to avoid native vegetation.
- Control of weeds which impact on native vegetation to be undertaken by bush regenerators where funding permits.

Road works and Drain maintenance

- No pushing graded material onto vegetation or over embankment.
- No damage to roots and trunks of native trees.
- Dispose of drain spoil off site.

Stockpiling and Parking

- Stockpiles or machinery parking permissible if necessary but only in cleared or grassed gaps away from native vegetation.
- Plan new stockpiles away from MCV areas and establish and maintain sediment control structures around existing stockpile sites.
- Remove existing stockpiles from the root zones of trees and manage weeds in these areas.

Tree works

- Removal of native trees or pruning of threatened species only on advice of ecologist.
- Pruning must follow best practice guidelines, see **Figure 8**.
- In areas where native vegetation needs to be pruned or felled, the felled material should, where possible, be left on the site as habitat. Alternatively, leave on site to be mulched. Mulch should be spread on bare areas and avoid native vegetation and areas where there is potential runoff to waterways.

General works

- Avoid pushing graded material onto vegetation; grade to avoid windrowing of material on edge of formation. Dispose of excess spoil away from vegetation, avoid soil compaction and disturbance. Do not push graded material over embankments.
- Do not “tidy up”. Retain natural features such as logs, leaf litter, fallen timber and rocks.
- Restoration at locations where weeds threaten native vegetation to use bush regeneration techniques according to a 3-5 year plan. Revegetation works if required to use appropriate species and local provenance stock. Medium priority if funding available.

3. Low Conservation Value

LCV areas are highly altered from their natural state. The vegetation is usually degraded, but may include sections of higher value vegetation and threatened plant species. Canopy species if present are on average widely spaced and large sections of these zones are substantially cleared. There is generally moderate to high levels of weed infestation and low or no recruitment of native plant species and low connectivity to other remnant vegetation. They rarely contain habitat elements such as rocks and logs.

Much of this vegetation will be maintained by slashing. Active management for restoration will not usually be conducted and weed management will generally be of low priority.

LCV zones will usually include:

- widely spaced native trees;
- significant lengths of substantially cleared roadside; and
- open areas of exotic grasses, herbaceous and woody weeds.

Threatened flora species and EECs may be present and will be marked.

Resources will not usually permit investment in restoration activities. Weed management will normally be of low priority (unless part of a strategic plan).

Management of LCV roadsides should incorporate the following actions:

Slashing and Slope mowing

- Slope mowing and slashing permissible, avoiding native trees and shrubs and regeneration to best extent possible. Note threatened species may be present.

Spraying and Weed management

- Spot spray and over spray where necessary.
- Avoid native vegetation.
- Control weeds which impact on the roadside and adjacent land.

Stockpiling and Parking

- Stockpiles or machinery parking permissible, if necessary, in gaps away from native vegetation.
- Use these areas for activities which are not appropriate in HCV and MCV zones, e.g. stockpiles, compounds, spoil dumps and machinery parking.

Road works and Drain maintenance

- Avoid damage to native vegetation

Tree works

- Removal of native trees or pruning of threatened species only on advice of ecologist.
- Pruning must follow best practice guidelines, see **Figure 8**.

General works

- Do not “tidy up”. Retain natural features such as logs, leaf litter, fallen timber and rocks.
- Restoration and revegetation is a low priority.

Special Management Areas

Special management areas are those locations identified by Council as requiring specific management actions. They include locations recorded by Council, noted in mapping products and/or that have been sign posted. These may include areas where requests for specific roadside management actions have been received by Council from adjacent landholders or the community.

These areas include:

- 'No Spray' sites;
- Community or landholder plantings and regeneration areas;
- Sites of cultural or heritage significance.

Management of these locations will be in line with HCV zone actions.

Threatened Species and remnant EECs

The locations of threatened species and remnant EECs are identified in the Roadside Management Guidelines map series. The marking of all locations is recommended.

Management of these locations will be in line with HCV zone actions.

4.3. Restoration Guidelines

4.3.1 Regeneration and Revegetation

Weed control works outside of higher priority noxious weeds (controlled by FNCW) will be undertaken by Council as funding sources are identified. The control of weeds utilising best practice bushland restoration techniques should focus on the priority sites listed below;

- HCV and MCV zones where significant or dense weeds have been identified;
- Threatened species and EEC point locations;
- Significant weed locations, in particular locations where the weeds will be spread by management actions. These locations are only available in electronic format;
- Locations where restoration or plantings are within or adjacent to the road reserve;
- Locations adjacent to National Parks and Nature Reserves.

Examples of potential locations for restoration are provided below.

HCV and MCV zones where significant or dense weeds have been identified include:

- Garden of Eden Road, Tomewin (Threatened species, dense weed, significant weed species and inappropriate plantings).
- Hopkins Creek Road, Chillingham (Threatened species, significant weed species and inappropriate plantings). Supportive landholders and opportunity for community and Tweed Shire Council to work together.
- Glengarrie Road, Tomewin.

- Urliup Road (HCV and threatened species, significant weeds) control of Kahili Ginger and *Tithonia* would result in good conservation gain for relatively small effort.
- Richards Deviation near Dunbible (HCV in near natural condition but several areas of Japanese Honeysuckle).
- Todd Rd and O'Reillys Rd near Numinbah (HCV vegetation and threatened species with *Ardisia crenata* invading).
- Jones Road.
- Cudgera Creek Road.

Locations where restoration work sites or plantings occur within or adjacent to a road reserve include:

- Byrill Creek Road; Mount Warning Road; Tweed Valley Way at Stotts Island; Tweed Coast Road; Kyogle Road, Byangum; Crooks Valley Road.
- Locations adjacent to National Parks and Nature Reserves, including: Mt Warning Road (Mt Warning NP), Clothiers Creek Road (Cudgen NR), Tweed Coast Road (Wooyung and Cudgen NRs), Couchy Creek Road (Limpinwood NR), Hogan's Road (Duroby NR).

Restoration works are only likely to be successful in areas where neighbouring landholders are supportive, therefore it is important to liaise with landholders and provide information prior to undertaking works.

Where significant weeds are in low numbers in an area of HCV or MCV early treatment is the most cost effective measure.

4.3.2 Community Involvement

Residents of the Tweed Shire are important stakeholders in roadside vegetation and other management issues. The management of roadsides is frequently a personal and emotive issue as the community sees roadsides as having many values. These values vary from traditional ones including stock movement and infrastructure to broader environmental and social issues such as biodiversity and aesthetics.

A number of organisations with well established community networks, such as Dunecare, Landcare and Wildlife Carers are very active and provide valuable forums for the dissemination of information relating to the management of roadsides.

Adjacent landholders and community groups may be involved in, or may undertake, roadside management for a number of reasons and with generally positive, but sometimes undesirable results. A two-way exchange of information and support will benefit the values of the roadside environment.

Management of native roadside vegetation may complement the values of adjacent vegetation by increasing its area and improving connectivity. Weeds can be managed to prevent spread across land tenure boundaries.

Roadside management conducted other than by Council may be primarily conservation-oriented, may be carried out to reduce the need for chemical usage by neighbours concerned about or sensitive to chemicals, or may be primarily for aesthetic reasons.

Issues that may arise include:

- Safety for workers;
- Need for traffic control where roadside trees are to be removed;
- Skill levels of workers in native vegetation;
- Inappropriate plantings.

It is recommended that Council adopt a process whereby permission is required to undertake works within Council managed road reserves that comply with the Plan. The Plan will provide guidance in determining the appropriateness or otherwise of any proposed works. Feedback can then be provided to the community or proponent to allow, encourage or prohibit the works according to the specific roadside management zone.

Works in HCV vegetation areas could be approved subject to site inspection and discussion with proponent to ensure skills are appropriate.

In lower conservation value management zones, any proposed weed management techniques should be assessed and guidance provided to avoid impacts on road users, such as the potential for stem injected trees to fall on roads.

Any vegetation allowed to develop through regeneration or planting may have the potential to restrict visibility or cause other management problems, so planning to allow for this consideration is essential. Planting undertaken in HCV and MCV zones should be restricted to appropriate native species of local provenance stock; non-invasive exotics are also acceptable but not preferred. A list of environmental weeds that must not be planted should be readily available.

5 Legislation

Councils must ensure that they comply with legislation when maintaining or constructing roads. The interaction of potential impacts on roadside vegetation with legislation may be complex and require expert interpretation. In addition, legislation is amended from time to time and it is the responsibility of Council managers and staff responsible for rural road and roadside management to ensure compliance with current legislation. Whilst Councils are often exempt from the need to obtain approval under a number of Acts they are still responsible for conforming to the intent of an Act.

The following Acts may need to be considered when working within roadsides in NSW; however this should be considered as neither exhaustive nor definitive (sourced from compilations by Turnbull *et al.* (2005)). Specialist legal or planning advice should be sought where works with potential to impact on environmental values are proposed.

5.1 Commonwealth Legislation

Telecommunications Act 1997

The Telecommunications Act provides for the development of electricity supply to confer certain powers, authorities, duties and functions on the Energy Corporation of New South Wales and to provide for the regulation of the sale and hiring of electrical apparatus.

Under the Act a carrier may inspect any land prior to installation, install or maintain a facility and do anything on the land that is necessary or desirable for that purpose, including, making surveys, taking levels, sinking bores, taking samples, digging pits and examining the soil; felling and lopping trees and clearing and removing other vegetation and undergrowth; closing, diverting or narrowing a road or bridge; installing a facility in, over or under a road or bridge; altering the position of a water, sewerage or gas main or pipe; and altering the position of an electricity cable or wire.

Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act establishes a Commonwealth process for assessment of the significance of impact of proposed actions on matters of national environmental significance or on Commonwealth land. Areas in which this Act may apply to Tweed LGA roadsides include impacts on any:

- World Heritage properties;
- National Heritage places;
- Listed threatened or endangered species or endangered ecological communities; and

- Listed migratory species, e.g. those scheduled under the JAMBA and CAMBA agreements.

Where the impact of any proposed roadside activities on any of the above is assessed as significant, Commonwealth government approval will be required. In cases where approval is required in relation to Commonwealth interests, an Environmental Impact Statement (EIS) will usually be the vehicle to address those matters (there are other options), in addition to any NSW requirements. Section 45 of the EPBC Act provides for bilateral agreements between the Commonwealth of Australia and the State of NSW to reduce duplication of assessments of environmental impact.

5.2 New South Wales Legislation

A range of legislative requirements in NSW must be taken into consideration when carrying out works in roadside reserves. The following list of acts and their application to roadside activities provides an overview of major legislative requirements in NSW. See NSW REC (1996) and RTA (2001) for further detail.

Roads Act 1993

The Roads Act gives the local road authority (either Council or the Transport Roads and Maritime Services [TRMS]), responsibility for planning, construction and maintenance of road corridors.

Section 88 of the Act overrides other Acts allowing the removal and lopping of trees or other vegetation on, or overhanging, a public road where it is necessary to carry out roadwork or remove a traffic hazard. It also requires the public to seek Council consent for activities undertaken within a road reserve.

Environmental Planning and Assessment Act 1979 (and *Environmental Planning and Assessment Regulation, 2000*)

The Act and Regulation are the primary sources of obligations with respect to development activity in NSW. As consent authorities under this Act Councils and State Government are able to regulate a wide range of activities including some related to vegetation management, such as road maintenance and construction.

The two mechanisms used to assess the environmental impacts of developments that are likely to be relevant to roadside vegetation management are:

1. Development Control (Part 4 of the Act) – Under which Council will make specific development decisions by assessing a proposal against the provisions contained within a Landuse Planning Instrument (such as State Environmental Planning Policies (SEPP's); Regional Environmental Plans

(REP's), and Local Environmental Plans (LEP's)) and assessment criteria contained within the EPA Act (e.g. Threatened species, populations and ecological communities).

2. Duty of Public Authorities (Part 5 of the Act) – Some forms of development do not require development consent and are not subject to the controls of an Environmental Planning Instrument (EPI) such as a LEP (for example when they are development permitted without consent under the provisions of the State Environmental Planning Policy (Infrastructure) 2007). These developments are called “activities”. In these cases Council has a duty to consider the environmental implications of granting approval for the “activity”.

Determining which Part of the Act is applicable to roadside maintenance and construction activities can be complicated. Where doubt exists legal advice should be obtained (see also *Environmental Impact Assessment Policy, Guidelines and Procedures* (RTA 2001) and Farrier and Stein (2011).

Part 5 of the Act will apply to most proposed roadside activities when the activity is being undertaken by or on behalf of a public authority, including roadwork's and works established temporarily (for a period less than 12 months, such as concrete or bitumen manufacturing plant) on or adjacent to a construction site and exclusively providing material to the development being carried out on that site. The environmental impacts of these works should be included in the Part 5 assessment (Review of Environmental Factors – REF) of that activity.

In Tweed Council LGA, Part 4 approvals may be necessary where roadside activities are:

1. Affected by LEP zonings
2. Are not defined as “development permitted without consent” under the Infrastructure SEPP
3. Regarded as “designated development” under s.77A of the Act.

Electricity Supply Act 1995

The Electricity Supply Act regulates the supply of electricity in the retail market, sets out the functions of persons engaged in the conveyance and supply of electricity and for other purposes.

Section 48 of the Act "Interference with electricity works by trees", applies if a network operator has reasonable cause to believe that a tree situated on any premises could destroy, damage or interfere with its electricity works, or could make its electricity works become a potential cause of bush fire or a potential risk to public safety.

A network operator may serve a written notice on the owner requiring the owner to trim or remove the tree, or may, at its own expense, trim or remove the tree itself.

This section applies despite the existence of a tree preservation order or environmental planning instrument (other than a State environmental planning policy), but does not apply to any tree within a 'protected area' or to any tree that is the subject of or is within an area that is the subject of:

- an interim heritage order, or a listing on the State Heritage Register, under the Heritage Act 1977;
- an order in force under section 136 of the Heritage Act 1977;
- an interim protection order under the National Parks and Wildlife Act 1974; or
- a protection conferred by any similar law.

A 'protected area' means an area that is within:

- a national park or nature reserve within the meaning of the National Parks and Wildlife Act 1974;
- land that is reserved or zoned for environmental protection purposes under the Environmental Planning and Assessment Act 1979; or
- a public reserve within the meaning of the Local Government Act 1993.

Threatened Species Conservation Act 1995

The TSC Act provides for the protection of all threatened native plants, animals and communities within NSW. The Act aims to promote their recovery and to manage the processes, which threaten them. The Act places specific responsibilities on applicants, proponents, consent and determining authorities and the NPWS in the fields of environmental planning, development control, joint management agreements, recovery planning and threat abatement planning. The Act further requires that a government agency must not undertake actions inconsistent with a Recovery Plan.

The Act lists all threatened species, populations and ecological communities and key threatening processes. In addition the Act provides a register of areas of Critical Habitat under Part 3, which will have been provided to Council (No Critical habitat in the Tweed LGA is registered on roadside).

Section 91 provides for application for a licence to pick or harm threatened species, populations or ecological communities, or their habitats. Where assessment of the application determines that the impact of the action may be significant, a Species Impact Statement must be prepared. A certificate under s 95(2) may be issued if the impact of the proposed works is found not likely to be significant.

An action that is not required to be licensed under this Act may however be required to be licensed under the *National Parks and Wildlife Act 1974* if it is likely to affect protected fauna or protected native plants or may otherwise constitute an offence under that Act.

National Parks and Wildlife Act 1974

Under s118a, it is an offence to pick or harm threatened species, populations or ecological communities, or their habitats. Defences include approvals, licences or certificates and actions taken in accordance with specified property vegetation plans and conservation agreements.

Other defences under s118g and of potential relevance to roadside management include:

- clearing of non-protected re-growth;
- the removal of noxious weeds;
- the maintenance of public utilities (such as those associated with the transmission of electricity, the supply of water, the supply of gas and electronic communication; and
- Any activity reasonably considered necessary to remove or reduce an imminent risk of serious personal injury or damage to property.

In addition, s.90 requires consent to knowingly destroy, deface or damage or knowingly cause or permit the destruction or defacement of or damage to an Aboriginal relic or site.

Native Vegetation Act 2003

Consent for clearing activities on roadsides may be required under this Act, in those situations where these activities are not excluded under any of the following Acts; *Rural Fires Act*, *Noxious Weeds Act*, *State Emergency and Rescue Management Act*, *Threatened Species Conservation Act*, *Environmental Planning and Assessment Act*, *Fisheries Management Act*, *Mining Act*, *National Parks and Wildlife Act*, *Petroleum (Onshore) Act*, *Plantations and Reafforestation Act*, *Roads Act*, *Rivers and Foreshores Improvement Act*, *Surveying Act* and *Water Act* or *Water Management Act*.

Rural Fires Act 1997

The Rural Fires Act provides a framework for bushfire hazard reduction activities to be carried out. Local responsibility rests with the BFMC who is required to prepare a Bushfire Risk Management Plan for the LGA covering all land tenures including roadsides. The Act also allows the Council to require private landholders to undertake bushfire hazard reduction on private property according to their desired technique.

Noxious Weed Act 1993

Declared noxious weeds within the Council area are required to be managed to a level as specified on schedules under this Act including those located within the road reserve. Council's responsibility for compliance with the Act on Council managed roads has been devolved to the North Coast County Council trading as Far North Coast Weeds.

Soil Conservation Act 1938

Provides for the conservation of soil resources and mitigation of erosion through appropriate controls and restricts the clearing of vegetation on protected land (riparian and steeply sloping land).

Protection of the Environment Operations Act 1997

The POEO Act is the main law in NSW regulating water, air and noise pollution. In particular, the Act provides a general ban on polluting water without permission. This is relevant for Councils managing rural roads and roadside environments where runoff from road maintenance and construction activities could potentially pollute water.

Local Government Act 1993

The Local Government Act provides for a policy and legislative framework for a responsible system of government in NSW. The purpose of the Act includes requiring councils "to have regard to the protection of the environment in carrying out its responsibilities".

Crown Lands Act 1989

The Crown Lands Act requires that developments on Crown land, including roadside, are consistent with environmental protection principles so that natural resources are protected wherever possible.

Fisheries Management Act 1994

Section 201 of the Act requires permits to be issued for any roadwork's that involve dredging or reclamation within a waterway and s.205 requires a permit to cut, remove, damage or destroy marine vegetation on public water land or an aquaculture lease, or on the foreshore of any such land or lease.

6 Recommendations

It is recommended that Tweed Shire Council:

- Adopt the RVMP (2013) and Roadside Management Guidelines (2013;
- Publicise the development and proposed adoption of the Plan and Guideline within Council and the community;
- Apply for funding (e.g. from NSW Roadside Environment Committee /Local Shires Association) to implement the Plan;
- Install roadside markers at all threatened species and EEC locations;
- Install roadside markers to identify the start and finish of the management zones1 HCV and 2 MCV;
- Liaise with local authorities involved in vegetation management in roadside reserves including Essential Energy, Telstra, Far North Coast Weeds and the NSW Rural Fire Service. Negotiate protocols with local service providers to acknowledge the aims of the management strategies outlined in these guidelines in their service installation guidelines;
- Update threatened species, populations and ecological communities and their habitats records identified within road reserves to the RVMP GIS database that result from additional record identification or loss due to clearing or works authorised under this guideline;
- Investigate the purchase and installation portable digital devices in all roadside maintenance vehicles including tractors and trucks containing relevant digital mapping layers for the RVMP and other roadside maintenance documents for easy and quick reference by the operator.
- Add locations of designated stockpiles, compounds and parking areas to Councils digital mapping layers;
- Establish training programs for Council staff and contractors involved in roadside vegetation management. Training to include the use of the Guidelines and in machine digital devices, and best practice methods such as tree lopping, weed and native plant identification and weed control;
- Compile and regularly update a register of stakeholders, community groups (e.g. Landcare) and individual landholders for regular notification and consultation about roadside activities;

- Provide information to landholders on appropriate roadside management, suitable species selections for planting, weed species, garden escapees and garden dumping, e.g. Brunswick Valley Landcare planting guide (Brunswick Valley Landcare 2012). Particularly target new subdivision areas, where landholders are concerned about use of roadside sprays, and areas where garden weeds are spreading into the roadside;

- Regularly update the 'No Spray' Register. Establish a protocol aimed at avoiding the use of herbicides and chemical sprays along roadsides adjacent to organic farms and properties where landholders have expressed a desire that spraying not occur. Add this mapping layer to the RVMP GIS database and regularly update these locations;

- Provide information to landholders adjacent to HCV vegetation, highlighting its conservation significance, habitat features and scenic amenity and encourage landholders to assist in maintaining and protecting remnant vegetation;

- Initiate a monitoring system for rehabilitation projects and high conservation areas to assess success of works or any disturbance;

- Submit a copy of the Guidelines to the local BFMC for acknowledgement and incorporation into any future bushfire planning activities (including the Bushfire Risk Management Plan); and

- Review the Plan on a 5 yearly basis. Update information sources as they become available or after substantial works in road reserves that may impact on the application of the Plan.

7 References

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Appendix 1 - Data Collection and Results

1 Roadside Survey Procedures

1.1 Data Collection

1.1.1 Field Procedures

We surveyed roads from a field vehicle driving at low speed using the "windscreen" style of survey suggested in NSW REC (1996), with one navigator/observer and one observer/recorder. When necessary to complete or confirm observations, we inspected short sections of vegetation or individual plants from a stationery vehicle or on foot.

Two teams (coded HJ *et al*. and AM *et al.*) conducted the field surveys between 19th June and 14th August 2012. As two teams were employed, we conducted an initial trial of methods, in which both teams surveyed the same road section. To ensure consistency, the teams compared results, discussed discrepancies and refined methods.

Observations were recorded in two spatial themes:

- Line - Linear segments of the roadside delineated according to the vegetation. A minimum length of 500m was prescribed in the project brief, to suit display at a practical scale of mapping for presentation in the Field Manual.

- Point - Point locations of vegetation or plants of particular relevance for management or management issues.

Prior to each day of fieldwork, field maps were prepared using 2009 geo-referenced and ortho-rectified aerial imagery as a base layer and overlain by a GIS layer "Council Maintained Rural Roads centre line" showing roads of the project area (roads in urban areas, roads maintained by the NSW Roads and Maritime Services, some roads neighbouring or providing access to National Parks estate and unmaintained road reserves were excluded). Boundary fences, where present, were variable distances from the formed road and could not be considered a reliable indication of the extent of the road reserve. The GIS cadastral boundary layer indicated that the road reserve often exceeded the standard width and also demonstrated instances where the actual road is not located on the paper road. The area currently under management by Council was considered as a minimum priority for survey (impacts concentrated in the first 3-4m on either side of the road surface), but wider areas were treated as part of the project area when possible and meaningful for the purposes of the project.

Depending on the preferences of the survey teams the information was recorded in hardcopy (maps, notepads) or digital (GPS waypoints, mobile database) formats. Data were entered into two forms designed for line and

point data (**Figure 1**). GPS systems, laptop computers and location aware tablet devices were used to provide positional context whilst on the road.

Data were collected separately for each side of the road.

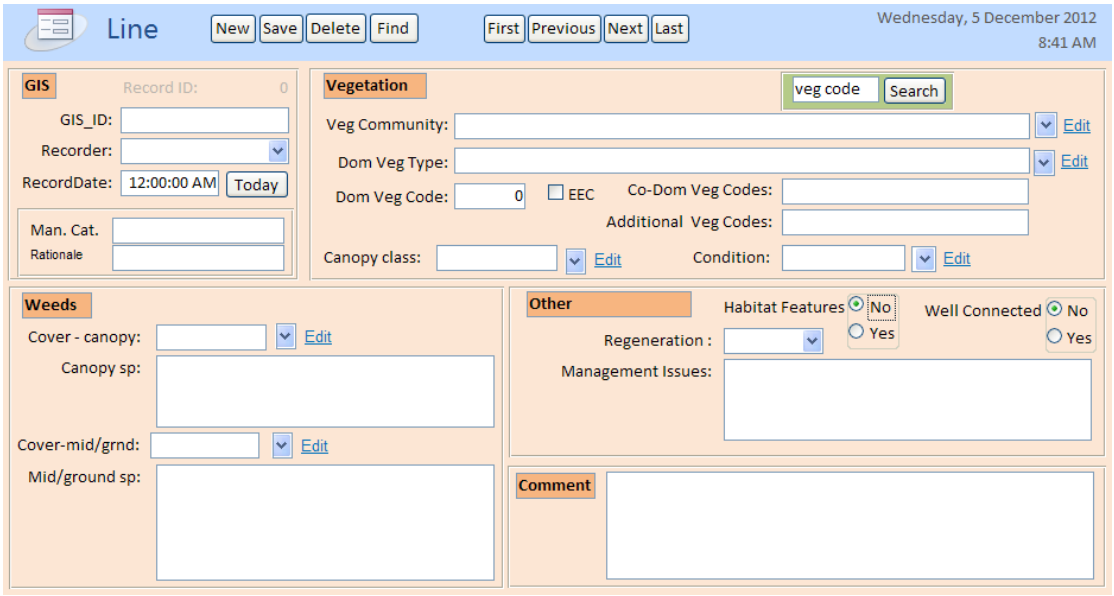

Figure 1a Line data form

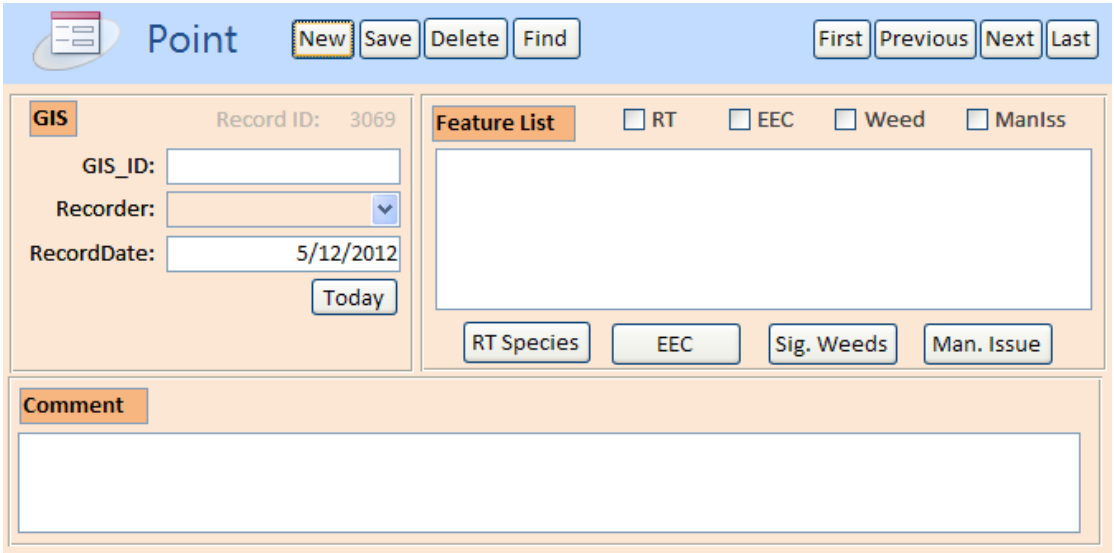

Figure 1b Point data form

1.1.2 Post Processing

In the office, field location data were refined using GIS, guided by air photos. As GPS waypoints reflected the location of the vehicle on the roadway, points were moved slightly to the corresponding roadside position.

At the completion of each day's fieldwork the teams transferred the spatial components (points and lines) to Esri shapefiles and the associated attributes to Microsoft Access database tables. The data were checked for consistency

and completeness then forwarded for amalgamation into the shire wide dataset.

1.1.3 Data Amalgamation

The daily shapefiles (line and point) were imported into a GIS (TNTMips Microimages). The linear roadside features were transferred to a Shire wide vector structure derived from a 10 metre buffer of the Council Maintained Rural Roads centre line. The point features were appended to the shire wide point dataset.

The attribute information for both GIS files was appended to a centralised Microsoft Access database. The line and point records in the Access database were linked to the associated GIS features within TNTMips.

At the conclusion of each day the line and point datasets were exported and made available to all project team members via a Google Earth link (May and October 2010 Google Earth mapping). The link allowed the survey teams to view the overall survey progress and to scrutinise their individual contributions.

1.2 Field Survey Sheets

Requirements for data collection were developed in consultation with Council and with reference to guidelines established by the NSW Roadside Environment Committee (NSW REC 1996) and other recent roadside vegetation management plans (e.g. Turnbull *et al*. 2005, Carey and Brainwood 2011). The types of data and their definitions were refined in light of the overriding principal that survey data would form the basis for allocation of roadside vegetation management zones.

When a line segment was identified as substantially cleared of native vegetation (Vegetation type 1099), no further line data were collected (point data only).

1.2.1 Line Data

The fields for which data were collected and data categories are summarised (**Table 1**) with explanations/definitions to follow.

Table 1 Summary of line data collection

Data field	**Database field name**	**Data categories (names and/or codes)**
GIS ID	GIS ID	(automatically generated)
Recorder	Recorder	AM et. al. HJ et. al.
Date	Record Date	
Vegetation Community	Vegetation Community	From Kingston *et al.* (2004)
Vegetation type	Veg Type	From Kingston *et al.* (2004)

Data field	Database field name	Data categories (names and/or codes)
(dominant)		Name
Vegetation type (dominant)	Veg Code	From Kingston *et al.* (2004) Code
EEC	EEC	Y/N
Vegetation type (co-dominant)	XtraCoDomVegCode	From Kingston *et al.* (2004) Code
EEC	EEC	Y/N
Vegetation type (additional)	XtraVegCode	From Kingston *et al.* (2004) Code
Canopy class	Vegetation Structure	Continuous, discontinuous, isolated clumps
Condition	Vegetation Condition	Near natural, modified, degraded
Habitat value	Habitat Features	Y/N
Connectivity	Vegetation Connectivity	Y/N
Regeneration	Regeneration	Extensive, moderate, none
Weeds - canopy		
Cover	Canopy Weed Density	>50%, 20-50%, >0-<20%, 0
Dominant species	Canopy Weed Species	
Weeds - mid-ground strata		
Cover	Mid/ground Weed Density	>50%, 20-50%, >0-<20%, 0
Dominant species	Mid/ground Weed Species	
Management issues	Management Issues	If present, select from drop down menu
Comments	Comments	

Vegetation Community/type

Vegetation was classified according to the system of the Tweed Vegetation Management Strategy (Kingston *et al.* 2004) and was assigned by name and/or code.

For each section of roadside distinguished, the form and underlying table was structured to require the recoding of at least a single (*dominant*) vegetation type.

The form and underlying table also allowed for the recording of:

- *Co-dominant* vegetation types. To qualify as a *co-dominant* vegetation type within a record, the cover of the type would need to be at least approximately 20% of the total.

- *Additional* vegetation types. To qualify as an *additional* vegetation type (i.e., not a co-dominant) within a record, the cover of the type would need to be less than approximately 20% of the total.

Endangered Ecological Communities

For each section of roadside, the presence of an EEC was automatically recorded if vegetation type codes equivalent to EEC's were recorded as dominant or co-dominant. The project follows TSC in taking a precautionary approach to the identification of EEC's e.g. many coastal vegetation types were considered as EEC's of the floodplain group, although the substrate may be sand rather than the alluvium soil that defines the floodplain EEC's.

The Dominant and Co-dominant type fields included provision for tagging of a vegetation type as an EEC, where applicable. The Additional type did not have this provision. For this reason, small occurrences of vegetation types corresponding to EEC's were more generally recorded as a point feature (**Section 1.1.1**).

Canopy Class

The cover of the upper stratum (tree canopy) was recorded using cover ranges (**Table 2).** For a number of reasons, existing systems with a larger number of classes were not used. Even with only three classes, many sections of roadside had a range of covers that fell into at least two classes.

Table 2 Canopy classes

Canopy classes	**Crown separation (diameters)**
Continuous	>1
Discontinuous	1-10
Isolated clumps or trees	≥10-20

Weed Cover and Species

Data on weed cover and types / species were collected for the canopy (upper stratum) and the mid/ground strata.

The cover of weeds was assigned to one of four classes (**Table 3**).

Table 3 Weed cover classes

Cover ranges (as % of total plant cover in stratum)	**Description**
0	None
>0 - <20	Low
20 – 50	Medium
>50	High

The fields for recording species or classes of weed species were designed to accept multiple entries. The aim was to record the dominant species or classes of weed species only.

Data on weed types / species were recorded in the following way:

- If a single species or a small number of species individually accounted for >20% of the weed cover in a record, it (or they) were recorded individually.

- The predefined list of weeds used in the form included a number of aggregations of species (e.g. exotic grasses, exotic herbs and exotic legume vines). If, for instance, no single exotic grass formed >20% of the weed cover in a stratum, but as a group exotic grasses formed >20% of the cover, a record of exotic grasses was made.

- If, for instance, Molasses Grass formed >20% cover of weeds in a stratum and a group of other exotic grasses formed 30% of cover, records of Molasses Grass and exotic grasses were made.

Connectivity

A section of roadside vegetation was recorded as 'well-connected' if:

- It was immediately adjacent to a contiguous area of largely native vegetation >10 ha. Parts of the section of road may also be adjacent to relatively cleared areas.
- The section of roadside vegetation is across the road from an area of largely native vegetation >10 ha, provided the road carries a relatively low volume of traffic.

Habitat Features

A section of road was recorded as having habitat features if it had:

- Most of the characteristics (**Table 4**) to at least a moderate extent; or
- Only some of the characteristics listed below, but those present were abundant.

Table 4 Habitat features

Features
Old-growth trees with hollows
Fruiting trees and nectar sources
Camphor Laurel forest (included because of its importance as food for frugivorous birds).
Large woody debris on ground
Stags (standing dead trees)
Dense ground cover, leaf litter, rocks and crevices
Wetland and riparian habitats.

Regeneration

The cover of young tree seedlings / saplings was assessed and assigned to one of three classes (**Table 5**). These are broad categories – "none" may include low densities of regenerating natives.

Table 5 Regeneration classes

Class	**Definition**
Extensive	Subjective assessment
Moderate	Subjective assessment
None	Subjective assessment

Vegetation Condition

The overall condition of vegetation in each section of road was assessed and assigned to one of three classes (**Table 6**).

Table 6 Vegetation condition classes

Class	**Definition**
Near Natural	Vegetation with negligible disturbance A proportion of plants with age-related features (such as tree hollows) and a species composition characteristic of the ecologically mature forest. Abundant habitat for wildlife. Mature upper stratum present and mid strata present where expected for vegetation type. A well developed understorey usually present. May include non-woody communities (e.g. heathland, sedgeland, etc.) of native vegetation in excellent condition.
Modified	Retains some natural structural elements e.g. canopy present but been thinned and/or includes Camphor

Class	Definition
	Laurel. Often with mid storey cleared may include individual stems or patches of regeneration. Disturbance evident including fire, woody debris and tree removal and gardening or 'tidying' of understorey. May contain planted native and exotic species. Entire site may be dominated by dense even-aged regrowth of native species.
Degraded	Isolated native trees and shrubs may be present singly or in small clumps. Ground layer often dominated by exotic grass or herb species or Lantana. May provide limited habitat from isolated stags or on-ground logs, or fruiting exotic species. May include amenity plantings of exotic and/or native trees. Camphor Laurel-dominated vegetation.

Management Issues

Management issues that affected a significant proportion of a line section of road were recorded in the line dataset. Issues that affected only relatively short sections of roadside were recorded in the point dataset (**Section 1.1.1**).

Fields for both datasets were filled from a prescribed list of issues (**Table 7**).

The list included a value called "other". If this value was entered for a section of road, the issue was generally described in the "comments" field.

Table 7 Prescribed list of management issues

Issue	Description
Erosion	Soil removal, channelling and rutting, sediment deposition.
Drainage	Culverts, table drains: maintenance thereof and consequences of non-maintenance.
Stockpiles	Building and roading materials piled in poorly selected sites.
Services	Underground cables and pipes, phone lines, water, sewage.
Rubbish dumping	Construction, household waste.
Cultural sites	Aboriginal or other cultural, including trees, geological formations, buildings, other structures.
Regeneration works	Includes systematic weed control work, plantings of native species but not "plantation" as defined by Kingston *et al.* 2004.
Garden waste dumping	Garden waste.

Issue	Description
No Spray Location	Adjoining organic property or chemical-sensitive residents.
Aerial power/phone lines	High and low voltage power lines and phone lines requiring regular clearing.
Inappropriate management	Works undertaken by adjacent landholders, Council and other authorities that damage the native vegetation.
Other	Details provided in Comments field.

Comments

This field was used for various purposes including:

- Presence of threatened fauna habitat (e.g. Koala food trees);
- Large or old growth trees;
- Variations in vegetation structure that could not be described in the dedicated vegetation structure field;
- Notes that expand on matters identified in the “Management Issues” field (especially if the value “other” is recorded in this field); and
- Rainforest understorey.

1.2.2 Point Data

Point data types are shown (**Table 8**). The form and underlying database was designed to accept more than one data type and/or multiple entries of the same data type for a point. For instance, a number of threatened species could be entered for a single point.

Table 8 Point data

Data field	Database field name	Data categories (names and/or codes)
GIS ID		Automatically generated
Recorder	Recorder	AM et. al. HJ et. al. FNCW HighRiskPath Lui Weber TSC (Section 3.2.3)
Date	Record date	
Threatened Species	RT	If present, select from drop down menu
EEC	EEC	If present, select from drop down menu
Significant weed	Weed	If present, select from drop down menu
Management issues	ManIssue	If present, select from drop down menu
Comments		

Threatened Flora Species

Surveyors recorded the identity and locations of specimens of threatened species (NSW Threatened Species Conservation Act 1995 or Commonwealth Environment Protection and Biodiversity Conservation Act 1999) and annotated those marked with TSC's plaques in the Comments field. The specimen was noted as "planted" whenever context suggested.

Endangered Ecological Communities

Records were made of small occurrences of EECs (Threatened Species Conservation Act 1995).

Significant Weed Occurrences

A list of significant weeds included species known to occur in this region and:

- Scheduled in control classes 1, 2 or 3 under the provisions of the Noxious Weeds Act (1993); and/or
- Environmental weeds of particular relevance to roadside management, primarily those commonly spread by machinery.

Management Issues

The prescribed list of management issues used for the line data (**Table 7**) was also used for the recording of point data.
If the value "other" was entered for a point, the issue was generally described in the "Comments" field.

Comments

This field was used for various purposes which include:

- Notes that expand on entries in other fields in the form, especially the "Management Issues" field where the value "other" is recorded.
- Inappropriate plantings
- Bunya Pines planted so that cones currently or in the future will drop on the road.

1.2.3 Data Sources

The majority of data in the management plan was collected specifically for the plan.

Point locations of significant weeds and threatened species of plants incorporated into the database and displayed in the maps include some records from three additional sources:

- Roadside occurrences of threatened plants collected and supplied by Tweed Shire Council.

- Roadside occurrences of threatened plants collected by Lui Weber (pers. comm.)
- Occurrences of significant weeds collected and supplied by Far North Coast Weeds (FNCW).

Threatened species data from external sources were edited e.g. to update taxonomy and a subset of the FNCW dataset was selected to include only records:

- made in 2012;
- within 100 metres of roads subject of this plan; and
- scheduled in control classes 1, 2 or 3 under the provisions of the Noxious Weeds Act (1993).

One additional weed species, *Cecropia peltata,* was included because it is a Class 1 weed in Queensland under the provisions of the *Land Protection (Pest and Stock Route Management) Act 2002* and is a "new and emerging weed" proposed to be scheduled Class 1 under the *Noxious Weeds Act1993* in NSW.

Recorder codes in the database (**Table 9**) indicate the source of data.

Table 9 Data sources

Code	**Data source / reference**
AM et. al.	Current survey
HJ et. al.	Current survey
FNCW HighRiskPath	Far North Coast Weeds
Lui Weber	Lui Weber (pers. comm.)
TSC	Tweed Shire Council

1.3 Map Production and Data Export

A hard-copy map series (25 x A3 sheets, scale 1:25000) was produced for inclusion in the Roadside Management Guidelines for the use of roadside works crews. The mapped themes included Threatened species locations (as points) and the Roadside Vegetation management zones represented as individual lines for both sides of the road. The lines were coloured to reflect the associated management Zone**.** Larger scale examples of the Roadside Management Guidelines maps were produced for consultation and training purposes.

Digital maps of Roadside Vegetation management zones in KMZ format suitable for viewing in Google Earth were produced for ease of review by Council staff during the Project.

All GIS layers were exported to ArcGisFileGeodatabase format (MGA56 GDA94) and accompanying metadata statements were prepared.

1.4 Limitations

Most of the survey was conducted from moving vehicles and employed rapid assessment techniques. Accordingly, the results are not a complete and accurate inventory of flora specimens and vegetation in the roadside study area. Vegetation mapping was produced at a coarse scale and did not discriminate much of the fine-scale variation exhibited in the vegetation which was not required for this Project and was partly due to the minimum road segment mapping being 500m.

Roadside line segments were usually heterogeneous, i.e. different vegetation types were included within one segment. While the data collection design permitted more than one vegetation type to be specified in a line segment, other data fields required that cover or condition be averaged over the length of the line.

Professional experience and local knowledge of vegetation communities informed the subjective decisions which were required in assigning vegetation to condition, habitat and regeneration fields and, again, were based on observations undertaken during rapid assessment procedures.

Management zones assigned from data collected as described are similarly not always uniform e.g. management Zone 1 HCV line segments may include small sections of LCV vegetation and/or cleared land.

The presence and identification of threatened species and weeds to species level was conducted as best as possible using the rapid assessment procedures of this survey; as this was not a key component of the Brief limited time was allocated to this task and specimens may have been missed.

Some weed species are best detected seasonally when flowering or fruiting and may have been overlooked e.g. Parramatta Grass *Sporobolus pyramidalis.* Similarly, species on the slashed verge are likely to escape notice when newly slashed.

Applying EEC definitions (vegetation descriptions etc from Scientific Committee determinations) can be difficult – where not clear cut, a precautionary interpretation was employed.

Survey staff marked point locations and extremities of line segments by GPS waypoints, usually from a moving vehicle. The grid reference for the point may be displaced from the true location.

Some elements of the vegetation will change rapidly on the timescale of the plan and may need to be reviewed periodically.

The location and extent of the road reserve was often uncertain in these situations a minimum width of 20m was adopted (**Section 1.1.1**).

2 Results

2.1 Vegetation Communities and Types

The roadside distances occupied by vegetation communities and types (**Tables 10** and **11**) are calculated from the dominant vegetation type for each line segment, and provide an indication of relative abundance. Co-dominant or additional vegetation was frequently present and has not been considered in the summary results.

Sclerophyll forests on bedrock and rainforest were the most abundant vegetation communities recorded on the roadsides.

Table 10 Vegetation communities

Vegetation Community	**Length (km)**	**% of Total**
Rainforest and Riparian Communities	142.69	9.48%
Sclerophyll Open Forests on Bedrock Substrates	298.62	19.84%
Sclerophyll Forests / Woodlands on Sand Substrates and Alluvium	24.48	1.63%
Melaleuca and Swamp She-oak Forests	10.96	0.73%
Heathlands	0.79	0.05%
Highly Modified / Disturbed	1,027.38	68.27%
Grand Total	**1,504.92**	**100.00%**

Table 11 Vegetation types

Vegetation community	Vegetation type	Code (Veg Code)	EEC	Native bush	Length (km)	% of total
Rainforest and Riparian Communities	Littoral Rainforest	101	Littoral Rainforest	Yes	18.18	1.21
	Sub-tropical / Warm Temperate Rainforest on Bedrock Substrates	102	Lowland Rainforest	Yes	104.37	6.94
	Dry Rainforest	103	Lowland Rainforest	Yes		
	Lowland Rainforest on Floodplain	104	Lowland Rainforest on Floodplain	Yes	20.14	1.34
	Myrtaceous Riparian Low Closed Forest to Woodland	105	No	Yes		
	River She-oak Open Forest	106	No	Yes		
	Cool Temperate Rainforest	107	No	Yes		
Sclerophyll Open Forests on Bedrock Substrates	Blackbutt Open Forest Complex	201	No	Yes	29.24	1.94
	Grey Ironbark / White Mahogany / Grey Gum Open Forest Complex	202	No	Yes	68.84	4.57
	Broad-leaved Apple Open Forest	203	No	Yes	0.30	0.02
	Scribbly Gum / Pink Bloodwood Open Forest	204	No	Yes		
	Sydney Blue Gum Open Forest	205	No	Yes	8.77	0.58
	Flooded Gum Open Forest	206	No	Yes	35.26	2.34
	Brush Box Open Forest	207	No	Yes	113.09	7.51
	Tallowwood Open Forest	208	No	Yes	30.63	2.04
	Turpentine +/- Pink Bloodwood Open Forest	211	No	Yes	12.49	0.83
	New England Blackbutt Open Forest	213	No	Yes		
Sclerophyll Forests / Woodlands on Sand Substrates and Alluvium	Coastal Pink Bloodwood Open Forest to Woodland	301	Sub-tropical Coastal Floodplain Forest	Yes		
	Coastal Pink Bloodwood / Brush Box Open Forest to Woodland	302	Sub-tropical Coastal Floodplain Forest	Yes		
	Coastal Brush Box Open Forest to Woodland	303	Sub-tropical Coastal Floodplain Forest	Yes	2.52	0.17
	Coastal Forest Red Gum Open Forest to Woodland	304	Sub-tropical Coastal Floodplain Forest	Yes	1.46	0.1

Vegetation community	Vegetation type	Code (Veg Code)	EEC	Native bush	Length (km)	% of total
	Coastal Swamp Mahogany Open Forest to Woodland	305	Sub-tropical Coastal Floodplain Forest	Yes		
	Coastal Scribbly Gum Open Forest to Woodland	306	Sub-tropical Coastal Floodplain Forest	Yes		
	Coastal Blackbutt Open Forest to Woodland	307	Sub-tropical Coastal Floodplain Forest	Yes	0.72	0.05
	Coastal Tallowwood Open Forest to Woodland	308	Sub-tropical Coastal Floodplain Forest	Yes	0.85	0.06
	Coastal Swamp Box Open Forest to Woodland	309	Swamp sclerophyll floodplain forest	Yes	0.31	0.02
	Banksia Dry Sclerophyll Open Forest to Shrubland	310	No	Yes	14.93	0.99
	Coastal Acacia Communities	311	No	Yes	2.83	0.19
	Black She-oak Low Open Forest to Woodland	312	No	Yes		
	Cypress Pine Open Forest to Woodland	313	Coastal Cypress Pine Forest	Yes	0.86	0.06
Melaleuca and Swamp She-oak Forests	Broad-leaved Paperbark Closed Forest to Woodland	401	Swamp sclerophyll floodplain forest	Yes	8.57	0.57
	Broad-leaved Paperbark / Swamp She-oak Closed Forest to Woodland	402	Swamp sclerophyll floodplain forest, Swamp oak floodplain forest	Yes	0.20	0.01
	Broad-leaved Paperbark + Eucalyptus spp.+/- Swamp Box Closed Forest to Woodland	403	Swamp sclerophyll forest, Subtropical Coastal Floodplain Forest	Yes	0.43	0.03
Heathlands	Dry Heathland to Shrubland	501	No	Yes	0.79	0.05
	Wet Heathland to Shrubland	502	No	Yes		
	Montane Heathland/Scrub	503	No	Yes		
Melaleuca and Swamp She-oak Forests	Swamp She-oak Closed Forest to Woodland	601	Swamp oak floodplain forest	Yes	1.76	0.12
Estuarine Complexes	Mangrove Open Forest to Woodland	602	No	Yes		
	Saltmarsh Communities	603	Coastal saltmarsh	Yes		

Vegetation community	Vegetation type	Code (Veg Code)	EEC	Native bush	Length (km)	% of total
Sedgelands and Related Communities	Sedgeland / Rushland (Murray & James Study Area Only)	701	Freshwater wetlands on coastal floodplains	Yes		
	Fernland / Forbland (Murray & James Study Area Only)	702	Freshwater wetlands on coastal floodplains	Yes		
	Freshwater Wetlands	703	Freshwater wetlands on coastal floodplains	Yes		
Foredune Complex	Foredune Complex	801	No	Yes		
Miscellaneous Map Units	Rock Faces	901	No	No		
Highly Modified / Disturbed	Native Grasslands (Murray & James Study Area Only)	902	No	Yes		
Miscellaneous Map Units	Open Water	903	No	No		
	Not Assessed	998	No	No		
Highly Modified / Disturbed	Mowed Heathland (Murray & James Study Area Only)	1001	No	Yes		
	Early Regrowth Rainforest	1002	Lowland rainforest	Yes	11.59	0.77
	Acacia / Other Sclerophyll Regrowth Open Forest to Woodland	1003	Lowland rainforest	Yes	12.4	0.82
	Camphor Laurel Dominant Closed to Open Forest	1004	No	No	198.30	13.18
	Native Plantation	1005	No	No	8.86	0.59
	Exotic Plantation	1006	No	No	1.28	0.09
	Urban Bushland	1007	No	No		
	Post-mining Regeneration	1008	No	Yes		
	Unspecified Plantation	1009	No	No		
	Substantially Cleared of Native Vegetation	1099	No	No	794.95	52.82

2.2 Endangered Ecological Communities

Note 1 EECs are listed by short name as follows:

Full name	Short name
Littoral Rainforest in the NSW North Coast	Littoral rainforest
Lowland rainforest in the North Coast and Sydney Bioregions	Lowland rainforest
Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion	Lowland Rainforest on Floodplain
Sub-tropical Coastal Floodplain Forest of the NSW North Coast bioregion	Sub-tropical Coastal Floodplain Forest
Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions	Swamp oak floodplain forest
Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	Swamp sclerophyll floodplain forest
Coastal Cypress Pine Forest in the NSW North Coast Bioregion	Coastal Cypress Pine Forest
Coastal saltmarsh in the NSW North Coast, Sydney Basin and South East Corner bioregions	Coastal Saltmarsh
Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	Freshwater wetlands on coastal floodplains

The road lengths of vegetation types that are considered to correspond to EECs (**Table 11)** indicate that 184.36 km or 12.27% of the vegetated line sections are dominated by EEC vegetation **(Table 12).** Lowland rainforest is the most abundant EEC recorded, with moderate occurrences of the coastal floodplain group of EEC vegetation.

Table 12 EECs (line data)

EEC or group	Length (km)	% vegetated length
Lowland Rainforest	128.36	8.53
Coastal Floodplain group	36.96	2.47
Other EECs	19.04	1.27
TOTAL	184.36	12.27

As noted for vegetation types generally (**Section 2.1**), parts of the lines may be occupied by other non-dominant types and lines with EEC co-dominants are not included in the summary results.
Additional indications of EEC occurrences are summarised from point data (**Table 13**).

Table 13 EECs (point data)

Vegetation type	EEC	Total no points	% no points
Broad-leaved Paperbark + Eucalyptus spp.+/- Swamp Box Closed Forest to Woodland	Swamp Sclerophyll Floodplain Forest	2	0.4
Broad-leaved Paperbark Closed Forest to Woodland	Swamp Sclerophyll Floodplain Forest	3	0.5
Coastal Swamp Box Open Forest to Woodland	Swamp Sclerophyll Floodplain Forest	4	0.7
Swamp She-oak Closed Forest to	Swamp oak floodplain	1	0.2

Vegetation type	EEC	Total no points	% no points
Woodland	forest		
Lowland Rainforest on Floodplain	Lowland Rainforest on Floodplain	39	6.9
Sub-tropical / Warm Temperate Rainforest on Bedrock Substrates	Lowland Rainforest	506	89.1
Early Regrowth Rainforest	Lowland Rainforest	7	1.2
Littoral Rainforest	Littoral Rainforest in the NSW North Coast	6	1.1
	TOTAL	**568**	**100**

Again, the Lowland Rainforest EEC predominates in the point data with moderately high occurrences of Coastal Floodplain EECs.

A number of precautions must be applied to interpretation of EEC data, along with the uncertainties re abundance within lines of variable lengths described above.

- EECs are defined by descriptions in NSW Scientific Committee determinations and may be difficult to delineate and apply to mapping units in which vegetation communities and types are defined and described using different methods.

- Some mapped vegetation types (Kingston *et al*. 2004) are known to include both EEC and non-EEC vegetation, e.g. Acacia regrowth (some rainforest regrowth consistent with Lowland Rainforest EEC) and many coastal types which include vegetation on alluvium (consistent with the Coastal floodplain groups of EECs) as well as vegetation on sand. Precautionary approaches have been taken in assigning vegetation types to EECs.

2.3 Threatened Species

Five hundred and eighty five records of 30 separate threatened species were compiled (**Table 14**), illustrating the high biodiversity values of the Tweed native vegetation. The findings are consistent with a study undertaken in Tweed Shire (Schenk and Wallace 1996) that indicated that a high proportion of road reserves contain rare and threatened plants.

Lepiderema pulchella, Macadamia tetraphylla and *Syzygium moorei* were the most frequently recorded, though these include planted specimens of *Lepiderema pulchella* and *Syzygium moorei* in particular (database annotated accordingly **Section 1.2.2**).

Table 14 Records of threatened flora species

SCIENTIFIC NAME	COMMON NAME	No points	Record source[a]	TSC ACT[2]	EPBC ACT[4]
Acacia bakeri	Marblewood	27	a	v	
Acronychia littoralis	Scented Acronychia	4	a	e	e
Archidendron hendersonii	White Lace Flower	13	a	v	
Baloghia marmorata	Marbled or Jointed Baloghia	1	b	v	v

SCIENTIFIC NAME	COMMON NAME	No points	Record source[a]	TSC ACT[2]	EPBC ACT[4]
Cassia brewsteri var. marksiana	Brush Cassia	8	a	e	
Corynocarpus rupestris subsp. rupestris		2	b	v	v
Cryptocarya foetida	Stinking Cryptocarya	2	b	v	v
Davidsonia jerseyana	Davidson's Plum	45	a	e	e
Davidsonia johnsonii	Smooth Davidson's Plum	2	b	e	e
Diospyros mabacea	Red-fruited Ebony	2	b	e	e
Diospyros major var.*ebenus*	Shiny-leaved Ebony	1	b	e	
Diploglottis campbellii	Small-leaved Tamarind	6	a	e	e
Doryanthes palmeri	Spear Lily	1	a	v	
Drynaria rigidula	Basket Fern	1	a	e	
Endiandra floydii	Crystal Creek Walnut	16	a	e	e
Endiandra hayesii	Rusty Rose Walnut	11	a	v	v
Endiandra muelleri subsp. bracteata	Green-leaved Rose Walnut	7	a	e	
Fontainea australis	Southern Fontainea	1	b	v	v
Gossia fragrantissima	Sweet Myrtle	1	a	e	e
Grevillea hilliana	White YielYiel or White Silky Oak	2	b	e	
Hicksbeachia pinnatifolia	Red Boppel Nut	81	a	v	v
Lepiderema pulchella	Fine-leaved Tuckeroo	133	a	v	
Macadamia tetraphylla	Rough-leaved Queensland Nut	111	a	v	v
Niemeyera whitei	Rusty Plum	5	a	v	
Oberonia titania	Soldier's Crest Orchid	1	a	v	
Ochrosia moorei	Southern Ochrosia	2	b	e	e
Pomaderris notata	Cliff Pomaderris	1	a	v	
Randia moorei	Spiny Gardenia	2	a	e	e
Syzygium hodgkinsoniae	Red Lilly Pilly	12	a	v	v
Syzygium moorei	Durobby or Coolamon	84	a	v	v
TOTAL		**585**			

1 Record source: a = current survey +/- TSC and/or Lui Weber records, b = TSC and/or Lui Weber records (**Section 1.2.3**)
2 Threatened Species Conservation Act 1995 (NSW)
3 Environmental Protection and Biodiversity Conservation Act 1999 (Commonwealth)

2.4 Weeds

2.4.1 General Weed Density

The records of weed occurrences in roadside line segments are summarised (**Table 15a** and **b, 16 a** and **b**). The relative abundance of individual weed species and groups of species is indicative only as for the purposes of the summary table; occurrences are scored as present/absent for a line regardless of the varying length of the lines and weed densities within the lines. General weed density data were collected for vegetated lines. The data suggests that Camphor Laurel is by far the most abundant canopy weed species, while a moderate quantity of exotic pines was noted.

Overall canopy weed density was high for about a quarter of the vegetated lines, reflecting the extensive occurrence of Camphor Laurel dominated vegetation.

Table 15a Canopy weed density

Canopy weed density (%)	Length (km)	% total vegetated lines
> 50	200.04	25.16
20 - 50	79.27	9.97
>0 - <20	191.86	24.13
0	323.78	40.73
Total	**794.95**	**100.00**

Table 15 b Canopy weed species- number of occurrences in vegetation lines

Scientific name	Common name	Noxious weed status	Count	% total
Acacia saligna	Golden Wreath Wattle		2	0.33
Anredera cordifolia	Madeira Vine		1	0.16
Chrysanthemoides monilifera subsp. rotundata	Bitou Bush	4	1	0.16
Cinnamomum camphora	Camphor Laurel	4	515	84.29
Corymbia torelliana	Cadaghi		10	1.64
Delonixregia	Royal Poinciana		1	0.16
Eriobotrya japonica	Loquat		1	0.16
Erythrina crista-galli	Cockspur Coral Tree		1	0.16
Erythrina X sykesii	Coral Tree		5	0.82
Ficus microcarpa	Small-fruited Fig		1	0.16
Ipomoea cairica	Five-leaved or Coast Morning Glory		1	0.16
Ipomoea indica	Blue Morning Glory		2	0.33
Ipomoea species	Morning Glory		1	0.16
Jacaranda mimosifolia	Jacaranda		6	0.98
Koelreuteria species	Golden Rain Tree		1	0.16
Leptospermum laevigatum	Coast Teatree		2	0.33
Leucaena leucocephala	Lead Tree or Coffee Bush		3	0.49
Ligustrum sinense	Small-leaved Privet	4	1	0.16
Macfadyena unguis-cati	Cat's Claw Creeper		3	0.49
Pinus species	A Pine Tree		53	8.67
Total			**611**	**100.00**

In the mid/ground strata, *Cinnamomum camphora, Desmodium uncinatum, Lantana camara, Schefflera actinophylla, Senna pendula* var. *glabrata* were the most abundant of the weed species recorded as individual species, while the broad classes of exotic grasses, exotic herbs and exotic legumes were also recorded frequently. About a quarter of the road sections were scored as having weed density <20%.

Table 16a Mid/ground strata weed density

Mid/ground weed density (%)	Length (km)	% total vegetated lines
> 50	225.31	28.34
20 - 50	352.03	44.28
>0 - <20	121.79	15.32
0	95.82	12.05
Total	**794.95**	**100.00**

Table 16 b Mid/ground strata weed species – number of occurrences in vegetation sections

Scientific name	Common name	Noxious weed status	Count	% total
	Exotic grasses		789	22.89
	Exotic herbs		678	19.67
	Exotic legume vines		257	7.46
Ambrosia artemisiifolia	Annual Ragweed	5	1	0.03
Anredera cordifolia	Madeira Vine		7	0.20
Araceae species	Ornamental Araceae		2	0.06
Araujia sericifera	Moth Vine or Mothplant		1	0.03
Ardisia crenata	Coralberry		7	0.20
Ardisia species	Coral Berry		2	0.06
Asparagus aethiopicus	Asparagus Fern		5	0.15
Asparagus plumosus	Climbing Asparagus Fern		2	0.06
Asparagus species	Asparagus Fern		1	0.03
Callisia repens	Creeping Inch Plant		1	0.03
Cardiospermum grandiflorum	Balloon Vine		1	0.03
Cestrum nocturnum	Lady-of-the-Night		2	0.06
Cinnamomum camphora	Camphor Laurel	4	288	8.36
Coffea arabica	Coffee		2	0.06
Corymbia torelliana	Cadaghi		1	0.03
Delairea odorata	Cape Ivy		3	0.09
Desmodium uncinatum	Silver-leaved Desmodium		221	6.41
Duranta erecta	Sky Flower		4	0.12
Eriobotrya japonica	Loquat		16	0.46
Erythrina X sykesii	Coral Tree		2	0.06
Eugenia uniflora	Brazilian Cherry		1	0.03
Hedychium gardnerianum	Ginger Lily		5	0.15
Hedychium species	Ginger Lily		2	0.06
Hypoestes species	Speckleplant		8	0.23
Inga edulis	Ice Cream Bean		2	0.06
Ipomoea cairica	Five-leaved or Coast Morning Glory		4	0.12
Ipomoea indica	Blue Morning Glory		1	0.03
Ipomoea species	Morning Glory		14	0.41
Justicia species	Shrimp Plant		2	0.06
Koelreuteria species	Golden Rain Tree		15	0.44
Lantana camara	Lantana	4	558	16.19
Leptospermum laevigatum	Coast Teatree		4	0.12
Leucaena leucocephala	Lead Tree or Coffee Bush		3	0.09
Ligustrum lucidum	Large-leaved Privet	4	60	1.74

Scientific name	Common name	Noxious weed status	Count	% total
Ligustrum sinense	Small-leaved Privet	4	73	2.12
Lilium formosanum	Formosan Lily		1	0.03
Lonicera japonica	Japanese Honeysuckle		4	0.12
Lygodium japonicum	Japanese Climbing Fern		2	0.06
Macfadyena unguis-cati	Cat's Claw Creeper		9	0.26
Melinis minutiflora	Molasses Grass		4	0.12
Nephrolepis species	A Fishbone Fern		17	0.49
Ochna serrulata	Ochna		18	0.52
Passiflora edulis	Common Passionfruit		2	0.06
Passiflora suberosa	Small Passionfruit or Corky Passion Vine		17	0.49
Passiflora subpeltata	White Passionflower		4	0.12
Pennisetum purpureum	Elephant Grass		1	0.03
Pinus species	A Pine Tree		9	0.26
Plectranthus verticillatus			3	0.09
Psidium cattleianum var.cattleianum	Strawberry Guava		1	0.03
Psidium guajava	Guava		5	0.15
Ricinus communis	Castor Oil Plant		1	0.03
Salix species	Willow	5	1	0.03
Schefflera actinophylla	Umbrella Tree		126	3.66
Senna pendula var. glabrata	Winter Senna		111	3.22
Senna septemtrionalis	Smooth Senna		1	0.03
Setaria palmifolia	Palm Grass		1	0.03
Solanum chrysotrichum	Giant Devil's Fig		4	0.12
Solanum mauritianum	Wild Tobacco Bush		1	0.03
Solanum seaforthianum	Brazilian or Climbing Nightshade		4	0.12
Sphagneticola trilobata	Singapore Daisy		4	0.12
Syagrus romanzoffiana	Cocos Palm		1	0.03
Tabebuia chrysantha	Yellow Trumpet Tree		1	0.03
Tecoma stans	Yellow Bignonia	3	1	0.03
Thunbergia alata	Black-eyed Susan		4	0.12
Thunbergia grandiflora	Blue Trumpet Vine		1	0.03
Tithonia diversifolia	Mexican Sunflower		1	0.03
Tradescantia fluminensis	White-flowered Wandering Jew		13	0.38
Tradescantia zebrina	Zebrina		2	0.06
Triumfetta rhomboidea	Chinese Burr		18	0.52
Urochloa mutica	Para Grass		2	0.06
Total			3440	100.00

2.4.2 Significant Weeds

Records of significant weeds were compiled for 32 weed species at 1,714 point locations (**Table 17**). Three species, *Araujia sericifera, Aristolochia*

elegans and *Delairea odorata* on the target list for significant weeds (**Section 1.2.2**) were not recorded.

The most abundant significant weeds were *Solanum chrysotrichum, Sphagneticola trilobata, Erythrina* X *sykesii, Anredera cordifolia, Hedychium* species and *Ipomoea* species. Of particular concern were records of Rhus Tree (Noxious Class 4) in the Garden of Eden Road vicinity, apparently already known to FNCW.

Table 17 Significant weed species at point locations

Scientific name	Common name	Noxious weed status[1]	No points	Record source[2]
Abrus precatorius subsp. africanus	Crab's Eye or Precatory Bean		3	a
Anredera cordifolia	Madeira Vine		139	a
Araceae species	Ornamental Araceae		62	a
Araujia sericifera	Moth Vine or Mothplant		0	n/a
Ardisia species	Coral Berry		40	a
Aristolochia elegans	Dutchman's Pipe		0	n/a
Baccharis halimifolia	Groundsel Bush	3	22	a
Bryophyllum species			21	a
Buddleja madagascariensis	Buddleja		17	a
Caesalpinia decapetala	Thorny Poinciana	3	9	a
Callisia repens	Creeping Inch Plant		18	a
Cardiospermum grandiflorum	Balloon Vine		3	a
Cecropia peltata	Snakewood		8	FNCW
Celtis sinensis	Chinese Celtis or Japanese Hackberry	3	3	a
Cestrum nocturnum	Lady-of-the-Night		76	a
Coffea arabica	Coffee		3	a
Colocasia esculenta	Taro		14	a
Delairea odorata	Cape Ivy		0	N/A
Dioscorea species	Exotic Yams		7	a
Equisetum species	Horsetails	1	3	FNCW
Erythrina crista-galli	Cockspur Coral Tree		29	a
Erythrina X sykesii	Coral Tree		155	a
Hedychium species	Exotic Gingers		120	a
Hylocereus undatus	Night-blooming Cactus		9	a
Hymenachne amplexicaulis	Hymenachne	1	18	FNCW
Hypoestes species	Speckleplant		42	a
Ipomoea species	Ipomoea species		106	a
Lonicera japonica	Japanese Honeysuckle		35	a
Lygodium japonicum	Japanese Climbing Fern		5	a
Macfadyena unguis-cati	Cat's Claw Creeper		39	a
Pithecoctenium crucigerum	White Trumpet Flower or Monkey's Comb		3	a
Pueraria lobata	Kudzu	3	2	a
Salvinia molesta	Salvinia	3	2	FNCW
Schinus terebinthifolius	Broad-leaved Pepper Tree	3	10	a
Solanum chrysotrichum	Giant Devil's Fig		279	a
Solanum viarum	Tropical Soda Apple	2	98	FNCW
Sphagneticola trilobata	Singapore Daisy		223	a
Sporobolus pyramidalis	Giant Rats Tail Grass	3	12	a
Tecoma stans	Yellow Bignonia	3	30	a
Thunbergia grandiflora	Blue Trumpet Vine		3	a
Tithonia diversifolia	Mexican Sunflower		40	a
Toxicodendron succedaneum	Rhus Tree	4	6	a
TOTAL			**1714**	

1 Control class under the provisions of the Noxious Weeds Act (1993)
2 Record source: FNCW = records supplied by Far North Coast Weeds (**Section 1.2.3**), a = current survey +/- FNCW records.

Notifiable weeds (Classes 1, 2 and 5) were not recorded during surveys though some records were included in the FNCW dataset.

2.5 Condition

Only a small proportion of the vegetation surveyed were classified as in "near natural" condition (**Table 18**). Most were in a modified or degraded state, reflecting the generally disturbed roadside environment and dominance of weeds, particularly Camphor Laurel.

Table 18 Condition

Condition category		Length (km)	% total
Near natural		72.31	4.8
Modified		269.96	17.9
Degraded		367.70	24.4
NA (Substantially cleared of native vegetation)		794.95	52.8
	Total	**1,504.92**	**100.0**

2.6 Heritage and Scenic Values

The Tumbulgum cemetery was noted as a heritage location. The presence of old growth trees scattered along roadsides e.g. Dunloe Park, Warwick Park, Brays Creek Road at Tyalgum was noted (in comments field) to indicate mature eucalyptus forests with scenic values as well as important habitat values.

2.7 Management Issues

Management issues data proved difficult to identify and record consistently, so data are for reference and should not be considered exhaustive. Summary data is extracted for point locations only, and the database contains some additional information as part of the line data set.

Table 19 indicates that regeneration works, signalling need for modification of roadside management techniques, were noted at a number of locations. Dumping of rubbish and garden refuse was problematic.

Table 19 Management issues recorded at point locations

Management issues	No points	% no points	Comment
Aerial power/phone lines	6	4.0	Examples of major management issues only[1]
Cultural sites	2	1.3	
Erosion	10	6.6	
Garden waste dumping	10	6.6	
"No Spray" location	3	2.0	Additional sites likely to be included on TSC register
Regeneration works	43	28.5	Include significant roadside plantings along the Tweed

Management issues	No points	% no points	Comment
			Coast Way adjacent to Stotts Island and along cane drains adjacent to roads. Other locations include Kirbys Road Limpinwood and Byrrill Creek Road near Cedar Creek.
Rubbish dumping	7	4.6	
Services	1	0.7	
Stockpiles	5	3.3	
Other	64	42.4	
Total	**151**	**100.0**	

Note 1 A GIS layer showing electricity supply infrastructure was supplied for the purposes of the project. As power lines were ubiquitous on roadsides, the GIS layer was not useful for prioritising locations for management attention.

“Other issues” commonly reported were Bunya Pines planted too close to the road, grading of road base against tree trunks and inappropriate plantings of exotic species.

3 Management Zones

At the conclusion of the roadside survey, the line data were interrogated to determine management zones. (Additional point data were compiled for threatened flora species, point locations of EECs and a subset of the weed species known from the study area and were made available to inform other aspects of management, but only the line data were employed in this section).

The management Zone for each individual mapped line segment was established by comparing the attributes associated with each line segment to the attributes contained within the 12 'steps' of**Table 20**.

The comparison was started at Step 1 and continued through to Step 12 until a match was found. Step 12 represented a 'safety net' that caught any segment whose attributes satisfied none of the previous steps. Once a condition (Step) was satisfied the process assigned the corresponding management zone and moved on to consider the next segment.

An automated hierarchical routine scripted in Visual Basic within a Microsoft Access Database performed the comparisons.

Table 20 - Allocation of mapped line segments to management zones

Database fields and data categories									
Step	**Management zone**	**Description**	**EEC[1]**	**Vegetation type[2]**	**Vegetation connectivity**	**Vegetation condition[3]**	**Canopy weed density[4]**	**Mid/ground strata weed density[4]**	**Regeneration[5]**
1	3. Low Conservation Value (LCV)	Any with vegetation type 1099 – substantially cleared of native vegetation)	No	Type 1099	Yes or No	Any value	Any value	Any value	Any value
2	1. High Conservation Value (HCV)	Any with EECs co-dominant; and vegetation condition NOT degraded	Yes	Any type[6]	Yes or No	NOT degraded	Any value	Any value	Any value
3	HCV	Any native vegetation communities with low weed cover in canopy and mid/ground strata	Yes or No	Any native type	Yes or No	Any value	NOT (20 - 50% or >50%)	NOT (20 - 50% or >50%)	Any value
4	HCV	Any native communities in near natural condition	Yes or No	Any native type	Yes or No	Near natural	Any value	Any value	Any value
5	HCV	Any native communities with vegetation connectivity; in near natural or modified condition; low weed cover in canopy; low or medium weed cover in	Yes or No	Any native type	Yes	Near natural or modified	NOT (20 - 50% or >50%)	NOT (>50%)	Extensive or Moderate

Database fields and data categories									
Step	**Management zone**	**Description**	**EEC[1]**	**Vegetation type[2]**	**Vegetation connectivity**	**Vegetation condition[3]**	**Canopy weed density[4]**	**Mid/ground strata weed density[4]**	**Regeneration[5]**
		mid/ground strata; extensive or moderate regeneration							
6	2. Moderate Conservation Value (MCV)	Any native communities with low weeds in canopy; low or medium weeds in mid/ground strata	Yes or No	Any native type	Yes or No	Any value	NOT (20 - 50% or >50%)	NOT (>50%)	Any value
7	MCV	Any native communities in near natural or modified condition; extensive or moderate regeneration	Yes or No	Any native type	Yes or No	Near natural or modified	Any value	Any value	Extensive or moderate
8	MCV	Any native communities with vegetation connectivity; near natural or modified condition	Yes or No	Any native type	Yes	Near natural or modified	Any value	Any value	Any value
9	MCV	Any native communities with vegetation connectivity; extensive or moderate regeneration	Yes or No	Any native type	Yes	Any value	Any value	Any value	Extensive or moderate
10	MCV	Any native vegetation communities with	Yes or	Any native	Yes	Any value	NOT (>50%)	NOT	Any value

Database fields and data categories									
Step	**Management zone**	**Description**	**EEC[1]**	**Vegetation type[2]**	**Vegetation connectivity**	**Vegetation condition[3]**	**Canopy weed density[4]**	**Mid/ground strata weed density[4]**	**Regeneration[5]**
		vegetation connectivity; medium or low weeds in canopy and mid/ground strata	No	type				(>50%)	
11	MCV	Any remaining with EEC co-dominant	Yes	Any type[6]	Yes or No	Any value	Any value	Any value	Any value
12	LCV	Remainder	No	Any type	Yes or No	Any value	Any value	Any value	Any value

1 See Table 11 for EEC status of vegetation types

2 See Table 11 for list of vegetation types, their codes and native bush status

3 See Table 6 for list of values for condition

4 See Table 3 for list of weed cover classes

5 See Table 5 for list of regeneration classes

6 There is no need to specify native vegetation communities at this cell because all EEC vegetation communities are native (see Table 11)

Appendix 2 - Detail of Vegetation in Management Zones

Table A2-1 Length of mapped roadside segments in each management zone by vegetation community

Vegetation communities in each management Zone	Length (km)	% of total	% of category
1. High Conservation Value			
Rainforest and Riparian Communities	83.25	5.53	30.67
Sclerophyll Forests / Woodlands on Sand Substrates and Alluvium	17	1.13	6.26
Sclerophyll Open Forests on Bedrock Substrates	156.19	10.38	57.54
Melaleuca and Swamp She-oak Forests	9.02	0.60	3.32
Heathlands	0.79	0.05	0.29
Highly Modified / Disturbed	5.2	0.35	1.92
TOTAL HCV			
2. Medium Conservation Value			
Rainforest and Riparian Communities	59.44	3.95	30.52
Sclerophyll Open Forests on Bedrock Substrates	87.81	5.83	45.09
Sclerophyll Forests / Woodlands on Sand Substrates and Alluvium	6.73	0.45	3.46
Melaleuca and Swamp She-oak Forests	1.94	0.13	1.00
Highly Modified / Disturbed	38.83	2.58	19.94
TOTAL MCV	**194.75**	**12.94**	**100.00**
3. Low Conservation Value			
Sclerophyll Open Forests on Bedrock Substrates	54.62	3.63	22.41
Sclerophyll Forests / Woodlands on Sand Substrates and Alluvium	0.75	0.05	0.31
Highly Modified / Disturbed	983.35	65.34	77.28
TOTAL LCV	**1038.72**	**69.02**	**100.00**
TOTAL	**1504.92**	**100.00**	

Table A2-2 Length of mapped roadside segments in each management zone by vegetation type

CODE	Vegetation types in each management zone	Length (km)	% of total	% of category
	1. High Conservation Value			
101	Littoral Rainforest	18.18	1.21	6.70
102	Sub-tropical / Warm Temperate Rainforest on Bedrock Substrates	55.54	3.69	20.46
104	Lowland Rainforest on Floodplain	9.53	0.63	3.51
202	Grey Ironbark / White Mahogany / Grey Gum Open Forest Complex	37.66	2.50	13.87
205	Sydney Blue Gum Open Forest	1.81	0.12	0.67
206	Flooded Gum Open Forest	12.57	0.84	4.63
207	Brush Box Open Forest	60.36	4.01	22.24
208	Tallowwood Open Forest	21.19	1.41	7.81
211	Turpentine +/- Pink Bloodwood Open Forest	3.12	0.21	1.15
303	Coastal Brush Box Open Forest to Woodland	2.52	0.17	0.93
304	Coastal Forest Red Gum Open Forest to Woodland	1.46	0.10	0.54
307	Blackbutt Open Forest Complex	19.48	1.29	7.18
307	Coastal Blackbutt Open Forest to Woodland	0.72	0.05	0.27
308	Coastal Tallowwood Open Forest to Woodland	0.85	0.06	0.31
310	Banksia Dry Sclerophyll Open Forest to Shrubland	9.74	0.65	3.59
311	Coastal Acacia Communities	0.85	0.06	0.31
313	Cypress Pine Open Forest to Woodland	0.86	0.06	0.32
401	Broad-leaved Paperbark Closed Forest to Woodland	6.93	0.46	2.55
402	Broad-leaved Paperbark / Swamp She-oak Closed Forest to Woodland	0.2	0.01	0.07
403	Broad-leaved Paperbark + Eucalyptus spp.+/- Swamp Box Closed Forest to Woodland	0.43	0.03	0.16
501	Dry Heathland to Shrubland	0.79	0.05	0.29
601	Swamp She-oak Closed Forest to Woodland	1.46	0.10	0.54
1002	Early Regrowth Rainforest	1.31	0.09	0.48
1003	Acacia / Other Sclerophyll Regrowth Open Forest to Woodland	1.46	0.10	0.54
1004	Camphor Laurel Dominant Closed to Open Forest	2.43	0.16	0.90
	TOTAL HCV	***271.45***	***18.04***	***100.00***
	2. Medium Conservation Value			
102	Sub-tropical / Warm Temperate Rainforest on Bedrock Substrates	48.83	3.24	25.07
104	Lowland Rainforest on Floodplain	10.61	0.71	5.45
202	Grey Ironbark / White Mahogany / Grey Gum Open Forest Complex	18.19	1.21	9.34

CODE	Vegetation types in each management zone	Length (km)	% of total	% of category
203	Broad-leaved Apple Open Forest	0.3	0.02	0.15
205	Sydney Blue Gum Open Forest	4.35	0.29	2.23
206	Flooded Gum Open Forest	13.03	0.87	6.69
207	Brush Box Open Forest	39.05	2.59	20.05
208	Tallowwood Open Forest	5.94	0.39	3.05
211	Turpentine +/- Pink Bloodwood Open Forest	1.82	0.12	0.93
307	Blackbutt Open Forest Complex	5.13	0.34	2.63
309	Coastal Swamp Box Open Forest to Woodland	0.31	0.02	0.16
310	Banksia Dry Sclerophyll Open Forest to Shrubland	5.19	0.34	2.66
311	Coastal Acacia Communities	1.23	0.08	0.63
401	Broad-leaved Paperbark Closed Forest to Woodland	1.64	0.11	0.84
601	Swamp She-oak Closed Forest to Woodland	0.3	0.02	0.15
1002	Early Regrowth Rainforest	10.28	0.68	5.28
1003	Acacia / Other Sclerophyll Regrowth Open Forest to Woodland	3.21	0.21	1.65
1004	Camphor Laurel Dominant Closed to Open Forest	25.34	1.68	13.01
	TOTAL MCV	***194.75***	***12.94***	***100.00***
	3. Low Conservation Value			
202	Grey Ironbark / White Mahogany / Grey Gum Open Forest Complex	12.99	0.86	1.25
205	Sydney Blue Gum Open Forest	2.61	0.17	0.25
206	Flooded Gum Open Forest	9.66	0.64	0.93
207	Brush Box Open Forest	13.68	0.91	1.32
208	Tallowwood Open Forest	3.5	0.23	0.34
211	Turpentine +/- Pink Bloodwood Open Forest	7.55	0.50	0.73
307	Blackbutt Open Forest Complex	4.63	0.31	0.45
311	Coastal Acacia Communities	0.75	0.05	0.07
1003	Acacia / Other Sclerophyll Regrowth Open Forest to Woodland	7.73	0.51	0.74
1004	Camphor Laurel Dominant Closed to Open Forest	170.53	11.33	16.42
1005	Native Plantation	8.86	0.59	0.85
1006	Exotic Plantation	1.28	0.09	0.12
1099	Substantially Cleared of Native Vegetation	794.95	52.82	76.53
	TOTAL LCV	***1,038.72***	***69.02***	***100.00***
	Total	**1,504.92**	**100.00**	

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