8 Surface Water and Hydrology

8.1 Introduction

A Surface Water and Hydrology Assessment was undertaken as part of the Environmental Assessment and is presented in full as **Appendix E Surface Water and Hydrology**. A summary is provided in this chapter. The objectives of the assessment were to:

- describe the surface water catchments, water quality, water quantities and water use in the study area;
- describe groundwater condition within the study area;
- identify potential impacts of the Project on surface water and groundwater; and
- recommend measures to minimise impacts of the Project on surface water and groundwater.

8.2 Assessment Methodology

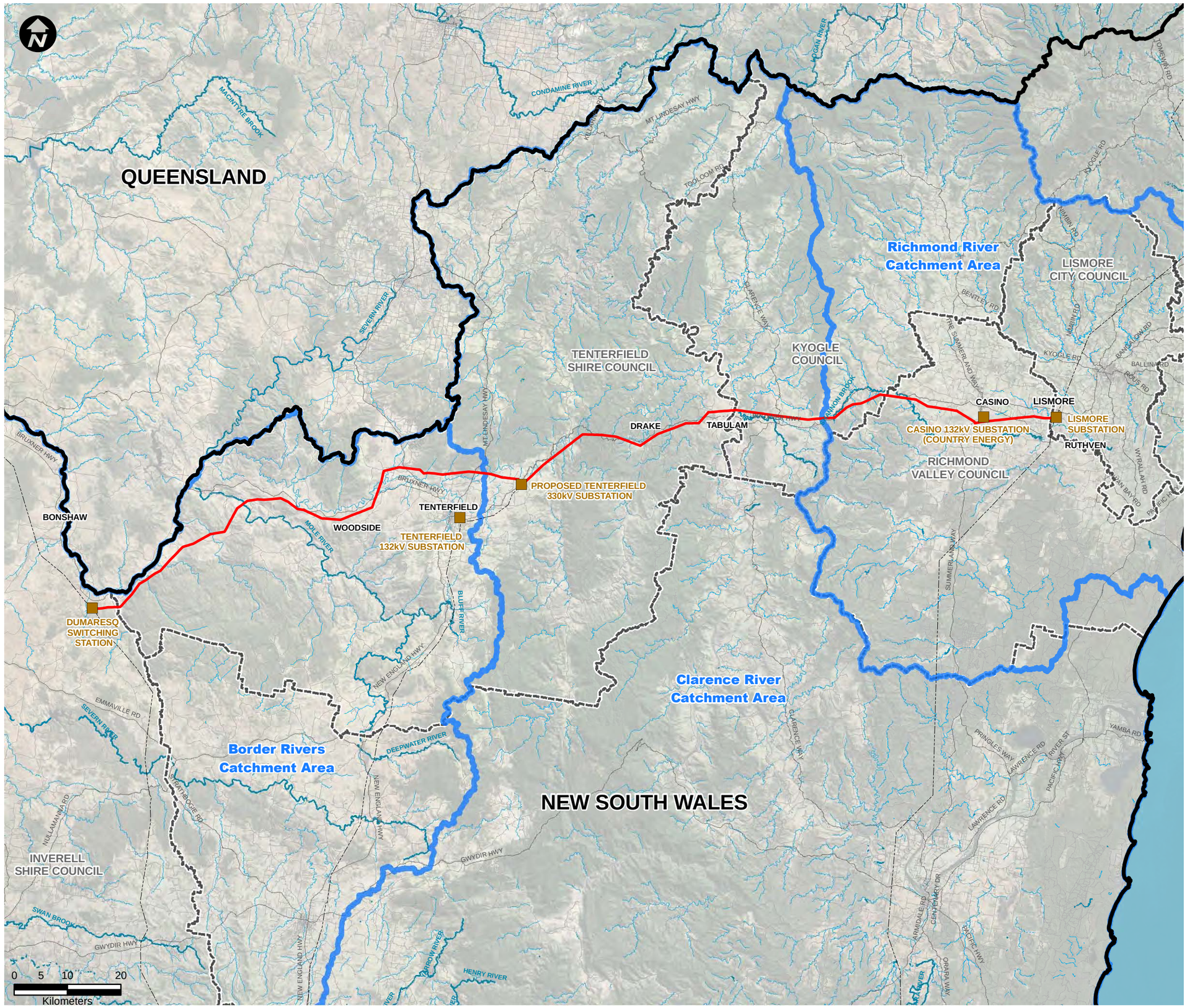
The surface water and hydrology assessment was based on a review of the following information:

- publicly available CMA information and existing water quality reports from a range of sources;
- the statutory planning framework and appropriate legislative context (refer to **Chapter 5 Statutory Planning**);
- water quality and quantity information and other natural resources information available from online searches between September 2009 and February 2010 of the NSW Natural Resources Atlas Database (for surface water and groundwater);
- aerial and satellite imagery; and
- assessment of the Project against the relevant NSW Water Quality and Water Flow Objectives established by DECCW for relevant catchment areas. These water quality and water flow objectives are the agreed environmental values and long-term goals for the management of surface water within NSW.

8.3 Existing Environment

8.3.1 Regional Setting

The Project traverses two Catchment Management Authorities (CMAs): the Border Rivers-Gwydir CMA Region and the Northern Rivers CMA Region. There are three river catchments relevant to the Project within these two CMAs. The Clarence River Catchment and the Richmond River Catchment fall within the Northern Rivers CMA Region; and the Border Rivers Catchment falls within the Border Rivers-Gwydir CMA. **Figure 8-1** shows the location of the three major river catchments.



Datum: GDA94, Projection: UTM, Grid: MGA Zone 56

LEGEND:

- Existing Transmission Lines^
- Proposed 330kV Alignment^
- Substation/Switching Station
- Roads
- Waterways
- Surface Water Catchment Areas
- State Border
- Local Government Area

Symbols and lines used in this figure are indicative and are not intended to reflect actual size of represented features.
Symbols and lines have been enhanced to aid visibility.

Source: Aerial Imagery from © Microsoft Bing Maps 2010
^ Transgrid 2010

Map compiled using MapInfo StreetPro and NPWS Data.

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Client: TransGrid

Project: FAR NORTH NSW (DUMARESQ - LISMORE 330kV TRANSMISSION LINE) PROJECT

Title: RIVER CATCHMENT AREAS

Figure: 8-1

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8.3.2 Surface Water Characterisation

The main watercourses within the study area include Dumaresq River (near the Dumaresq Switching Station), Clarence River (in the vicinity of Tabulam), Richmond River and Wilsons River (in the vicinity of Casino and Lismore). None of the surface water features are within the downstream reaches of regulated rivers where water has been extracted or diverted. Consequently, the Project is located within river catchment areas that are highly dependent on rainfall for flow variability.

There are a number of different ways to classify stream types. This assessment has considered the classification system of surface water features according to flow characteristics (**Table 8-1**). This approach is outlined in the NSW Fisheries Office of Conservation (2003) guidelines- *Why do fish need to cross the road?* (Fairfull and Witheridge, 2003).

Table 8-1 below is adapted from these guidelines for the purposes of categorising the surface water features across the study area according to flow characteristics and the relative importance of the waterway as potential fish habitat.

Table 8-1 Waterway Classification

Waterway type	Characteristics of Waterway Type	Potential importance as aquatic habitat
Class 1	Major permanently flowing waterway	Major fish habitat
Class 2	Named creeks or waterways: with clearly defined bed and banks; with semi - permanent to permanent; waters in pools or in connected wetland areas. Freshwater aquatic vegetation is present.	Moderate fish habitat
Class 3	Generally unnamed waterways or drainage lines with intermittent flow, or flow only following rain events. Aquatic vegetation which would provide some refuge, breeding or feeding areas may or may not be present.	Unlikely fish habitat

Figures 2-1a- 2-1ae (Appendix E Surface Water and Hydrology) classifies the waterways across the Project by flow characteristic and potential aquatic habitat provision, as per the above descriptions.

For context, the Strahler system of river classification could also have been used to categorise the surface water features across the Project. 'First Order Streams' under the Strahler system would broadly correlate to Class 3 waterways. These would include minor streams and drainage features. First order streams connect with minor streams to create larger 'second order' streams and rivers. These would equate with Class 2 Waterways as defined in **Table 8-1** above. Second order streams or rivers would then connect with other second order features to create 'third order' rivers, broadly equivalent to Class 1 Waterways as classified within this assessment and **Table 8-1** above.

A broader surface water classification system than Strahler has been used in this Environmental Assessment to also capture the ecological significance of surface water features across the Project as shown in **Table 8-1** above.

Alignment west

Alignment west and the associated access tracks would cross the following surface water features (listed from west to east in order of where the waterway and Project first intersect):

1. Beardy River;
2. Black Creek;
3. Sandy Creek;
4. Gulf Creek;
5. Shed Creek;
6. Reedy Creek;
7. Rocky Camp Creek;
8. Mole River;
9. Orchard Creek;
10. Ravine Creek;
11. Skillio Hut Creek;
12. Five Mile Creek;
13. Deadman Creek;
14. Eight Mile Creek;
15. Swamp Creek;
16. Ten Mile Creek;
17. SunnySide Creek;
18. Tarban Creek;
19. Tenterfield Creek;
20. Gosling Swamp Creek;
21. Ram Swamp Creek;
22. Halls Creek;
23. Washpool Creek;
24. Chinamans Swamp Creek; and
25. Cataract River.

Alignment west and the associated access tracks would also intersect an estimated 83 unnamed streams, intermittent or ephemeral creeks, or visible drainage lines. These crossings have primarily been identified through analysis of aerial / satellite imagery and topographic mapping.

As shown within **Figures 2-1a – 2-1ae (Appendix E) and Table B-1** within **Appendix E Surface Water and Hydrology**, alignment west intersects 46 Class 3 waterways, two Class 2 waterways, and one Class 1 waterway at two locations.

Plates 8-1 and 8-2 show selective surface water features observed within or in close proximity to alignment west during field investigations. Photograph locations are presented in **Figure 8-2.**

Plate 8-1 View of Mole River North of Proposed Alignment

Plate 8-2 View of Mole River South of Proposed Alignment

Alignment east

Alignment east and the associated access tracks would cross the following surface water features (listed from west to east in order of where the waterway and Project first intersect):

1. Clear Creek;
2. Sandy Creek;
3. Sheep Yard Creek;
4. Slaty Creek;
5. Crooked Creek;
6. White Rock Gully;
7. Plumbago Creek;
8. Cataract River;
9. Violet Creek;
10. Teatree Creek;
11. Saleyard Gully
12. Clarence River;
13. Tunglebung Creek;
14. Culmaran Creek;
15. Shannon Brook;
16. Mummulgum Creek;
17. Oaky Creek;
18. Reids Creek;
19. Richmond River; and
20. Walsh's Creek.

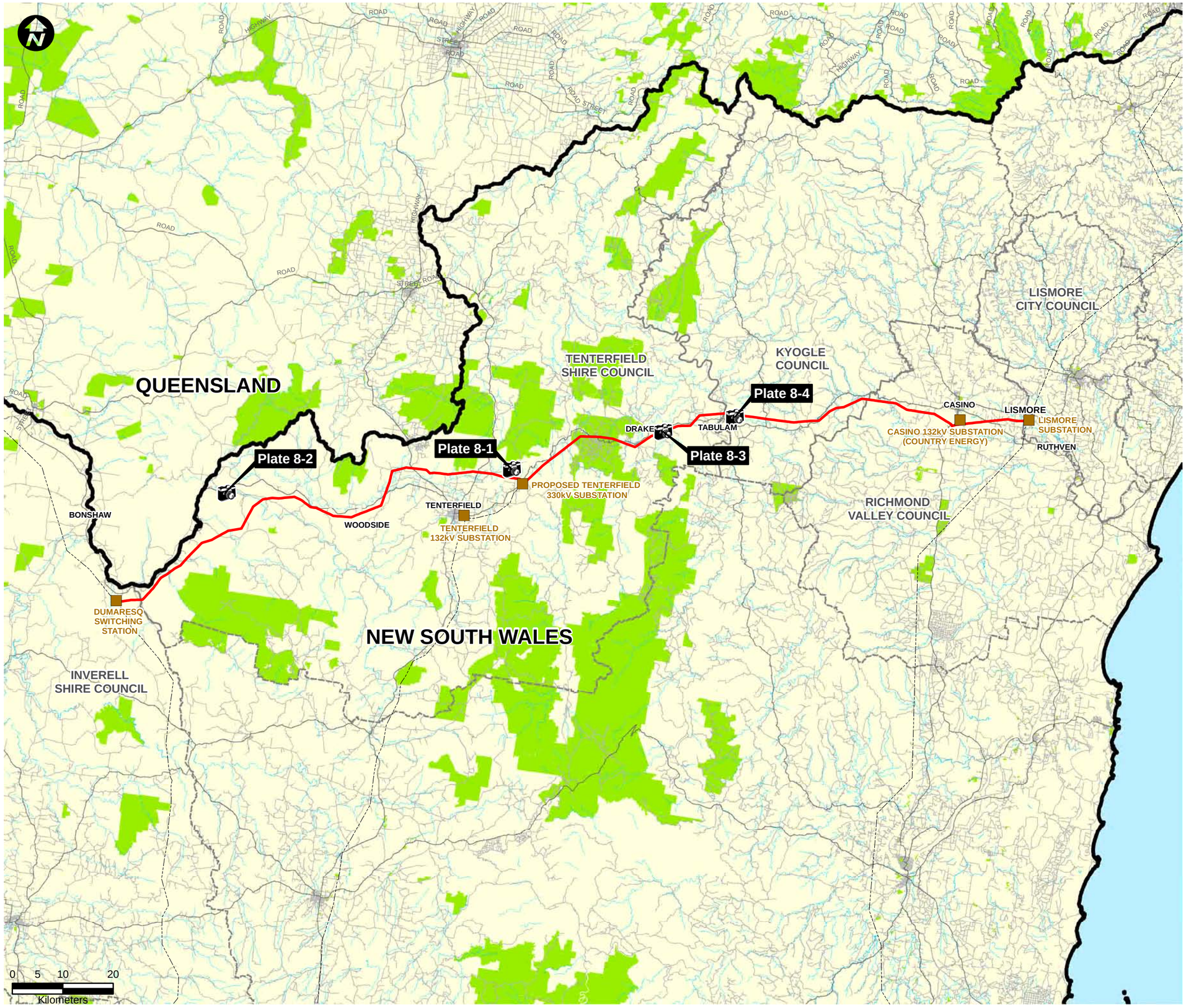
The easement and access track locations would also intersect an estimated 57 unnamed streams, intermittent or ephemeral creeks, or visible drainage lines. The existing 132kV transmission line and access tracks currently traverse these 57 surface water features.

As shown within **Figures 2-1 a - 2-1ae (Appendix E) and Table B-1** within **Appendix E Surface Water and Hydrology,** alignment east intersects 38 Class 3 waterways, no identified Class 2 waterways, and three Class 1 waterways.

Plates 8-3 – 8-4 show surface water features observed in proximity to alignment east during field investigations. Photograph locations are shown on **Figure 8-2**.

Plate 8-3 Teatree Creek

Plate 8-4 Clarence River. View from Bruxner Hwy at Tabulam



Datum: GDA94, Projection: UTM, Grid: MGA Zone 56

LEGEND:

- Existing Transmission Lines
- Proposed 330kV Alignment^
- Substation/Switching Station
- State Border
- Local Government Area
- National Park/State Forest
- Roads
- Waterways
- Photographed Surface Water Features

Symbols and lines used in this figure are indicative and are not intended to reflect actual size of represented features.
Symbols and lines have been enhanced to aid visibility.

Source: ^ Transgrid 2010

Map compiled using MapInfo StreetPro and NPWS Data.

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Client: TransGrid

Project: FAR NORTH NSW (DUMARESQ - LISMORE 330kV TRANSMISSION LINE) PROJECT

Title: SURFACE WATER PHOTOGRAPH LOCATIONS

Figure: 8-2

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Details of all the surface water features identified that would be intersected by the alignment and access tracks are identified in **Table B-1** within **Appendix E Surface Water and Hydrology**. Aerial mapping references are also included.

Table 8-2 offers a summary of the waterway classes potentially impacted by the Project.

Table 8-2 Waterway Classification Summary

	Alignment west	Alignment east
Class 1 waterways	Cataract River intersected between APs 37-38 and APs 38-39.	Timbarra River (Clarence) intersected between APs 49-50. Shannon Brook intersected between APs 59-60. Richmond River intersected between APs 66-67.
Class 2 waterways	Beardy River intersected between APs 3-4. Mole River intersected between APs 16-17.	None identified.
Class 3 waterways	Project crosses waterways classified as Class 3 at 46 points.	Project crosses waterways classified as Class 3 at 38 points.

8.3.3 River Catchment Quality

The Assessment of River Condition (ARC) submitted to the National Land and Water Resources Audit Office in 2001 sought to assess the aggregate impacts of resource use on rivers and to identify the priority management challenges for their maintenance or improvement. The aim was to report on waterway condition at a national scale. River basins within the ARC were identified nominally for reporting purposes. The relevant basin reference numbers under ARC assessment are provided below to assist in cross referencing.

The two main components of the ARC were features of the environment (ARCE) and the aquatic biota (ARCB) (Norris *et al*, 2001). The assessment summarised the results of data from over 500 river monitoring sites across numerous river basins. At a broad river catchment level, water quality issues affecting the Border Rivers, Clarence River and Richmond River Catchments (416, 204 and 203) are identified below.

Border Rivers

The Border Rivers Basin (416) ARCE was reported as moderately modified and the ARCB was significantly impaired. The basin condition was moderately modified based on the hydrological disturbance index, moderately modified based on the catchment disturbance index, moderately modified based on the habitat index and substantially modified based on the nutrient and suspended load index (Norris *et al*, 2001).

Clarence

The Clarence River Basin (204) ARCE was moderately modified and the ARCB was significantly impaired. The basin condition was non-assessed by the hydrological disturbance index, moderately modified based on the catchment disturbance index, largely unmodified based on the habitat index and substantially modified based on the nutrient and suspended load index (Norris *et al*, 2001).

Richmond

The Richmond River Basin (203) ARCE was moderately modified and the ARCB was significantly impaired. The basin condition was largely unmodified based on the hydrological disturbance index, moderately modified based on the catchment disturbance index, moderately modified based on the habitat index and substantially modified based on the nutrient and suspended load index (Norris *et al*, 2001).

The results of the assessment as reported in 2001 are summarised at the river catchment level in **Table 8-3**.

Table 8-3 Assessment of River Condition (ARC)

River Catchment	Water Quality Characterisation				Assessment of River Condition (ARC)	
	Turbidity	Salinity	pH	Nutrients	ARCE	ARCB
Border Rivers	Major issue	Not a Significant Issue	Undetermined	Significant Issue	Moderately Modified	Significantly Impaired
Clarence River	Not a Significant Issue	Not a Significant Issue	No Data	Undetermined	Moderately Modified	Significantly Impaired
Richmond River	Undetermined	Undetermined	No Data	Significant Issue	Moderately Modified	Significantly Impaired

Source: Australian Natural Resources Atlas from the National Land and Water Resources Audit

8.3.4 Acid Sulfate Soils

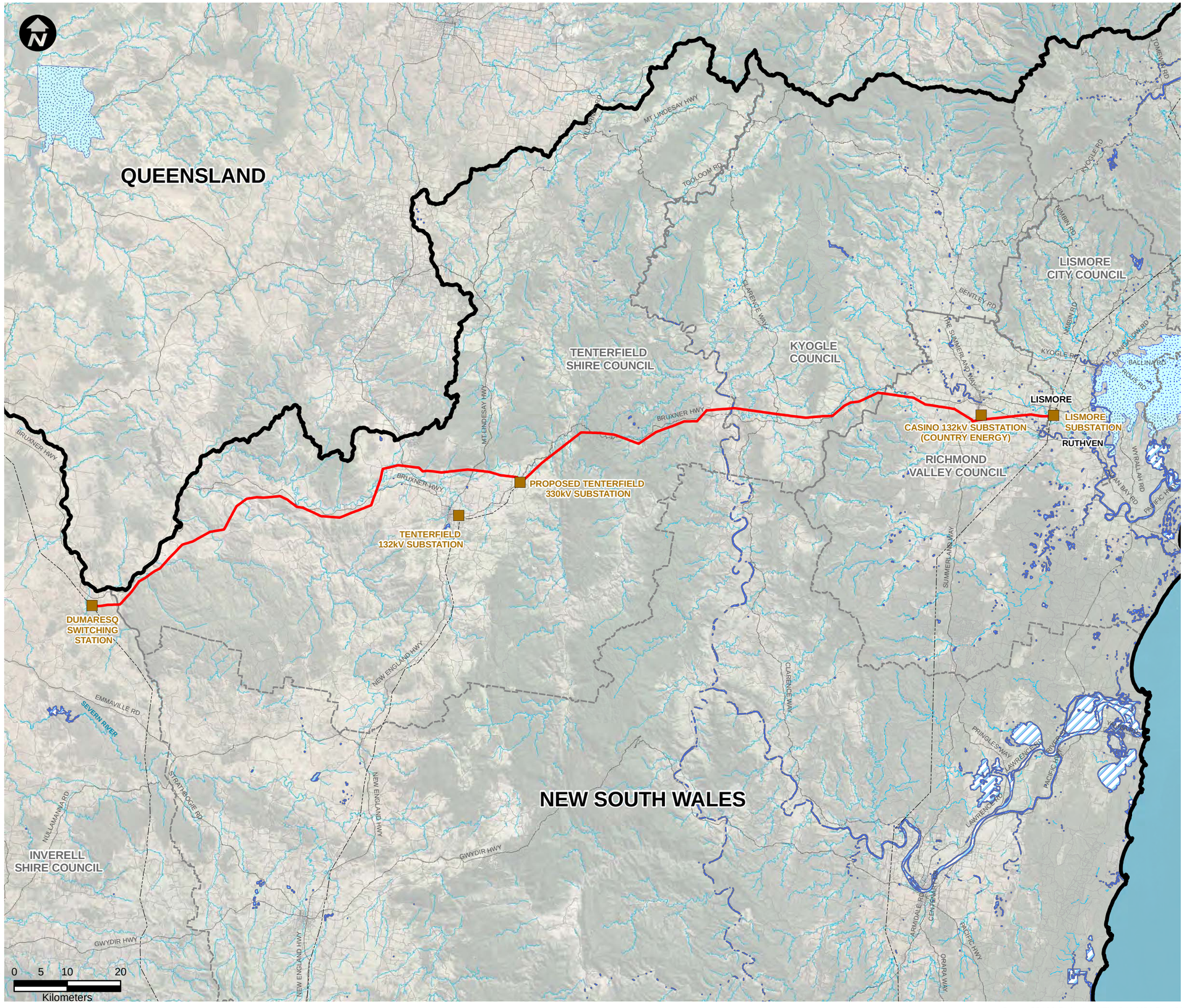
As discussed in **Chapter 7 Soils, Geology and Topography**, the potential for Acid Sulfate Soils within the study area is considered to be low. Potential occurrences between Dumaresq Switching Station and Lismore Substation are unlikely, with patches of extremely low probability around Tabulam, Casino and Sandy Hills.

8.3.5 Groundwater Data

Groundwater availability maps provide a basis for the assessment of the expected and dominant groundwater resources for specified areas. This mapping was not available for the study area at the time of this assessment. A review of Groundwater Works Summary data collected at the point of well development from the NSW Natural Resources Atlas indicates that the predominant purpose of registered bores across the study area is to provide water to domestic stock. From groundwater bore records at 22 locations across the general geographical span of the study area, it is estimated that depth to groundwater ranges from approximately 6m to 40m below ground level. Registered groundwater bore information, representative of the information available across the study area, is presented in Appendix D of the **Appendix E Surface Water and Hydrology**.

Groundwater dependant ecosystems

A desktop based search of information from the NSW Natural Resource Atlas did not identify any groundwater dependent ecosystems in proximity to the Project. The closest groundwater dependent ecosystem is located approximately 10km to the east of Lismore Substation. **Figure 8-3** shows the proximity of groundwater dependent ecosystems to the Project.



LEGEND:

- Existing Transmission Lines^
- Proposed 330kV Alignment^
- Substation/Switching Station
- Roads
- Waterways
- Wetlands~
- Groundwater Dependent Ecosystems*
- State Border
- Local Government Area

Symbols and lines used in this figure are indicative and are not intended to reflect actual size of represented features.
Symbols and lines have been enhanced to aid visibility.

Source: Aerial Imagery from © Microsoft Bing Maps 2010
^ Transgrid 2010
~ Wetlands of New South Wales. Department of Environment, Climate Change & Water - DECCW (2003)
* Australian Water Resources Assessment 2000 - NLWRA (2000) Surface Water Management Areas, (c) Commonwealth of Australia

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Project: FAR NORTH NSW (DUMARESQ - LISMORE 330kV TRANSMISSION LINE) PROJECT

Title: WETLANDS AND GROUNDWATER DEPENDENT ECOSYSTEMS

Figure: 8-3

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8.4 Assessment of Impacts

8.4.1 Surface Water

The main environmental impacts with regard to surface waters are likely to occur where the proposed alignment and access tracks cross watercourses and gullies. Clearing of vegetation in proximity to watercourses and the establishment of waterway crossings such as causeways and culverts would have the potential to disrupt the hydrologic, hydraulic, and geomorphic functions of a watercourse affecting flows, bed and bank stability as well as the ecological values and functions of the riparian corridor (NSW DWE, 2008). Other impacts can include bed and bank erosion and continuing pollution from erosion and sedimentation.

Establishment of Access Tracks

Access to each new structure along the alignment would be required for construction and for maintenance during operation.

For the purposes of preliminary design and assessment, the access tracks have been allocated to one of three categories depending on the level and type of works required. The three categories are:

- **Category 1**: minimal work required. This would include removal of surface obstacles and/ or minor upgrades to existing tracks (i.e. resurfacing, widening etc.). Ground disturbance would be minimal.
- **Category 2**: earth works required. Construction of tracks where existing tracks do not exist.
- **Category 3**: tracks required over wet or swampy ground. Typically construction would require excavation of unstable material, drainage works and the import of rock material.

Further detail regarding access tracks is included within **Chapter 4 Project Description**.

Category 1 access tracks would not be expected to significantly impact surface water features due to the minimal ground disturbance involved with their establishment. Category 2 access track construction would involve varying degrees of ground excavation works and cut and fill construction techniques. The works for Category 3 access tracks would potentially include the excavation of poorly drained soil material, dewatering or other drainage works, the installation of geotextile material at the base of the excavation, and backfill with stable construction material for a solid surface on which to construct the track.

Earthworks could potentially impact upon surface water quality and stream flow through increased sedimentation of local waterways. Higher rates of sediment within runoff entering local tributaries could cause increases to the turbidity of surface water features. Chemical contaminants originating from plant and equipment could also potentially runoff into local waterways from access track construction sites. Similarly, disturbance to the watertable from dewatering activities could potentially include changes to groundwater hydrology.

Mitigation measures to minimise these potential impacts are discussed in **Section 8.5**.

Watercourse crossings

The route selection for the alignment and access track locations sought to minimise the number of watercourse crossings required wherever possible. A number of existing creek crossings would require repair or upgrading since they are typically maintained only to allow 4WD passenger vehicular access. In their current condition, they would not accommodate the larger equipment necessary for the proposed construction work. The locations of the creek crossings identified to date are illustrated in **Figures 2-1a – 2-1ae (Appendix E)** and are detailed in **Table B-1** within **Appendix E Surface Water and Hydrology**. **Table B-1** notes the waterway classification of each surface water feature intersected by the Project. The data provided in the table describes the watercourses between each AP span, as well as the waterway classification of these features and the potential location of watercourse crossings.

Table 8-4 summarises the number of existing creek crossing upgrades and new crossings required within the easement and surrounds for the alignment. This is a preliminary assessment based on field inspections undertaken to date for the access track locations identified by TransGrid in consultation with landholders where possible.

Table 8-4 Alignment Watercourse crossing requirements (preliminary)

	Watercourse crossings to be upgraded		Watercourse crossings to be installed	
	On easement	Off easement	On easement	Off easement
Alignment West	6	11	14	11
Alignment East	7	4	0	0

Source: Based on Aerial and Topographic mapping issue dates 22/02/2011

The published guidelines available from Industry and Investment NSW would inform the design of creek crossings. Creek crossings would be site specific designs and potential crossing types would range from the installation of culverts, to fords, wet crossings or causeways.

The construction of watercourse crossings could potentially destabilise the bed and bank features of streams causing increased erosion as well as other changes to the natural flow regime. The imposition of an artificial barrier would potentially inhibit the flow of water and change erosion and deposition rates. The ecological impacts of watercourse crossings on fish passage and habitat are discussed in **Chapter 9 Biodiversity**. The design and construction of appropriate water crossings in order to address the abovementioned potential risks and impacts is discussed in **Section 8.5.1**.

Changes to Surface Water Hydrology

Given the discrete nature of the substation and structure work sites and the distance between work sites, the potential for works to significantly affect either the rate or volume of water entering natural drainage systems of catchment areas across the development footprint is considered minimal. Localised drainage diversions and minor, temporary changes to runoff volumes and flow rates would occur as a result of the establishment of work site areas, vegetation clearance for the easements and the upgrade and/or construction of new access tracks. These surface water impacts would not be expected to result in significant changes at the regional or local scale over the medium to long term.

Increased Flood Risk

Given the staged construction schedule as well as the temporary nature of the surface water hydrology impacts, the Project is unlikely to affect an overall change to the interception rates of surface water flow or contribute to significant changes in rates of water infiltration. Appropriate drainage would be incorporated into the 330 kV Substation compound design.

Watercourse crossings would be appropriately designed and installed in accordance with required guidelines. Watercourse crossings would be constructed in such a way as to ensure minimal alteration to surface water flow. For these reasons, the Project is considered unlikely to contribute towards increased risks of flooding.

It is unlikely that the Project would be significantly impacted by flooding events, given the discrete and well spaced location of structures across an expanse in excess of 205km. Tower structures would be installed with appropriate footings to ensure stability, and the tower structures themselves do not represent a significant barrier which would serve to concentrate surface water flow. As is the case with all of TransGrid's assets, appropriate emergency response procedures exist and, in the event of an emergency, would be followed. The integrity of the structures would be assessed and repair works commissioned in the event of damage from a storm or flooding event.

Changes to Surface Water Quality

Rainfall in the areas disturbed by construction activities has the potential to cause soil erosion. Runoff from work sites and structure locations as well as areas cleared of vegetation for access tracks and easement areas may contain high levels of sediments that could enter the natural drainage system. Construction activities are also likely to present an erosion hazard. Potential impacts would be as a result of creek and water crossings, sediment movement from ground disturbance at structure sites and as a consequence of driving vehicles over unsealed or unprepared surfaces.

Planning of the Project has considered the location of waterways and the potential impact of runoff. In line with the NSW Office of Water's *Controlled Activities Guidelines*, the design has ensured that the majority of Angle Positions would be located greater than 40m from any surface water feature. The location of intermediate supporting structures as assessed in this report are indicative. The design process for finalising intermediate structure locations would take into account the preference to avoid areas within 40m of surface water features. This objective is necessarily balanced alongside other objectives to minimise impacts to vegetation and heritage sites. Appropriate erosion and sedimentation measures would be applied to any such area where impacts in proximity to watercourse are unavoidable (e.g. installation of sediment controls such as sediment fences). In addition, riparian vegetation would be maintained wherever feasible in order to limit the disturbance to the bank and riparian environment.

During construction works, there would be potential for spills and gross pollutants to be mobilised by runoff and to enter the natural drainage system in the absence of appropriate mitigation measures. Additional impacts would arise at the location of the proposed Tenterfield 330kV Substation. Within the proposed substation compound, all major oil filled pieces of equipment would be installed within an area serviced by primary containment. The primary containment system would consist of a bunded area around the equipment draining to a primary oil containment tank. More general construction phase worksite measures are discussed in **Section 8.5**.

8.4.2 Surface Water Use

The use of water would be required during the construction of the transmission line and the Tenterfield 330kV Substation for concrete batching, access track construction, dust suppression activities, drilling work for footings and for earth staking installation.

Exact water requirements would be determined at the detailed design stage, however it is estimated from previous projects that approximately 4 to 4.5 mega litres of water would be required for the entire Project. It is expected that sufficient water would be available from town water supplies and existing dams to service all construction water requirements. During the construction phase, consultation with NSW Office of Water would be undertaken to ensure that permitting requirements are met.

The operations phase water requirements at the Tenterfield 330kV Substation would be supplied by rainwater tanks.

8.4.3 Groundwater Impacts

The primary potential impact to groundwater would be through the boring and excavation works for the installation of support structures and access tracks in locations where shallow aquifers exist. No groundwater would be extracted for use during construction.

Intersecting groundwater could potentially lead to:

- potential changes to hydrological conditions through dewatering activities (if carried out inappropriately);
- water quality decline / contamination if there is a fuel or chemical leak/spill near dewatering work sites (ie. if sufficient buffer zones are not maintained between dewatering work sites and areas where vehicles are refuelled or where other chemicals are stored); and
- a reduction in groundwater level and reduced flow to groundwater dependent ecosystems (if dewatering activities are carried out inappropriately).

Boring and Excavation Works

Excavation for the purposes of erecting supporting structures would require bored foundations to a depth of around 5m. The deepest footings required for the 330kV substation would be for the oil containment tank, typically between 3 - 4m bgl. From a review of groundwater bore data available online from NOW, it is anticipated that the groundwater level across most areas is unlikely to be within 5m of the ground surface and therefore the potential for ground disturbing activities to directly impact on groundwater is considered to be limited to areas across alignment east.

Changes to Groundwater Hydrology

The depth to groundwater across alluvial floodplain areas is likely to be shallower towards the eastern end of the alignment between Casino and Lismore. Dewatering works may be required to allow construction to safely proceed by limiting the potential for excavation instability (either through wall collapse or floor heave) and preventing waterlogged ground conditions. Dewatering is the process of removing groundwater to lower the water table below the lowest level of excavation.

The Project would not be expected to cause a significant disruption to the water table given the small extent and discrete nature of access track and structure footing excavations that would be required. The distances between the proposed structures would be between 200 - 500m, with access track construction proceeding in accordance with the four stages outlined in the Project schedule (refer to **Chapter 4 Project Description**). The closest groundwater dependent ecosystem to the Project is located approximately 10km to the east of Lismore Substation, therefore no impacts to groundwater dependent ecosystems would be expected. A significant cumulative impact on the underlying groundwater would not be expected as a result of the described works being carried out at discrete sites with significant separation along the 205km alignment.

8.4.4 Assessment Against Water Quality and River Flow Objectives

The impact of the Project on the current condition of the Border Rivers, Clarence River and Richmond River basins is considered to be low. The assessment has considered the potential of the Project to affect the water quality and river flow objectives for these catchments. Section 4.3 of **Appendix E Surface Water and Hydrology** offers a table comparing the Project against all water quality and river flow objectives relevant to the study area.

The current condition of surface water features varies in terms of water quality and level of current disturbance from historical agricultural development and modification, flow modification, erosion and weed infestation.

The protection of aquatic ecosystems, visual amenity and primary and secondary contact recreation are listed as common Water Quality Objectives for all river catchment categories assessed in relation to the Project. Common aims also include the protection of water quality for livestock, irrigation, homestead supply, drinking water quality and for aquaculture. The impact of the Project construction on the above stated water quality objectives would be minimal given the mitigation measures outlined in **Section 8.5** and given that supporting structures, work site areas and access tracks have been preferentially positioned further than 40m from water features wherever possible.

It would be unlikely that the Project would negatively impact upon livestock water use or the recreational use of creeks. Water for construction activities would not be sourced from natural water sources, and the impacts of construction would be mitigated to prevent surface run-off of sediment and nutrients into local waterways. It is unlikely that the Project would negatively impact upon the goal of maintaining aquatic ecosystem health, given that vegetation would be maintained along the riparian zones of waterways where this would not impact upon safety clearance requirements.

In considering the river flow objectives, a common river flow objective across all categories of relevant watercourses was to minimise the effect of weirs and other structures. The protection of pools in dry times, natural flows and flow variability, important rises in water levels, management of groundwater for ecosystems and maintenance of wetland and flood inundation were also strongly represented objectives across the categories relevant to the Project. Access along the easement would require a number of water crossings to be either constructed or upgraded. The design and construction of all tracks across waterways would be in accordance with the NSW Industry and Investment policy and guidelines and TransGrid specifications. All proposed works would be undertaken in a manner to minimise the potential for soil erosion, sedimentation and water quality decline across the Project as detailed in **Section 8.5**.

The proposed works would enable the appropriate upgrade of a number of existing watercourse crossings. As presented in **Table 8-4**, 14 on easement and 15 off easement watercourse crossings have so far been identified by TransGrid as requiring upgrade.

A preliminary characterisation of existing watercourse crossings in the vicinity of the Project concluded that a number were now outdated and in need of upgrade in accordance with current best practice. Upgrades carried out as the result of the Project would likely improve the natural flow and variability of watercourses within the alignment, given that outdated and ineffective structures would be removed and replaced with instream structures informed by NSW Industry and Investment guidelines for watercourse crossings (refer to **Section 8.5.1**).

8.5 Mitigation Measures

8.5.1 Construction Phase

Prevention of Soil Erosion and Sedimentation Impacts

The location of the proposed Tenterfield 330kV Substation, supporting structures and access tracks have been selected to avoid heavily vegetated and riparian areas in order to reduce as far as practical the area subject to soil disturbance. New supporting structures would be constructed at the locations of existing structures across alignment east wherever possible to limit the areas of disturbance. All areas disturbed during works would be revegetated or otherwise stabilised as soon as practicable following dismantling works and construction activities progressively along the alignment.

At a minimum, the measures outlined in the *Managing Urban Stormwater – Soils and Construction Volume 1 and 2* (NSW Department of Housing, 2004) (commonly referred to as the Blue Book guidelines) would be implemented for all construction works.

Watercourse Crossing Design and Construction

For locations where watercourse crossings are required, watercourse crossing type and size would be matched to the natural stream width to minimise high speed flows which can occur when water is forced through a narrow opening. Low flow culverts, where required, would be designed to ensure deep water is provided for larger fish during low flow periods. The design and construction of tracks across waterways would be undertaken in accordance with relevant NSW Industry and Investment and NOW guidelines including *Policy and Guidelines for Fish Friendly Waterway Crossings* (NSW DPI, 2003) and *Why Do Fish Need to Cross the Road*? (Fairfull and Witheridge 2003) (as discussed in **Section 8.3.2**) as well as Controlled Activity Guidelines under the *Water Management Act, 2000* (WMA). All in-stream works would be periodically inspected and monitored until they are suitably stabilised.

Prevention of Chemical Contamination

Refuelling would not be carried out in proximity to watercourses. In addition to potential impacts of spills on surface water quality, spills also have a higher potential to enter the groundwater table at dewatering site locations. Handling measures, including the use of drip trays, would be in use for refuelling in the field.

Primary and secondary containment bunding would be incorporated into the Tenterfield 330kV Substation design and would be in place prior to the installation for any oil filled equipment. Further details concerning bunding are discussed within **Chapter 16 Hazard, Risk and Bushfire**.

Groundwater Quality

Dewatering works, where required, would be appropriately licensed and carried out by suitably trained personnel.

8.5.2 Operational Phase

Watercourse Crossing Maintenance

The condition of upgraded and newly constructed watercourse crossings would be inspected as part of maintenance inspections along the line. Repairs would be carried out to ensure all causeway or culvert installations remain in good working order.

Prevention of chemical contamination

Primary and secondary containment bunding would be incorporated into the Tenterfield 330kV Substation design and would ensure that any potential spills from oil filled equipment would be contained.

8.6 Draft Statement of Commitments

Table 8-5 details the mitigation measures and commitments proposed for the Project. Provided the mitigation measures listed below are adhered to, the Project would be in broad agreement with the water quality and river flow objectives for the major river basins through which the alignment passes.

Table 8-5 Draft Statement of Commitments – Surface Water and Hydrology

	Mitigation Measures	Implementation of mitigation measures		
		Design	Construction	Operation
C1	Supporting structures and associated access tracks would be preferentially located further than 40m from any surface water feature.	✓	✓	
C2	Erosion control measures would be implemented at each supporting structure work sites, at the substation construction site, and at the locations of all access tracks to be upgraded or constructed.		✓	
C3	Temporary drainage and sediment controls would be installed around the proposed Tenterfield 330kV Substation to collect surface water flows from areas likely to be disturbed during construction. Disturbed areas would be stabilised and or revegetated prior to the removal of these measures.	✓	✓	
C4	Where practicable, tankers transporting fuel would be parked on level ground and a minimum of 40m away from prescribed streams or water bodies.		✓	✓
C5	All access roads would be appropriately constructed and maintained during the construction phase and ongoing operation of the Project. All works would be undertaken in accordance with *Managing Urban Stormwater: Soils and Construction Volume 1* (Landcom, 2004) and *Volume 2* (DECC, 2008) (The Blue Book Volumes 1 and 2) and DLWC 2004 Guidelines.	✓	✓	✓
C6	Watercourse crossings would be designed in accordance with department of Primary Industries Policy and *Guidelines for Fish Friendly Waterway Crossings* (2004) and *Why Do Fish Need to Cross the Road?* (NSW Fisheries, 2003)	✓	✓	
C7	Watercourse crossings would be constructed in accordance with TransGrid specifications and undertaken in accordance with the NSW Department of Primary Industries Policy and *Guidelines for Fish Friendly Waterway Crossings* (2004) and *Why Do Fish Need to Cross the Road?* (NSW Fisheries, 2003) as well as *Controlled Activity Guidelines* under the Water Management Act 2000.	✓	✓	
C8	Watercourse crossing culvert size would be matched to the natural stream width to minimise high speed flows which can occur when water is forced through a narrow opening. Low flow culverts would be designed to ensure deep water is provided for larger fish during low flow periods.		✓	

	Mitigation Measures	Implementation of mitigation measures		
		Design	Construction	Operation
C9	Any required dewatering activities would be carried out in strict compliance with NSW Office of Water licensing conditions.		✓	
C10	Oil containment design within the proposed Tenterfield 330kV Substation would ensure all major oil filled equipment would be located within primary and secondary containment systems. The primary containment system would comply with the following requirements: • bunding to Australian Standard 1940 (2004); • bund capacity would exceed 130% of the largest oil volume of any tank within the bund plus 100mm of freeboard; • each bund would drain to a substation oil containment system; and • TransGrid document GD AS G2 101 *Oil Containment in Substations*.	✓		
C11	Where possible, no refuelling shall occur within 40m of a prescribed stream or water body.		✓	✓
C12	In the event of prolonged wet conditions creating vulnerability for water quality impacts, TransGrid would direct the contractor to cease work at any location where it is considered that there is a significant risk to water quality until conditions improve.		✓	

9 Biodiversity

9.1 Introduction

Consideration of the Project's impact on biodiversity is required as part of the Director General's Requirements (DGRs) and Supplementary DGRs. This chapter presents a summary of the biodiversity assessment undertaken for the Project area which includes the alignment, associated substations and switching station areas as well as access tracks. The biodiversity assessment for the Project has involved desktop reviews, targeted field surveys, mapping and a detailed assessment of the potential impacts and associated mitigation measures related to the Project. The full biodiversity assessment can be found in **Appendix F Biodiversity Report**.

Appendix A2, Volume 2 Part 1 of the EA provides cross references to where the DGRs have been met in this chapter and other chapters or in **Appendix F Biodiversity Report**.

9.2 Legislation

9.2.1 Commonwealth Legislation

Environmental Protection and Biodiversity Conservation Act 1999

The Administrative Guidelines for the *Environmental Protection and Biodiversity Conservation Act* 1999 (EPBC Act) set out criteria intended to assist in assessing whether an action, requires Commonwealth approval. In particular, the Guidelines contain criteria for assessing whether a proposed action is likely to have a 'significant impact' on a matter of National Environmental Significance (NES) and hence called 'Significant Impact Criteria' (SIC) assessment guidelines. Should the proponent deem the Project to have a significant potential impact on a matter of NES, a referral to the Commonwealth Minister for Sustainability, Environment, Water, Population and Communities (SEWPAC, formerly the Minister for the Department of Environment, Water, Heritage and the Arts) would be undertaken to obtain a confirmation as to whether the Commonwealth considers the Project a "controlled action".

The Project was referred to the Commonwealth and has been determined a 'controlled action' due to the likelihood of the Project having a significant impact on threatened species and communities listed under the EPBC Act (section 18 & 18A). The Commonwealth has advised that in accordance with the bilateral agreement between itself and the NSW Government under section 45 of the EPBC Act, it relies on the Environmental Assessment carried out under Part 3A of the Environmental Planning and Assessment Act 1979 (EP&A Act). In support of this, the Commonwealth Department of SEWPAC provided its requirements for environmental assessment (issued by the NSW Department of Planning (DoP) as supplementary DGRs) under the EPBC Act to the NSW Department of Planning (DoP).

9.2.2 State Legislation

Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act* 1995 (TSC Act) provides legal status for biota of conservation significance in NSW. The Act aims to, among other things, 'conserve biological diversity and promote ecologically sustainable development'. The TSC Act covers the following:

- protection of 'threatened species, populations and ecological communities', with endangered species, populations and communities listed under Schedule 1, 'critically endangered' species and communities listed under Schedule 1A, vulnerable species and communities listed under Schedule 2;

- listing of 'Key Threatening Processes' (under Schedule 3);
- preparation and implementation of Recovery Plans and Threat Abatement Plans;
- guidelines for the preparation of Species Impact Statements; and
- listing of identification of critical habitat for threatened species.

The DGRs issued under Part 3A of the EP&A Act require that potential impacts relating to NSW listed threatened species, populations and ecological communities and their habitats are assessed. The assessment has considered the scheduled listings in the TSC Act. Draft Guidelines for Threatened Species Assessment under Part 3A of the EP&A Act were issued by the NSW DEC and DPI in July 2005 (DEC/DPI, 2005).

The biodiversity assessment for this Project included: retrieval of existing records of TSC Act listed threatened species, populations and ecological communities likely to occur within the locality of the Project; targeted searches for threatened such species, populations and ecological communities and their habitats during field surveys as well as a thorough assessment of the likely impact on such threatened biota.

Fisheries Management Act 1994

The objects of the *Fisheries Management Act* 1994 (FM Act) are to conserve, develop and share the fishery resources of the State for the benefit of present and future generations.

The DGRs issued under Part 3A of the EP&A Act require that potential impacts relating to NSW listed threatened species, populations and ecological communities and their habitats are assessed. The FM Act provides scheduled listings of aquatic threatened species, populations and ecological communities that have been considered in this assessment. Draft Guidelines for Threatened Species Assessment under Part 3A of the EP&A Act were issued by the NSW DEC and DPI in July 2005 (DEC/DPI, 2005).

The biodiversity assessment for this Project included: retrieval of existing records of FM Act listed threatened species, populations and ecological communities likely to occur within the locality of the Project; targeted searches for threatened such species, populations and ecological communities and their habitats during field surveys as well as a thorough assessment of the likely impact on such threatened biota.

Permits under Section 219 (fish passage) are not required for Part 3A approvals. Despite the Part 3A exemption from this formal requirement, all Project works relating to riparian areas would be consistent with the Department Water and Energy Controlled Activity Guidelines (2008) and all waterway crossings would be upgraded and constructed in accordance with TransGrid specifications and I&I NSW policies and guidelines.

Noxious Weeds Act 1993

Under the NSW *Noxious Weeds Act 1993* (NW Act), all councils are responsible for the control of noxious weeds within their local government area (LGA). The NW Act provides for the declaration of noxious weeds by the Minister of Agriculture. Weeds may be considered noxious on a national, state, regional or local scale. All private landowners, occupiers, public authorities and councils are required to control noxious weeds on their land under Part 3 Division 1 of the NW Act. Noxious weeds in the alignment have been addressed as part of this assessment.

National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act* 1974 (NPW Act) provides for the preservation of land and the protection of that land, as well as the protection of flora and fauna and aboriginal heritage. For approved projects under Part 3A (s75U) of the EP&A Act, a separate licence or approval is not required for actions relating to harm to native fauna (and threatened species) that are essential for carrying out the approved project. There are no designated National Parks or Nature Reserves located within the proposed alignment or access tracks.

9.3 Assessment Methodology

The biodiversity assessment was undertaken in accordance with the DGRs issued by DoP on 11 September 2009, as well as Supplementary DGRs, issued 16 March 2010 (Appendix A of **Appendix F Biodiversity Report**). The assessment was designed, and implemented, using a tiered approach that has responded to the changing scope and relative design components for the Project. The approach included:

- incorporation of the outcomes of the regional desktop investigations undertaken for the Preliminary Environmental Assessment (PEA);
- defined desktop investigations for the Environmental Assessment (EA);
- an EBPC Referral submission to the Commonwealth Director-General;
- incorporation of the results of numerous field surveys undertaken for the PEA and constraints reporting (**Appendix B3, Volume 2**) ;
- field surveys undertaken specifically for the EA to address the DGRs, Supplementary DGRs; and
- preparation of associated reporting and mapping of the above results.

9.3.1 Desktop Review

A desktop review was undertaken to identify threatened species, populations and ecological communities listed under the TSC Act, FM Act and EPBC Act that could occur within the Project area. The following databases were reviewed as part of the desktop study:

- NSW DECCW Wildlife Atlas online database was reviewed for all TSC Act listed species;
- Commonwealth Protected Matters Search Tool online database was reviewed for all EPBC Act listed species;
- NSW DECCW Spatial Data Programs records;
- NSW DECCW threatened species, populations and ecological communities online search tool for the relevant Catchment Management Areas;
- I&I NSW Threatened fish and marine vegetation by geographic region online search tool;
- Forest NSW, Threatened Species Records, recorded for the far north NSW region;
- relevant vegetation mapping for the region including; State Forest mapping, NSW National Parks mapping, CMA mapping, DECCW *Vegetation Types Database* (2008) and Keith (2004); and
- relevant 'Plans of Management' for National Parks, State Forests and Nature Reserves within the vicinity of the alignment.

9.3.2 Field Survey Methodology

The field survey effort focused on mapping vegetation communities and identifying any terrestrial and aquatic threatened flora and fauna within and adjacent to the proposed alignment and access tracks. Due to the extensive size of the Project area, physical and seasonal constraints, as well as access limitations, a full survey of all areas was not feasible. However, surveys were undertaken in areas identified as being representative of the majority of the Project area and based on a survey effort adequate to meet the requirements of the assessment guidelines listed below.

All field surveys were designed and undertaken in accordance with the:

- *Threatened Biodiversity and Assessment; Guidelines for Developments and Activities Working Draft* (DEC, 2004);
- *Threatened Species Assessment Guidelines: the Assessment of Significance* (DECC 2007);
- *BioBanking Assessment Methodology and Credit Calculator Operational Manual* (DECC 2009); and
- *Draft Guidelines for Threatened Species Assessment* (DEC & DPI 2005).

Based on the recommended survey effort in these guidelines, representative vegetation formations and communities were identified and surveyed.

The specific field surveys were carried out over seven separate field assessments during the following periods:

- preliminary site visit: 5 to 9 April 2009 (Autumn);
- vegetation community mapping: 5 to 9 April (Autumn) 2009, 7 to 11 September (Spring) 2009, 22 to 25 September (Spring) 2009, 3 to 6 November (Spring) 2009, 9 to 12 March (Late Summer/ Autumn) 2010;
- targeted flora survey: 5 to 9 April (Autumn) 2009, 7 to 11 September (Spring) 2009, 22 to 25 September (Spring) 2009, 3 to 6 November (Spring) 2009, 9 to 12 March (Late Summer/Autumn) 2010;
- targeted fauna survey: 7 to 11 September (Spring) 2009, 7 to 11 December (Summer) 2009; and
- access track survey: 23 to 29 September (Spring) 2010.

9.4 Existing Environment

The Project crosses five Local Government Areas (LGAs) consisting of Tenterfield and Inverell in the west and Lismore, Kyogle, and Richmond Valley in the east. The Project is also located across two Catchment Management Areas (CMAs), Border Rivers/Gwydir in the west and Northern Rivers in the east. Within these CMAs the Project falls specifically within nine CMA sub-regions including, Tenterfield Plateau and Nandewar Northern Complex in Border Rivers/Gwydir CMA and Richmond Tweed, Woodenbong, Cataract, Stanthorpe Plateau, Rocky River George, Clarence Sandstone, Clarence lowlands in the Northern Rivers CMA (**Figures 2a** and **2b** of the **Biodiversity Report, Appendix F**). All figures are also provided at A3 scale in **Section 3, Volume 3, EA**.

The study area is located within the NSW North Coast, South Eastern Queensland, Nandewar and New England Tablelands bioregions (**Figure 2a** and **b** of the **Biodiversity Report, Appendix F**) as defined in the *Interim Biogeographic Regionalisation for Australia* (Thackway & Creswell 1995).

Flora

Approximately 345 flora species were recorded by URS ecologists during field surveys across the Project area. The majority of these were native species common to woodland and forest communities found within the region, refer to **Appendix F Biodiversity Report** for the list of all Project area flora species.

Vegetation Communities

Seven vegetation formations and 49 vegetation communities within these formations were mapped within the Project area (**Table 9-1)**. Refer to **Appendix F Biodiversity Report** for descriptions for each of the vegetation communities and their associated composition and condition.

Table 9-1 Vegetation Formations and Communities within the Project Area

Vegetation Formation	Vegetation Community
Dry Sclerophyll Forest (shrub/grass sub formation)	Dirty Gum/White Cypress Pine/Silver-leaved Ironbark Open Forest (Integrades)
	Flood Gum/Grey Ironbark Tall Open Forest (Disturbed)
	Forest Red Gum Grassy Open Forest
	Forest Red Gum/Broad-leaved Apple Dry Open Forest
	Forest Red Gum/Pink Bloodwood Open Forest
	Grey Gum/Grey Ironbark Open Forest
	Grey Ironbark/Grey Gum/New England Blackbutt Open Forest (Intergrades)
	Ironbark Wattle Woodland (Disturbed)
	Narrow-leaved Ironbark Dry Open Forest
	New England Blackbutt Dry Heathy Open Forest on Granites
	New England Stringybark Open Forest
	New England Stringybark/Peppermint/Grey Ironbark/Grey Gum Open Forest (Intergrades)
	Spotted Gum/Grey Box /Grey Ironbark Open Forest
	Spotted Gum/Grey Ironbark/Dry Open Forest
	Spotted Gum/Grey Ironbark/Narrow-leaved Ironbark Open Forest
	Spotted Gum/Grey Ironbark/Pink Bloodwood Open Forest
	Spotted Gum/Grey Ironbark/Thin-leaved Stringybark Dry Open Forest
	Spotted Gum/Thin-leaved Stringybark/Pink Bloodwood Open Forest
	Thin-leaved Stringybark/Broad-leaved Apple Open Forest
Dry Sclerophyll Forest (shrubby sub formation)	Grey Box - Narrow-leaved Ironbark - White Cypress Pine Open Forest
	Tumbledown Red Gum/Blakely's Red Gum/Pine Shrubby Open Forest
	Tumbledown Red Gum/Blakely's Red Gum/Pine Shrubby Open Forest (Disturbed-Regrowth)
	Youman's Stringybark/Yellow box/Blakely's Red Gum Woodland (Intergrades)
Forested Wetland	River Oak Riparian Woodland
	River Red Gum Riverine Woodland
	River Red Gum Riverine Woodlands (Disturbed)
	Swamp Box Swamp Forest (Disturbed)*
	Swamp Box/Swamp Mahogany Swamp Forest (Integrades)*
	Water Gum/Forest Red Gum Riparian Woodland
Grassland	Natural Grasslands on Basalt and Fine Textured Alluvial Soils & White Box Grassy Woodland†
	Natural Grasslands on Basalt and Fine Textured Alluvial Soils†

Vegetation Formation	Vegetation Community
Grassy Woodland	Blakely's Red Gum/Grey Box/Rough Barked Apple Grassy Woodland*
	Blakely's Red Gum/Grey Box/Rough Barked Apple Grassy Woodland* (Disturbed)
	Blakely's Red Gum/Grey Box/Rough-barked Apple Grassy Woodland†*
	Blakely's Red Gum/White Box Grassy Woodland* (Regeneration)
	Blakely's Red Gum/White Box Grassy Woodland* / †*
	Cabbage Gum Grassy Woodland
	Forest Red Gum/Swamp Box Open Forest (Disturbed)*
	Forest Red Gum/Swamp Box Open Forest*
	Fuzzy Box/Grey Box Grassy Woodland (Disturbed)
	Inland Grey Box Tall Grassy Woodland (Disturbed)
	Rough-barked Apple riparian forb/grass open forest
	White Box Grassy Woodland (Disturbed)*
	White Box Grassy Woodland†*
Semi Arid Woodlands (shrubby sub formation)	Dirty Gum Tall Woodland
	Silver-leaved Ironbark/White Cypress Pine Woodland
Wet Sclerophyll Forest (shrubby formation)	Messmate/Brown Barrel Grassy Open Forest
	Spotted Gum/Brush Box Moist Forest
	Sydney Blue Gum Open Forest
Exotic	Exotic Riparian Vegetation
Unknown	Un-Surveyed Wooded Vegetation

Threatened Flora Species

A total of 195 threatened flora species were identified through the desktop review process that could occur in the Project area. Of these threatened flora species, one listed under the FM Act, 69 listed under the TSC Act, and 47 listed under the EPBC Act were assessed as having potential to occur within the Project area based on a more detailed consideration of suitable habitat and available mapping data. Surveys were undertaken to target these potentially occurring threatened species in all areas of suitable habitat within the Project area. The following species were identified and their location mapped:

- Caley's Ironbark (*Eucalyptus caleyi* subsp*. ovendenii*)
- Bluegrass (*Dichanthium setosum*)

Details regarding these species and their location within the Project area are detailed in **Figures 4a** and **4b** within **Appendix F Biodiversity Report**.

Threatened Ecological Communities

A total of 19 Threatened Ecological Communities (TECs) were identified through the desktop review process that could occur in the Project area. Of these TECs, three listed under the TSC Act, two listed under the EPBC Act and one listed under the FM Act were assessed as having potential to occur within the Project area based on a more detailed consideration of geographical location, suitable habitat and available mapping data. One listing was common to both the TSC Act listings and the EPBC Act listings. This was for White Box, Yellow Box, Blakely's Red Gum woodland. Vegetation mapping surveys identified and mapped the following TECs within the Project area:

- *Aquatic ecological community in the natural drainage system of the lowland catchment of the Darling River;*

- *Sub-tropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion;*
- *Swamp sclerophyll forest on coastal floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions;*
- *White Box, Yellow Box, Blakely's Red Gum woodland; and*
- *Natural Grasslands on Basalt and Fine-textured Alluvial Plains of northern New South Wales and southern Queensland.*

Details regarding these TECs including their associated composition and condition as well as their location within the Project area are detailed in **Appendix F Biodiversity Report**.

Threatened Fauna

A total of 156 threatened fauna species were identified through the desktop review process that could occur in the Project area. Of these threatened fauna species, one listed under the FM Act, 94 listed under the TSC Act and 18 listed under the EPBC Act were assessed as having potential to occur within the Project area based on a more detailed consideration of suitable habitat and available mapping data. Surveys targeted these potentially occurring threatened species in all areas of suitable habitat within the Project area with the following thirteen species identified, during the survey effort and their location mapped:

- Eastern Bentwing Bat (*Miniopterus orianae oceaensis*);
- Eastern Cave Bat (*Vespadelus troughtoni*);
- Little Bentwing Bat (*Miniopterus australis*);
- Yellow-bellied Sheathtail Bat (*Saccolaimus flavientris*);
- Diamond Firetail (*Stagobopleura gutta*);
- Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*);
- Grey Crowned Babbler (*Pomatostomus temporalis temporalis*);
- Powerful Owl (*Ninox sternua*);
- Rufous Bettong (*Aepyprymnus rufescens*);
- Squirrel Glider (*Petaurus norfolcensis*);
- Turquoise Parrot (*Neophema pulchella*);
- Olive Whistler (*Pachycephala olivacea*); and
- Little Lorikeet (*Glossopsitta pusilla*).

Details regarding these species and their location within the Project area are detailed in **Figures 5a** and **5b** within **Appendix F Biodiversity Report**.

Threatened Populations

A total of three threatened fauna populations were identified through the desktop review process that could occur within the Project area. Of these threatened fauna populations, one listed under the TSC Act and one listed under the FM Act were assessed as having potential to occur within the Project area based on a more detailed consideration of suitable habitat and mapping data. These were:

- Emu population in the NSW north coast Bioregion and Port Stephens LGA; and
- Tusked Frog population in the Nandewar and New England Tablelands Bioregions.

No threatened populations were identified during field surveys conducted within the Project area.

Noxious Weeds

A total of 110 noxious weeds, declared by I&I NSW across the five Local Government Areas within the Project area were identified through the desktop review process. Of these weeds, 14 were identified and mapped during the field survey. Noxious weeds identified during the field survey are listed below and are discussed in **Appendix F Biodiversity Report**:

- African Lovegrass (*Eragrotis curvula*);
- Bathurst Burr (*Xanthium spinosum*);
- Blackberry (*Rubus fruticosus*);
- Cats Claw Creeper (*Macfadyena unguis-cati*);
- Cardoon (*Cynara cardunculus*);
- Coolati Grass (*Hyparrhenia hirta*);
- Common Prickly Pear (*Opuntia stricta*);
- Green Cestrum (*Cestrum parqui*);
- Lantana (*Lantana camara*);
- Oxalis spp. (*Oxalis* spp.);
- Paterson's curse (*Echium plantagineum*);
- Silver-leaved Night Shade (*Solanum elaeagnifolium*);
- Tiger Pear (*Opuntia aurantiaca*); and
- Tree of Heaven (*Ailanthis altissima*).

9.5 Assessment of Impacts

The proposed alignment has been developed following consideration of a range of biodiversity and environmental constraints, route options, and line design requirements, as well as on-going discussions with property owners, the community and other key stakeholders.

All threatened flora, fauna, populations and ecological communities listed under the EPBC Act, assessed as having potential to occur within the Project area have been assessed using the DEWHA (2009) SIC assessment guidelines for matters of NES.

All threatened flora, fauna, populations and ecological communities listed under the TSC Act and FM Act, were addressed using the DECC (2007) Assessment of Significance (AOS) guidelines in order to assess the potential impacts of the Project on threatened biota.

All SIC and AOS assessments can be found in **Appendix F Biodiversity Report**.

Threatened Flora Species

The assessments indicate that the Project has the potential to impact on twelve identified threatened flora species. Impacts on these species relevant to the Project have been assessed and noted as being either none, potential or adverse, and are detailed in **Appendix F Biodiversity Report** (refer to **Section 6.1.3**, as well as Appendices I and J).

Threatened Ecological Communities

Two Commonwealth listed Threatened Ecological Communities (TECs) were identified within the Project area, and the SIC assessment indicated a significant impact on both of the following listed TECs:

- *Natural Grasslands on Basalt and Alluvial Plains in Northern NSW and Southern Queensland; and*
- *White Box, Yellow Box, Blakely's Red Gum grassy woodland.*

Four State listed Threatened Ecological Communities (TECs) were identified within the Project area, and the AOS indicated the Project is considered to have an adverse impact on all of these TECs:

- *Aquatic ecological community in the natural drainage system of the lowland catchment of the Darling River;*
- *Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion;*
- *Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast; Sydney Basin and South East Corner Bioregions; and*
- *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland.*

A full description of the ecological communities considered likely to occur can be found in **Appendix F Biodiversity Report**, with accompanying SIC and AOS assessments provided in Appendices I and J of **Appendix F Biodiversity Report** respectively.

Threatened Fauna

The Project is considered to have some degree of impact on 54 threatened species likely to be either potentially or adversely impacted by the Project according to the State and Commonwealth assessment outcomes. Of the Commonwealth listed species, the Project is assessed to have a significant impact on five species listed under the EPBC Act. Of the NSW listed species, the Project is assessed to have a potential or adverse impact on thirty-six listed species, detailed in **Appendix F Biodiversity Report** (refer to **Section 6.1.5** as well as Appendices I and J).

Vegetation Clearing

TransGrid has a statutory responsibility to maintain adequate clearance between transmission line conductors and vegetation. These clearing related impacts have been considered throughout the assessment process using the principle of avoid, minimise, mitigate and offset. Avoidance was the first priority, during the route selection stage of the Project (**Appendix B3, Volume 2**). All attempts were made to select an alignment that avoided TECs and threatened species habitat as much as possible as well as common vegetation communities, particularly in areas with the greatest connectivity at a landscape level.

The final clearing requirement of the easement would be assessed on a case by case basis for each span and would depend on the terrain, vegetation, environmental conditions and precise height of conductors and is discussed in detail in **Section 4.3** of **Appendix F Biodiversity Report**.

Precise measurements of the amount of clearing required would not be available until the detailed design stage of the Project. Therefore, two clearing scenarios have been identified to assist with determining the upper (maximum) and lower (minimum) limits of the likely clearing areas. This is discussed in detail in **Section 4.3** of **Appendix F Biodiversity Report**. For the purposes of this assessment, vegetation clearing calculations have been determined according to the construction and maintenance needs of the Project, including access track and transmission line clearing.

The *maximum* vegetation clearance scenario outlines the greatest clearing area which would be required for the transmission line easement and to establish the proposed access tracks. The maximum scenario is an overestimate of the actual area that would be cleared. The final clearing requirement of the easement would be assessed on a case by case basis for each span and would depend on the terrain, vegetation, environmental conditions and precise height of conductors.

This maximum area of vegetation to be cleared is approximately 434 ha (refer to **Table 6-7** of **Appendix F Biodiversity Report**).

The *minimum* vegetation clearance scenario outlines the lowest area that would be required for the transmission line, specifically the structures, conductor clearance and associated access tracks and incorporates minimal clearing in areas where TECs occur.

This clearing scenario applies minimal clearing to areas:

- where TECs of TSC Act or EPBC Act status have been mapped and identified along the easement; and
- areas of un-surveyed wooded vegetation have been mapped; this approach is precautionary and assumes this vegetation may be a TEC.

In all other areas (i.e. where non TEC vegetation communities occur), the minimum scenario incorporates removal of all vegetation for the full width of the easement (as per the maximum clearing scenario) and clearing of 6m wide access tracks for category 2 and 3 tracks where they are located outside the easement.

The minimum area of vegetation to be cleared is approximately 312 ha (refer to **Table 6-7** of **Appendix F Biodiversity Report**).

In terms of TECs, the minimum and maximum areas to be cleared are provided in **Table 9-2**.

Table 9-2 Clearing Estimates for Threatened Ecological Communities

Threatened Ecological Community	Min Area (Ha)	Max Area (Ha)
AECDR^	0	0
Sub-tropical Coastal Floodplain Forest	1.42	11.20
Box Gum Woodland (TSC Act and EPBC Act)	5.52	47.85
Box Gum Woodland (TSC Act)	4.17	27.80
Swamp Sclerophyll Forest	0.04	0.82
Natural Grasslands	0.43	3.46
Total	**11.58**	**91.13**
Un-Surveyed Wooded Vegetation*	9.44	51.52
Clearing Total	**21.02**	**142.75**

^ Aquatic community with no terrestrial vegetation, hence there would be no clearing impacts
**areas of un-surveyed wooded vegetation have been included in this table as a precautionary measure. At this stage it is assumed that this vegetation may be a TEC.*

It is likely that the clearing of vegetation with regards to the Project would have short-term and long-term impacts on threatened species and ecological communities. The level of impact would reflect the capacity of these species and communities to adapt, migrate/disperse and/or find suitable habitat in adjacent areas. Flora species or their habitat would be impacted in various ways dependant on the species responses to disturbances such as intermittent clearing for maintenance. Flora impacts include, but are not restricted to:

- fragmentation;
- species habitat loss; and
- physical and genetic isolation.

The removal of vegetation classified as a TEC is likely to have a negative impact on the overall occurrence of these communities on a local, regional and national scale. However, the extent of the impact would depend on the condition, size and connection of the community with other ecological communities. The impact of clearing native vegetation on TECs within the area is considered within the **Appendices I** and **J** in **Appendix F Biodiversity**.

In general the Project is not likely to have a significant impact on TECs within alignment east and associated access tracks because the existing transmission line and tracks already fragment these communities. TECs within alignment east typically occur as fragmented patches of degraded forests and woodlands bordered by cleared farm land. The main impact of the Project on TECs in alignment east is an increase in edge effects, primarily weed invasion.

In contrast the Project is considered likely to have a significant impact on TECs within alignment west. TECs within alignment west typically occur as continuous patches of vegetation that have previously been cleared for grazing but are showing substantial regeneration.

For fauna species, the degree of short term impacts would depend upon the extent of clearing and the ability, or inability, of individuals to migrate to alternative suitable local habitats. More importantly the clearing of habitat resources along with vegetation is likely to have a greater long-term impact on locally occurring threatened fauna. The loss of habitat resources such as hollow bearing trees, rocks, and fallen timber can have a compounding effect on the lifecycle of current and future populations that are dependant on such resources for survival.

These clearing related impacts have been considered throughout the assessment process using the principle of avoid, mitigate and offset. Avoidance was the first priority, during the route selection stage of the Project (refer to **Appendix B**). All attempts were made to select an alignment that avoided TECs and threatened species habitat as much as possible as well as common vegetation communities, particularly in areas with the greatest connectivity at a landscape level. Any clearing impacts that could not be avoided would be mitigated with ameliorative measures and/or offset, if the biodiversity values of affected areas cannot be maintained or improved through these measures. Mitigation and management measures are discussed in detail in **Section 9.6** and **Section 9.7** and **Section 7** of **Appendix F Biodiversity Report**.

9.6 Mitigation Measures

Measures proposed in order to mitigate adverse effects of the Project on biodiversity are provided in **Appendix F Biodiversity Report** and outlined in the Statement of Commitments below. The majority of these measures form part of threat abatement plans, recovery plans and priority actions recommended by DECCW, SEWPAC and I&I NSW for threatened species, populations and ecological communities. Further, targeted mitigation measures have been detailed in **Sections 7.2** and **7.3** and **Table 7-1** of **Appendix F Biodiversity Report**.

The mitigation measures have been developed to provide best available practices within a statutory and policy framework. The safeguards and mitigations required to be addressed under Clause 5 of the Supplementary DGRs include details of measures that would be developed as the Project progresses into the next phase of design. After the EA has been publicly exhibited and if the Project is approved, environmental management plans would be developed which set out the detailed framework for continuing management, mitigation and monitoring programs as well as responsibilities for implementation.

TransGrid would implement a Biodiversity Offset Strategy in consultation with DECCW and SEWPAC to compensate for clearing associated with the Project and in line with the requirements of the offsetting policies of those bodies. The offset strategy is outlined below, and described in detail in **Section 7.3** of **Appendix F Biodiversity Report**.

9.7 Offset Strategy

TransGrid recognises that the clearing of vegetation for the development of the Project represents long term removal of vegetation. In light of the DECC (2005) guidelines for Part 3A biodiversity assessments (i.e. to maintain and improve biodiversity values resulting in no net impact on threatened species or native vegetation), as well as the Commonwealth Draft Policy Statement: use of environmental offsets under the *Environment Protection and Biodiversity Conservation Act 1999* (DEWHA 2007) and the DoP and Supplementary DGRs, an offset strategy would be designed and developed that is appropriate for the Project.

The potential impacts of the Project in relation to vegetation clearance have been identified and are provided in **Table 6-7 of Appendix F Biodiversity Report**. This table includes data on each type of community to be impacted, community condition, and the potential scale of impact, namely the amount of vegetation to be cleared, and any corresponding TECs that would be impacted. Based on this, any offset arrangement to be agreed with DECCW and SEWPAC would need to respond to the following potential Project impacts:

- Vegetation losses of between 312 ha and 434 ha of native vegetation;

- TEC losses of up to 91 ha, (or a maximum total of 143ha including the unsurveyed wooded vegetation) including principal TEC losses in the following communities:
  - Natural Grasslands on Basalt and Alluvial Plains in Northern NSW and Southern Queensland (EPBC Act);
  - White Box, Yellow Box, Blakely's Red Gum Grassy Woodland (EPBC and TSC Act);
  - Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion (TSC Act); and
  - Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast; Sydney Basin and South East Corner Bioregions (TSC Act).
- Other potential impacts on biodiversity values such as threatened flora, fauna and populations as discussed in **Section 6** of **Appendix F Biodiversity Report**.

TransGrid is committed to reaching an agreement with both DECCW and SEWPAC on an initiative that would meet the requirements, principles and guidelines for offsetting established by those bodies. To this end, detailed discussions have commenced with DECCW in relation to confirming the scale, geographic location, and biodiversity assets that would need to be reflected in an agreed offset outcome.

Proposed Biodiversity Offset

The offset package would be developed in accordance with the principals contained in the DECC guidelines (2005) and DECCW guidelines (2010). The offset package would be developed in consultation with the DECCW and SEWPAC and preliminary consultations have commenced.

The offset package would need to compensate for the likely vegetation and habitat losses described in **Table 6-7** of **Appendix F Biodiversity Report** in terms of the diversity of communities potentially impacted, the scale of that impact, and the condition of the impacted communities. **Section 6** of **Appendix F Biodiversity Report** provides detail in relation to the potential impacts of the Project with respect to each of these parameters.

Further consultation would occur with DECCW and SEWPAC in regards to the offset strategy.

The Maintain or Improve Test

The DECC (2005) guidelines identify matters that are relevant to the assessment of impacts to threatened species, populations or ecological communities or their habitats, arising from a Project assessed under Part 3A. A key principle in the DECC guidelines state that Projects maintain or improve biodiversity values (i.e. there would be no net impact on threatened species, populations, ecological communities or native vegetation). Where impacts cannot be avoided or mitigated then it is necessary to identify a suitable offset in order to maintain or improve biodiversity values.

The Project's response in relation to avoidance and mitigation of potential impacts has been detailed in **Section 7.1** and **7.2 of Appendix F Biodiversity Report**.

Any agreed biodiversity offset package would be used as a means of ensuring that the Project maintains and improves biodiversity in the locality. The offset would protect and conserve, in perpetuity, threatened species habitats, vegetation types including TECs and landscape features similar or equivalent to those found within the Project.

The offset would be:

- strategic in nature, adding value to DECCW and SEWPAC conservation priorities for the region;
- focused at a landscape level, to provide valuable outcomes to regional biodiversity connectivity;
- representative of the range of vegetation communities impacted, and the scale of those potential impacts;
- of a scale and configuration, that would,
  - be sustainable in terms of the maintenance of flora and fauna populations;
  - minimise edge effects; and
  - adequately offset the area of native vegetation that would potentially be impacted by the Project; and
- managed by DECCW, under the umbrella of the NSW NPWS, so as to improve its condition and biodiversity values, where this is possible.

On the basis of the above assessment, the proposed offset package is consistent with the DECCW and SEWPAC guidelines for offsets and would meet the key criterion for like-for-like trade-offs of biodiversity values. Agreement to an offset of the above type would compensate for the loss of native vegetation and threatened species habitats associated with the Project and maintain biodiversity values in the study area.

Further details concerning implementation of proposed mitigation measures have been provided in **Chapter 19 Draft Statement of Commitments**.

9.8 Draft Statement of Commitments

In order to mitigate impacts on biodiversity, the following management and mitigation strategies would be implemented.

Table 9-3 Draft Statement of Commitments – Biodiversity

	Mitigation Measures and Commitment	Implementation		
		Design	Construction	Operation
	Biodiversity - General			
D1	An Environmental Management Representative would be appointed by TransGrid to oversee the implementation of mitigation measures and commitments.	✓		
	Biodiversity – Vegetation Clearing			
D2	A suitably qualified ecologist/botanist would undertake targeted pre-clearance assessments for all structure locations and access tracks that are proposed to pass through areas of intact native vegetation, to identify site specific mitigation measures to be included in the CEMP. Wherever possible, access tracks would avoid TECs, EPBC listed communities, identified breeding habitat and populations of threatened flora.	✓	✓	

Mitigation Measures and Commitment		Implementation		
		Design	Construction	Operation
D3	A Flora Management Plan would be developed and included in the CEMP. The Flora Management Plan would identify measures and management protocols designed to assist in the avoidance and mitigation of impacts on flora as a result of vegetation clearing associated with the Project. Mitigation measures would be implemented to maximise the avoidance of threatened plants during clearing, to ensure the protection of local populations, to promote long-term connectivity of populations within the landscape and to control weed invasion where necessary	✓	✓	
D4	In vegetated areas the extent of clearing required would be clearly demarcated. Flagging tape would be used during construction to identify the edge of the area to be cleared. The Flora Management Plan and the pre-clearance assessments would identify those areas to be demarcated and avoided.	✓	✓	
D5	Where practical, hollow bearing trees would be selectively retained. This would be assessed on a case by case basis as part of the pre-clearance assessments.	✓		
D6	With TECs listed under the TSC and EPBC Act, the construction footprint associated with access tracks and transmission line structures would be minimised as far as possible. Access tracks would occur at restricted points and would be located in areas with minimal canopy cover where practical. If ground cover removal is required, all top soils from the area would be stockpiled separately and re-established following completion of construction activities.	✓	✓	✓
D7	With TECs listed under the TSC and EPBC Act, and important threatened species habitat constrained clearing and maintenance practices (Appendix C, TransGrid Policies, Volume 2, EA) would be implemented wherever possible, taking into consideration TransGrid's clearance requirements (GD AS G3 015 'Principles for the Clearing of Transmission Line Easements'). Wherever possible, bands of understorey vegetation would be retained. Intact habitat features such as hollow logs would be placed in these bands of vegetation.	✓	✓	✓

	Mitigation Measures and Commitment	Implementation		
		Design	Construction	Operation
	Biodiversity - Weed Management			
D8	Weed surveys, focusing on noxious weeds, listed by local control authorities (Noxious Weeds Act 1993 (NW Act)), in areas representing high risk in terms of weed management as assessed by a qualified ecologist/botanist, would be undertaken immediately prior to construction. These would identify and record the noxious weeds occurring along the alignment and associated access tracks, and in surrounding areas. (This information would then be utilised to prepare the Weed Management Plan that is part of the CEMP).	✓	✓	
D9	A Weed Management Plan would be developed as part of the CEMP and would include specific measures for the minimisation, management, mitigation and monitoring of noxious/ environmental weeds within all work areas, including the easement.		✓	
D10	Once construction is complete, noxious weeds listed by local control authorities (NW Act) within the alignment and associated work areas would be controlled as per TransGrid Standard GM EN G2 010 Noxious Weed Control, and as per the most recent information available from the I&I NSW (formerly called DPI, NSW Department of Primary Industries).			✓
	Biodiversity - Fauna Management			
D11	Clearing of vegetation would follow best practice methods for fauna rescue (as per NSW National Parks and Wildlife Service (2001) Policy for the Translocation of Threatened Fauna in NSW).		✓	
D12	A Fauna Management Plan would be developed as a part of the CEMP to minimise impacts to resident native and threatened species. This would include the following procedures: targeted pre-clearance surveys for breeding / nesting / primary habitat for threatened species; two stage clearing process for hollow bearing trees; management of fauna for translocation and rescue; coarse woody debris relocation plan; rehabilitation and revegetation plan to re-establish fauna passageways; and habitat replacement plan, including nest box, bat roosts and glider pole allocation and placement	✓	✓	

Mitigation Measures and Commitment		Implementation		
		Design	Construction	Operation
D13	Vegetation would be cleared using the two-stage approach in areas identified as containing habitat trees (trees with hollows and other habitat features such as nests, dreys etc). Areas containing habitat trees would be identified during targeted pre-clearance assessments of structure locations and access tracks proposed for construction in areas of intact native vegetation. This approach involves the following process: Initially all non-habitat trees would be removed, leaving 2-3m wide connections between stands of habitat trees. All habitat trees would be knocked (gently tapped with plant equipment) once all non-habitat trees have been removed at the end of each day. At least 48 hours after partial clearing, habitat trees would be removed and checked for fauna in the presence of a suitably qualified ecologist, fauna rescue personnel or certified wildlife handler. Suitably qualified personnel would guide the plant equipment operators on 'how' and to what side to fell habitat trees to facilitate fauna observation and rescue.	✓	✓	
D14	Where needed all fauna habitat features such as logs and tree hollows, known as coarse woody debris (CWD), would be relocated to the edge of the easement subject to safety and fire risk considerations.		✓	
D15	Any rescued fauna would be transferred to appropriate areas within adjacent habitat or placed in the care of WIRES or other certified wildlife rescue organisations within the local area, if injured		✓	
D16	If injured microbats are found during vegetation clearing procedures, only a vaccinated ecologist with the lyssavirus inoculation would handle these species		✓	
D17	During targeted pre-clearance assessments, ecologists would undertake targeted searches for the presence of gliders as well as the habitat suitability along the transmission to determine whether there is a requirement for installation of glider poles	✓	✓	
	Biodiversity – Connectivity, Fragmentation and Edge Effects			
D18	A Flora Management Plan would be developed as part of the CEMP and would include revegetation protocols which would be established following construction to re-connect potential wildlife corridors where possible. Provision would be made to reconnect remnant patches of vegetation along creek lines and floodplains. In all areas locally occurring species would be used to replace habitat		✓	✓

Mitigation Measures and Commitment		Implementation		
		Design	Construction	Operation
D19	Stockpiling of material would avoid TECs		✓	
D20	Soil erosion and sedimentation controls in accordance with the Soil and Water Management Plan and the Erosion and Sediment Control Management Plan would be implemented prior to vegetation clearing work commencing in an area.		✓	
	Biodiversity - Offset Strategy			
D21	A Biodiversity Offset Strategy would be developed in consultation with DECCW and DEWHA to compensate for clearing associated with the proposal.	✓	✓	

10 Indigenous Heritage

10.1 Introduction

This chapter provides a summary of the Indigenous Heritage assessment undertaken to address DGRs by DoP and DECCW. A full copy of the assessment is provided in **Appendix G Heritage**.

10.2 Legislation

Baseline principles for the conservation of heritage places and relics can be found in the Burra Charter, which recognizes that there are places worth keeping because they can enrich our lives on many levels. The significance of such places may be embodied in fabric (physical material), environmental setting, contents, use or its meaning to people, and should be assessed through methodical data collection. Since its adoption in 1979, the Burra Charter has become the standard of best practice in the conservation of heritage places in Australia.

A number of Acts of parliament provide for the protection of Aboriginal heritage at various levels of government. At Commonwealth level, the following statutes are relevant:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act); and
- *Aboriginal and Torres Strait Islander Heritage Protection Amendment Act* 1987 (ATSIHPA Act).

At state level, the following statutes are relevant:

- *Environmental Planning and Assessment Act 1979* (EP&A Act);
- *National Parks and Wildlife Act 1974* as amended (NPW Act); and
- *Heritage Act 1977.*

10.2.1 Commonwealth Legislation

Environment Protection & Biodiversity Conservation Act 1999 (EPBC Act)

The EPBC Act provides that any action assessed as likely to have a significant effect on listed matters of national environmental significance (MNES) can be declared a *controlled action*, and may only proceed with the Minister of the Environment's approval. MNES include National Heritage Places. No National Heritage Places are located within the study area.

Aboriginal and Torres Strait Islander Heritage Protection Amendment Act 1987

The *Aboriginal and Torres Strait Islander Heritage Protection Amendment Act of 1987* is a Federal act for the protection of Aboriginal heritage in circumstances where such protection is not available at a state level. This Act comes under Commonwealth jurisdiction which means that it can override state and territory statutes.

No heritage places or sites within the study area are listed under the EPBC Act. All sites identified are protected under NSW State legislation and should not require implementation of the ATSIHPA Act.

10.2.2 State Legislation

The *Environmental Planning and Assessment Act 1979* requires that environmental impacts, including cultural heritage impacts, are considered at a land use planning and decision making level. Under this Act, Aboriginal heritage is protected in two different ways:

1) Through environmental planning instruments such as State Environmental Planning Policies (SEPP) and Local Environmental Plans (LEPs).

2) As the Project requires approval under Part 3A, section 75F of the Act requires the Director-General to consult with the relevant public authorities when preparing the Director-General's requirements.

The *National Parks and Wildlife Act* 1974 (NPW Act) provides for the protection of Aboriginal objects (sites, objects and cultural material) and Aboriginal places. Aboriginal sites are protected by the NPW Act, but if certain sites are deemed as having great significance, they can be further protected by a heritage order, pursuant to the *Heritage Act* 1977 issued by the Minister, on the advice of the Heritage Council.

This Project is governed by Part 3A of the EP&A Act. Consequently, once planning approval has been granted, an Aboriginal heritage impact permit under section 90 of the *National Parks and Wildlife Act* 1974 is not required, nor is an excavation permit under section 139 of the *Heritage* Act. However, all impacts and heritage management for a project approved under Part 3A would be undertaken through the conditions of project approval and the statement of commitments which is likely to include an approved Aboriginal Heritage Management Plan as part of the CEMP.

10.3 Consultation

The Project falls within the boundaries of the Casino, Jubullum and Moombahlene Local Aboriginal Land Councils (LALCs). Consultation has been initiated for the Project in accordance with the *Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (DECCW, 2005 (Draft)) with reference to the *Interim Community Consultation Guidelines* (ICCGs).

Advertisements seeking expressions of interest from Aboriginal community organisations or individuals were placed in the Tenterfield, Casino and Lismore local papers. Stage 1 notification letters were issued to Aboriginal groups or individuals known to have an interest in Aboriginal heritage within the study area and to all government agencies and councils as required. As a result of the Stage 1 ICCG notification phase, eleven groups and two individuals (total 13) were identified and now form the Registered Stakeholder group as follows:

- Moombahlene LALC;
- Aboriginal Elder Lilly Bartholomew;
- Aboriginal Elder Bertha Daley;
- Kwiembal Elders Indigenous Group;
- Edgerton-Kwiembal People (Edgerton-Kwiembal Environmental, Heritage & Cultural Aboriginal Corporation);
- Kambuwal Aboriginal Corporation for Culture, Heritage & Land;
- Maree Aboriginal Corporation;
- Widajabul Aboriginal People;
- Ashford LALC;
- Ngulingah LALC;

- Jubullum LALC;
- Bandjalang People; and
- Casino LALC.

Stage 2 consultation letters describing the methods to be employed for the archaeological assessment and asking for any project specific cultural information were issued to all Registered Stakeholders with a 21 day response time. Responses to the Stage 2 letters concerned offers of service for the provision for the archaeological assessment. There is potential that additional cultural information may be offered during the Project as relationships with the Registered Stakeholders continue to be built.

Following the completion of all six field assessment periods, a copy of the draft report was provided to Jubullum LALC, Casino LALC, Moombahlene LALC, Edgerton Kwiembal Environmental & Heritage Aboriginal Corporation, Kwiembal Elders Indigenous Group, Kambuwal Aboriginal Corporation for Culture Heritage & Land, and the Maree Aboriginal Corporation. All other registered stakeholders were advised the report was available and were given the option to request a hard copy. A three week time period was given for response, and it was noted in the accompanying letter that a "no response" was considered to mean that stakeholders were satisfied with the draft report.

In total, nine copies of the report were distributed to the above stakeholders and no feedback was received within the allocated time period. All Registered Stakeholders who had a copy of the report were contacted by phone or email to follow up on the report's distribution and seek comment. A summary of the concerns raised by the organisations are provided in **Appendix G Heritage**.

10.4 Assessment Methodology

10.4.1 Desktop Study

Prior to undertaking the detailed heritage assessment, an Indigenous & Non- Indigenous Heritage Review (OzArk, 2009) was prepared that identified heritage constraints within the study area. This search encompassed the study area in its entirety with a buffer of five kilometres (km) either side for study area east and approximately 30km either side for study area west.

This desktop study undertook the following searches:

- Australian Heritage Database;
- The NSW Heritage Office State Heritage Register and State Heritage Inventory;
- National Native Title Claims Search;
- The Department of Environment, Water Resources, Heritage and the Arts (DEWHA, now Department of Sustainability, Environment, Water, Population and Communities (SEWPAC)) Protected Matters (EPBC Act) Database;
- Department of Environment, Climate Change and Water (DECCW) Aboriginal Heritage Information Management System (AHIMS);
- Local Environment Plans for Inverell, Tenterfield, Kyogle, Richmond Valley and Lismore LGAs; and
- S170 RTA Heritage and Conservation Register.

10.4.2 Predictive Model and Field Survey Methodology

The easement and the access tracks traverse numerous landform types with differing archaeological potential. It is known that certain features within the landscape are more likely to hold archaeological potential than others. Therefore in order to target field surveys along the alignment and access tracks, a predictive model was used. This model was based on the predominant patterns of Aboriginal site distribution that have their roots in theoretical archaeological models and on the regional and local context. The landform variability within the area meant that a variety of models had to be developed that acknowledge differences in site patterning based on available landforms. Using the concept of stream ordering, general predictions were made regarding the nature of sites and their location in the study area.

The known characteristics features were used to guide the model:

- open sites;
- isolated finds;
- modified trees;
- resource gathering sites;
- ceremonial sites/bora grounds;
- burials;
- rock shelter sites;
- grinding grooves; and
- quarries.

Further details regarding the predictive model are provided in **Appendix G Heritage**.

Using a predictive model, and guided by the results of the relevant desktop studies, easement and access track areas were graded into zones of high, medium and low archaeological potential for both indigenous and non-indigenous heritage significance. A tiered approach was undertaken such that areas of high and medium potential were targeted for field survey while areas predicted to be of low potential significance were not surveyed.

The field surveys were carried out over six separate field assessments:

- Alignment survey week 1: 14 September – 18 September 2009;
- Alignment survey week 2: 28 September – 2 October 2009;
- Alignment survey week 3: 31 November – 4 December 2009;
- Alignment survey week 4: 7 December – 11 December 2009;
- Access tracks survey 1: 18 October – 23 October 2010; and
- Access tracks survey 2: 2 November – 5 November 2010.

In excess of 55.9% of the easement was assessed (as opposed to 61.7% that was identified to be assessed in the survey methodology set out above). Alternatively this means that 90.6% of the properties designated for assessment were actually assessed. Equally 37% of the access tracks were identified for field survey and 34% were surveyed. Access limitations were the key reason that not all of the identified areas could be surveyed.

10.4.3 Significance Criteria

Following completion of the survey, sites were assessed for their significance. The appropriate management of cultural heritage items is usually determined on the basis of their assessed significance as well as the likely impacts of the Project. Cultural, scientific and public significance are identified as baseline elements of significance assessment and it is through the combination of these elements that the overall cultural heritage values of a site, place or area are decided.

Cultural significance

Cultural significance concerns the importance of a site or features to the Aboriginal community. Aspects of cultural significance include assessment of sites, items and landscapes that are traditionally significant or that have contemporary importance to the Aboriginal community. This type of significance may not be in accord with interpretations made by the archaeologist. Aboriginal community representatives advised on the cultural significance of sites.

Scientific significance

Assessing a site in this context involves placing it into a broader regional framework, as well as assessing the site's individual merits in view of current archaeological discourse. This type of significance relates to the ability of a site to answer current research questions and is also based on a site's condition (integrity), content and representativeness. Establishing whether or not a site can contribute to current research also involves defining 'research potential' and 'representativeness'. In general terms, any Aboriginal object has the ability to either add to our knowledge about an area's Aboriginal history, comment on the technological developments of a people or may act as potential markers for subsurface deposits.

Public significance

Sites that have public significance do so because they can educate people about the past. By reducing ignorance about why sites are important to the Aboriginal and scientific community, important sites can be protected. For a site to have high public significance it should contain easily identifiable and interpretable elements, and be relatively easily accessed.

10.5 Existing Environment

10.5.1 Existing Levels of Disturbance

The level of ground disturbance varies greatly across the study area. Large scale clearing of native vegetation has occurred in both study area east and west and the land has been intensively utilised for grazing and cropping purposes. Additionally roads, fences, dams and farm tracks have been constructed across the easement within the study area.

As a result, the easement in study area east and the proposed easement in study area west has undergone moderate prior disturbance that would have affected certain site types. Sites such as modified trees would have been removed from the landscape and other sites, such as open sites, stone arrangements and Bora Grounds may have been destroyed or altered through the actions of tree clearing, stock trampling and erosion.

10.5.2 Database Search Results

A search of the DECCW Aboriginal Heritage Information Management System (AHIMS) database revealed that 93 Aboriginal sites have been recorded within the parameters of the initial search of the study area (**Section 10.4.1**).

After identification of the preferred corridor, the search area was reduced to buffers of 5km for study area east and 7km for study area west. The data from this reduced search area was used to generate **Table 10-1** which shows there are 59 previously recorded Aboriginal sites, including shelters, burial grounds, open sites and modified trees (**Table 10-1**). Two of the 59 sites are likely to have been entered onto the AHIMS database twice. Consequently, the total number of sites for the searched area should be listed as 57[1].

Table 10-1 Previously Recorded Sites in Close Proximity to the Study Area

Site Type	Number
Open Site	29
Modified Tree	9
Aboriginal Ceremonial and Dreaming	7
Rock shelter with Art	3
Aboriginal Resource Gathering Site	3
Burial ground	3
Rock shelter / Caves	1
Rock shelter with Deposit	1
Stone Arrangement	1
Quarry and open site	1
Ochre Quarry	1
Total	**59**

10.5.3 Survey Results

Forty one Aboriginal sites were recorded during field surveys, which comprised 16 open sites (OS), 11 isolated finds (IF), eight modified trees (ST), five Potential Archaeological Deposits (PAD) and one Aboriginal Resource Gathering site (ARG). **Table 10-2** provides location details for the recorded sites from west to east along the alignment. The site designation 'TD' refers to sites recorded in study area west (i.e. sites recorded between Tenterfield and Dumaresq Switching Station) and 'LT' refers to sites recorded in study area east (i.e. sites recorded between Lismore Substation and Tenterfield) . Maps provided in the Heritage Report (**Appendix G Heritage)** and at A3 scale in **Volume 3, Section 4** of the EA, show the location of all recorded sites in relation to the proposed alignment and access tracks.

[1] Sites 12-5-0071 and 12-5-0055 are both called House Creek 1 and have identical co-ordinates; as do sites 11-3-0026 and 11-3-0045 which are both called Round Hill camp site.

Table 10-2 Aboriginal Sites Recorded During the Alignment Survey

Site Designation	Location comments *Maps provided in Appendix G and at A3 scale in Volume 3, Section 4 of the EA	Description of site
TD-OS4 with PAD (incorporates TD-OS15)	Located on the proposed access track to structure W14, **Figure Heritage 1**.	Open Site with PAD. Materials present included grey quartzite (the dominate material), basalt, chert and milk quartz. At least 27 artefacts were present.
TD-OS1	Located on access track to structure W25, **Figure Heritage 2**.	Open Site. Approximately 30m x 5m and is located on gravels in a previously cleared grazing agricultural landscape with good ground surface visibility. Artefact densities are less than one artefact per metre square. Several small milk quartz artefacts were observed (flakes and broken flakes). However, measurements were only taken of one definite quartz artefact. Other materials present included basalt, fine grained siliceous material, chert and indurated mudstone.
TD-OS2	Located between structure W25 and structure W26, **Figure Heritage 2**.	Open Site. The site is approximately 30m x 10m and is located on gravels in a previously cleared grazing agricultural landscape with good ground surface visibility. Artefact densities are less than one artefact per metre square. Several small artefacts were observed (flakes and broken flakes). However, measurements were only taken of a representative sample of definite artefacts. Materials present included grey quartzite, milk quartz, fine grained siliceous material, chert and indurated mudstone
TD-OS3 with PAD	Located north of the easement between structure W36 and structure W37, **Figure Heritage 3**.	Open Site with PAD. It consists of two artefact scatters of approximately 10 metre square each. Artefact densities are less than one artefact per metre square. Materials present included basalt, milk quartz, fine grained siliceous material, chert and quartzite.
TD-ARG1	Located north of the easement in the vicinity of structure W38, **Figure Heritage 3**.	Potential Aboriginal Resource Gathering Site. A large hole chopped into a log while it was lying on the ground in order to extract an animal from the hollow log.
TD-ST1	Located north of the easement in the vicinity of structure W38, **Figure Heritage 3**.	Modified Tree. The 15m tree is a yellow box (*Eucalyptus melliodora*) with a circumference at breast height of 3.8m and as such is of sufficient age to possess a cultural scar. The heartwood of the tree has rotted and has disappeared making definite identification of the nature of the scar difficult.
TD-OS5 with PAD	Located on the proposed access track to structure W45, **Figure Heritage 3**.	Open Site with PAD. The four artefacts recorded are situated on an elevated terrace above the Gulf Creek floodplain at 350m AHD. Artefact densities are less than one artefact per metre square. Artefacts present were limited to fine-grained basalt.
TD-OS6 (incorporated into TD-OS20 with PAD)	Located at structure W51, **Figure Heritage 3**.	Open Site. Artefact densities are less than one artefact per metre square. Only two artefacts were recorded despite good surface visibility in this area. Being basalt flake and light-grey quartzite flake.

Site Designation	Location comments *Maps provided in Appendix G and at A3 scale in Volume 3, Section 4 of the EA	Description of site
TD-OS7	Located at structure W52, **Figure Heritage 3**.	Open Site. An axe perform/blank and two flakes were recorded, a few undiagnostic (i.e. no identifiable flake characteristics present) pieces of good quality quartz were also observed. Artefact densities are less than one artefact per metre square.
TD-IF1	Located between structure W52 and structure W53, **Figure Heritage 3**.	Isolated Find. Potential hammer stone possessing a 'pitted surface'.
TD-IF2	Located between structure W52 and structure W53, **Figure Heritage 3**.	Isolated Find. Potential hammer stone. It comprises a water worn cobble possessing a 'pitted surface'.
TD-IF5	Located off-easement to the east of structures W53 and W54, **Figure Heritage 4**.	Isolated Find. Basalt flake with a platform and negative scar.
TD-IF3	Located off-easement to the east of structure W55, **Heritage 4**.	Isolated Find. Fine-grained siliceous axe blank.
TD-IF4	Located off-easement to the east of structure W55, **Figure Heritage 4**.	Isolated Find. Chert blade measuring 36 x 17 x 5.
TD-OS8	Located north of easement in vicinity of structure W59, **Figure Heritage 4**.	Open Site. Artefacts recorded were limited to five flakes. Artefact densities are less than one artefact per metre square
TD-ST2	Located north of the easement in the vicinity of structure W80, **Figure Heritage 5**.	Modified Tree. The 10m tree is a white box (*Eucalyptus albens*) with a circumference at breast height of 3.2m and as such is of sufficient age to possess a cultural scar. While the heartwood of the tree has rotted, the shape left is consistent with a Coolamon.
TD-OS9 with PAD	Located at structure W80 and on the access track between structure W80 and structure W81, **Figure Heritage 5**.	Open Site with PAD. One hundred plus artefacts were observed at this site although only a sample (n=6) were recorded. An average artefact density at the site is approximately 5 artefacts per square metre.
TD-OS10	Located on proposed access track to structure W90, **Figure Heritage 5**.	Open Site. 16 artefacts were observed and a sample of six was recorded. Fine-grained basalt was the dominant raw material. An average artefact density at the site is approximately two artefacts per square metre.
TD-IF6	Located between structure AP16 and structure W94, **Figure Heritage 6**.	Isolated Find. A chert cobble measuring 36 x 15 x 21.
TD-OS11 with PAD	Located between structure W97 and structure AP17, **Figure Heritage 6**.	Open Site with PAD. Seven artefacts were recorded at this site although others were observed. Artefacts were observed in natural scours in the earth as well as in disturbed contexts. It is anticipated *in situ* subsurface archaeological deposits remain. A geological diversity of raw materials was noted on site. Flakes were the only artefact type recorded.
TD-IF7	Located at structure W116, **Figure Heritage 7**.	Isolated Find. A broken coarse-grained basalt flake measuring 38 x 50 x 11 with significant platform preparation and three negative flake scars.
TD-ST3	Located between structure W121 and structure W122, **Figure Heritage 7**.	Modified Tree. The scar, is assessed as being an Aboriginal Scar (i.e. most likely of Aboriginal origin but without any feature that makes it a definite Aboriginal scar).

Site Designation	Location comments *Maps provided in Appendix G and at A3 scale in Volume 3, Section 4 of the EA	Description of site
TD-OS12	Located on proposed access to structure W133, **Figure Heritage 8**. This GPS point in site centre.	Open Site. Four artefacts were located at the site despite intensive investigation and reasonable ground surface visibility. The artefacts were all weathered and local basalt.
TD-OS13	Located on structure W138, **Figure Heritage 8**.	Open Site. Only two artefacts were located at the site despite intensive investigation and reasonable ground surface visibility. Artefact density was less than one artefact per square metre.
TD-IF8	Located between structure W163 and structure W164, **Figure Heritage 10**.	Isolated Find. A basalt flake/core and was recorded in a ploughed paddock. It has 60% cortex and measures 5.8 x 6.2 x 2.3 . It has two negative flake scars, one indistinct and one bladelet.
TD-ST4	Located west of easement in vicinity of structure W169, **Figure Heritage 11**.	Modified tree. Assessed as being a Possible Aboriginal Scar (i.e. due to the small size of the scar and the fact that it may have been created in the post-contact period suggests that it may not be of Aboriginal origin).
TD-ST5	Located west of easement in vicinity of structure W177, **Figure Heritage 12**.	Modified Tree. Dead tree with a circumference of 1,500mm, situated in close proximity to TD-ST6. The scar is approximately 400mm from the ground, is roughly ovoid in shape and is approximately 1,200mm top–bottom and 500mm left–right. There is substantial regrowth around the scar and no other markings appear to be present. assessed as being an Aboriginal Scar (i.e. this is a scar that conforms to most of the criteria, and where an Aboriginal origin is considered to be the most likely).
TD-ST6	Located east of easement in vicinity of structure W177, **Figure Heritage 12**.	Modified Tree. Scar is approximately 500mm from the ground, is roughly ovoid in shape and is approximately 1,200mm top–bottom and 600mm left–right. There is substantial regrowth around the scar and no other markings appear to be present (i.e. axe marks or carving). Marks around the tree above the scar show that an attempt to ringbark the tree was made at some time in the past. Assessed as being an Aboriginal Scar (i.e. this is a scar which conforms to most of the criteria, and where an Aboriginal origin is considered to be the most likely).
TD-IF9	Located between structure W226 and structure W227, **Figure Heritage 15**.	Isolated Find. Milk quartz flake and was recorded on the edge of an agricultural dam in an area of heavy disturbance.
LT-PAD4	Located between structure E1 and structure E2, **Figure Heritage 16**.	PAD. No artefacts were observed, however, designation of this area as a PAD occurred for a number of reasons (see **Section 4, Appendix G Heritage)**.
LT-OS2 with PAD	Located between structure E3 and structure E4, **Figure Heritage 16**.	Open Site with PAD. Materials present were limited to basalt, dark quartzite and milk quartz. The recorded artefacts were weathered and many lacked the distinctive features of flakes such as negative flake scars. However, they were assessed as Aboriginal in origin; particularly as milk quartz was not naturally present in the landscape.

Site Designation	Location comments *Maps provided in Appendix G and at A3 scale in Volume 3, Section 4 of the EA	Description of site
LT-OS3	Located west of easement in the vicinity of structure E18, **Figure Heritage 17**.	Open site. Two artefacts were observed along the access track which had good visibility, Grey quartzite and milk quartz flake. It is possible that further artefacts may occur.
LT-PAD3	Located at structure E25, **Figure Heritage 18**.	PAD. No artefacts were observed, however, designation of this area as a PAD occurred for a number of reasons (see **Section 4, Appendix G Heritage).**.
LT-PAD2	Located between structure E96 and structure E97, **Figure Heritage 21**.	PAD. No artefacts were observed, however, designation of this area as a PAD occurred for a number of reasons (see **Section 4, Appendix G Heritage**).
LT-OS1 with PAD	Located between structure AP50 and structure E114, **Figure Heritage 22**.	Open Site with PAD. The exposed artefacts covered an area of 10m x 4m and displayed a medium-level density of over 10 artefacts per square metre. Preliminary counts indicate this site contains in excess of 25 artefacts with a range of raw materials present including milk quartz, grey quartzite and a grey, fine-grained volcanic stone.
LT-PAD1	Located near structure AP51, **Figure Heritage 23**.	PAD. Ground surface visibility was very variable with some portions of the PAD (the majority) having the ground surface completely obscured by long grass. Designated a PAD due to the suitable landform that it occupies and its proximity to other recorded sites such as LT-IF2 that is located some 400m to the south east.
LT-IF2	Located between structure E122 and structure E123, **Figure Heritage 23**.	Isolated Find. Milk quartz flake with fine platform without cortex on the platform.
LT-IF1	Located between structure E125 and structure E126, **Figure Heritage 23**.	Isolated Find. Flake of an unidentified grey, fine-grained stone with a faceted platform with 50% cortex on the platform.
LT-PAD5	This site is within the existing 132kV easement but west of the point where the proposed Tenterfield 330kV Substation takes the line to the north. The proposed 330kV alignment would not impact on this site and it is therefore not plotted on the **Appendix G Heritage,** Appendix 4 figures.	PAD. No artefacts were observed, however, designation of this area as a PAD occurred for a number of reasons (see **Section 4, Appendix G Heritage)**.
LT-ST1	This site is located well away from the ETL and does not appear on the maps in **Appendix G Heritage,** Appendix 4.	Modified Tree. The 15m tree is a dead (ringbarked) Blakely's red gum (*Eucalyptus blakelyii*) with a circumference at breast height of 1.72m and as such is of sufficient age to possess a cultural scar. The heartwood of the tree has rotted; the shape left is consistent with a Coolamon.
LT-ST2	This site is located well away from the ETL and does not appear on the maps in **Appendix G Heritage,** Appendix 4.	Modified Tree. The 10m tree is a dead (ringbarked) Blakely's red gum (*Eucalyptus blakelyii*) with a circumference at breast height of 2.2m and as such is of sufficient age to possess a cultural scar. The heartwood of the tree has rotted; the shape left is consistent with a Coolamon.

Note 1: TD-OS6 is incorporated into TD-OS20 with PAD and will not be registered as a separate site.

Access track surveys recorded 11 Aboriginal sites comprised of seven open sites and four isolated finds. The recorded sites are listed in **Table 10-3.**

Table 10-3 Aboriginal Sites Recorded During the Access Track Survey

Site designation	Location comments * Maps provided in Appendix G and at A3 scale in Volume 3, Section 4 of the EA	Description of Site
TD-OS14	Midway between AP1 and AP2. **Figure Heritage 1**	Open Site. Recorded artefacts were of a local dark chert (that was noted in the water courses adjacent to TD-OS14), quartz, quartzite and a fine-grained indurated mudstone. Artefact densities across the site were variable but ranged between low and low/moderate. Recordings included an axe blank, chert scrapper and a range of flakes.
TD-OS15	Between AP3 and AP4 on west bank of Beardy River. **Figure Heritage 1**	Open Site. Continuation of TD-OS4 with PAD. Recorded chert, quartz and quartzite flakes and a milk quartz core in low density (less than 1/m^2).
TD-OS16	North of proposed access to structure W32. **Figure Heritage 2**	Open Site. The site is ideally located between two ecosystems: the floodplain of the Black Creek billabong and the resources of the wooded hills. This, coupled with the range of artefacts recorded (axe, scrapper, core etc.) indicates that TD-OS16 is, or at least would have been prior to agricultural disturbances, a long term occupation site.
TD-IF10	Associated with TD-OS16. Access to structure W31. **Figure Heritage 2**	Isolated Find. TD-IF10 is a river cobble with an area of pitting at the centre of one of its two flat sides. This may provide evidence that the cobble was used as an anvil.
TD-IF11	Associated with TD-OS16. Access to structure W31**, Figure Heritage 2**	Isolated Find. TD-IF11 is a milk quartz core showing multi-directional use and four negative flake scars. It measures 37.06 x 30.01 x 17.31.
TD-OS17	Access to structure W37. **Figure Heritage 3**	Open Site. Over 30 Aboriginal artefacts were observed with the majority being made from milk quartz and fine-grained basalt. Artefact densities were in excess of 5 per square metre.
TD-OS18	Access to structure W45. **Figure Heritage 3**	Open Site. The site appears to be highly disturbed and the thin soils suggest that subsurface archaeological deposits are unlikely.
TD-OS20 with PAD	Access to structure W52. **Figure Heritage 3** (site extends from position shown to the position of TD-OS6)	Open Site. Artefacts at TD-OS20 with PAD display a variety of raw materials and include both unaltered flakes, as well as re-worked pieces such as axe blanks, backed blades and scrappers. Generally, however, it was noted that there was very little incidence of reworking on the flakes and that the large majority are un-reworked. The artefact density at TD-OS20 with PAD, as well as the types of artefacts recorded at the site, indicates that TD-OS20 was an occupational camp that appears to have been used over a long period of time.
TD-OS19 with PADz	Access to structure W145. **Figure Heritage 9**	Open Site. However, it was assessed that due to the relatively undisturbed nature of the site 'off-track' and evidence of soil depth that there is the likelihood of further undisturbed archaeological deposits to exist in association with TD-OS19.
TD-IF12	20m south of structure W164. **Figure Heritage 11**	Isolated Find. TD-IF12 is a basalt flake with a wide platform and three negative flake scars. It measures 35.17 x 37.22 x 9.09.
TD-IF13	Opportunistic survey of Washpool Creek Fire Trail. **Figure Heritage 14**	Isolated Find. TD-IF13 is a milk quartz flake with a moderate platform and two negative flake scars. It measures 35 x 25 x 12.

* TD-OS15 is incorporated into TD-OS4 with PAD and will not be registered as a separate site.

10.5.4 Sensitive archaeological landforms recorded

During the course of assessment, 11 locations were recorded as Sensitive Archaeological Landforms (SALs). SALs were recorded exclusively in study area east for the following reasons:

- the ground surface visibility was generally lower in study area east when compared with study area west (due to thick grass and leaf litter). Therefore more landforms of an archaeologically sensitive nature could not be accurately assessed;
- the level of disturbance was greater in study area east when compared with study area west. Therefore there was a greater reliance on designating a landform a SAL rather than a PAD (as a PAD designation implies *in situ* and undisturbed archaeological deposits); and
- the hydrology of study area east, with the presence of large river systems such as the Clarence and Richmond Rivers, provided a situation of generally high archaeological sensitivity combined with low ground surface visibility. In study area west where similar drainage systems exists, such as the Mole River, ground surface visibility allowed the area to be assessed more fully.

Table 10-4 provides the location of the SALs.

Table 10-4 Sensitive Archaeological Landforms Recorded in Study Area East

SAL designation	Location comments	Description of Site
LT-SAL8	Overlooking Sheep Yard Creek between AP40 and 41	Designation of this area as a SAL occurred for a number of reasons including, its proximity to permanent water and the location in a riparian zone, an environment well known to provide ample food resources.
LT-SAL9	On Sheep Yard Creek between AP40 and 41	Designation of this area as a SAL occurred for a number of reasons including, its proximity to permanent water and the location in a riparian zone, an environment well known to provide ample food resources.
LT-SAL10	On Sandy Creek, between AP40 and 41	Designation of this area as a SAL occurred for a number of reasons including, its proximity to permanent water and the location in a riparian zone, an environment well known to provide ample food resources.
LT-SAL11	Between AP41 and 42	Designation of this area as a SAL occurred for a number of reasons including, its proximity to permanent water and the landform (a slight foot slope adjacent to the drainage line) has potential as a camping site. However, more appropriate landforms were present in the immediate vicinity beyond the easement, and a site with PAD was subsequently recorded at one of these – LT-OS2 with PAD.
LT-SAL7	On Yellow Creek, between AP48 and 49	Designation of this area as a SAL occurred for a number of reasons, including, its proximity to permanent water and the combined impacts from land clearing and construction of the ETL results in the probability that soils would not possess subsurface *in situ* deposits.
LT-SAL6	On Plumbago and Yellow Creek, near AP 49	Designation of this area as a SAL occurred for a number of reasons, including, the locality is in the immediate vicinity of permanent water and deep incision of Yellow Creek adjoining the SAL PAD exposes cobbles of raw materials suitable for the manufacture of stone tools.
LT-SAL4	Near the Clarence River near AP50	Due to the proximity of LT-OS1 with PAD, the low ground surface visibility and the suitable landform (a raised area beside water), this area was designated a SAL. The area has been cleared of native vegetation and extensively grazed and any archaeological deposits in the area have probably been disturbed by such land-use.

SAL designation	Location comments	Description of Site
LT-SAL5	On the Clarence River near AP50	Due to the proximity of a major waterway, the extremely low ground surface visibility and the suitable landform (a raised area beside water), this area was designated a SAL. The area has been cleared of native vegetation and extensively grazed and any archaeological deposits in the area have probably been disturbed by such land-use.
LT-SAL2	Tunglebung Creek, near AP51	Designated a SAL while nearby, better positioned landforms, have been designated a PAD (LT-PAD1). There was extremely low ground surface visibility in the area.
LT-SAL3	Tunglebung Creek, near AP51	Due to grass cover, there was very little ground surface visibility but the nature of the landform including the proximity to a permanent watercourse necessitated that the area be treated with caution (hence its designation as a SAL).
LT-SAL1	West of AP60	The area was designated a SAL due to low ground surface visibility, the possibility of little soil depth (rock outcrops nearby) and its position in the middle of a favourable ecological zone.

10.5.5 Assessed significance of the recorded sites

Following the survey, sites were assessed for their cultural, scientific and public significance, as detailed in **Appendix G Heritage** and summarised below.

Cultural Significance

Conversations held with the representatives of the Registered Stakeholder groups determined that all site types are culturally significant to the Aboriginal community because they provide physical evidence of Aboriginal occupation of the local area. However, no sites recorded as part of this assessment were held to be highly significant as the site type and manifestation did not warrant such a high rating. Generally open sites and modified trees were held by the Aboriginal representatives as holding moderate-high cultural significance as they had manifest attributes that could be identified by present-day Aboriginals with the past presence of their people. Sites such as PADs, at the present stage of our knowledge, were seen as holding unknown cultural significance although this would change if future investigation demonstrated that cultural material was, in fact, present.

Scientific significance

The overall location of sites discovered during the current assessment conforms to the general archaeological settlement pattern that has already been established throughout the broader region. Only five sites, LT-OS1, TD-OS9, TD-OS17, TD-OS19 and TD-OS20, displayed artefact densities greater than one per square metre and none displayed artefact types or raw materials that were unusual or rare in the general vicinity. These facts diminish the scientific significance of many of the recorded sites as they are unlikely to substantially add to knowledge concerning Aboriginal occupation or ways of life in the region. The open sites recorded were in varying states of disturbance, which also limits their scientific significance.

Public Significance

All the recorded open sites (OS), isolated finds (IF) and potential archaeological deposits (PADs) located during the present survey were assessed as having low public significance due to their manifestations as low to moderately dense artefact scatters located on privately held land that makes them inaccessible to the general public. Sites such as these are difficult for the lay person to interpret or access. The modified tree sites were accorded low-moderate public significance as they are easier for the lay person to interpret, although being on private land, they are inaccessible for the public to visit.

Table 10-5 summarises the significance of the sites recorded during this assessment.

Table 10-5 Summary of Heritage Significance

Site Designation	Type of Site	Cultural Significance	Scientific Significance	Public Significance
LT-IF1	Isolated Find	Moderate	Low	Low
LT-IF2	Isolated Find	Moderate	Low	Low
LT-OS1 with PAD	Open Site with PAD	Moderate-High	Moderate	Low
LT-OS2 with PAD	Open Site with PAD	Moderate-High	Low	Low
LT-OS3	Open Site	Moderate-High	Low	Low
LT-PAD1	Potential Archaeological Deposit	Low	Unknown	Low
LT-PAD2	Potential Archaeological Deposit	Low	Unknown	Low
LT-PAD3	Potential Archaeological Deposit	Low	Unknown	Low
LT-PAD2	Potential Archaeological Deposit	Low	Unknown	Low
LT-PAD4	Potential Archaeological Deposit	Low	Unknown	Low
LT-PAD5	Potential Archaeological Deposit	Low	Unknown	Low
LT-ST1	Modified Tree	Moderate-High	Low	Low-Moderate
LT-ST2	Modified Tree	Moderate-High	Low	Low-Moderate
TD-IF1	Isolated Find	Moderate	Low	Low
TD-IF2	Isolated Find	Moderate	Low	Low
TD-IF3	Isolated Find	Moderate	Low	Low
TD-IF4	Isolated Find	Moderate	Low	Low
TD-IF5	Isolated Find	Moderate	Low	Low
TD-IF6	Isolated Find	Moderate	Low	Low
TD-IF7	Isolated Find	Moderate	Low	Low
TD-IF8	Isolated Find	Moderate	Low	Low
TD-IF9	Isolated Find	Moderate	Low	Low
TD-IF10	Isolated Find	Moderate	Low	Low
TD-IF11	Isolated Find	Moderate	Low	Low
TD-IF12	Isolated Find	Moderate	Low	Low
TD-IF13	Isolated Find	Moderate	Low	Low
TD-OS1	Open Site	Moderate-High	Low	Low
TD-OS2	Open Site	Moderate-High	Low	Low
TD-OS3 with PAD	Open Site with PAD	Moderate-High	Moderate	Low
TD-OS4 with PAD	Open Site with PAD	Moderate-High	Moderate	Low
TD-OS5 with PAD	Open Site with PAD	Moderate-High	Low-moderate	Low
TD-OS6	Open Site	See TD-OS20 with PAD*	See TD-OS20 with PAD	See TD-OS20 with PAD
TD-OS7	Open Site	Moderate-High	Low	Low
TD-OS8	Open Site	Moderate-High	Low	Low
TD-OS9 with PAD	Open Site with PAD	Moderate-High	Moderate	Low

Site Designation	Type of Site	Cultural Significance	Scientific Significance	Public Significance
TD-OS10	Open Site	Moderate-High	Low	Low
TD-OS11 with PAD	Open Site with PAD	Moderate-High	Moderate	Low
TD-OS12	Open Site	Moderate-High	Low-moderate	Low
TD-OS13	Open Site	Moderate-High	Low-moderate	Low
TD-OS14	Open Site	Moderate-High	Low-moderate	Low
TD-OS15	Open Site	See TD-OS4 with PAD*	See TD-OS4 with PAD	See TD-OS4 with PAD
TD-OS16	Open Site	Moderate-High	Low-moderate	Low
TD-OS17	Open Site	Moderate-High	Moderate	Low
TD-OS18	Open Site	Moderate-High	Low	Low
TD-OS19 with PAD	Open Site	Moderate-High	Moderate	Low
TD-OS20 with PAD	Open Site	Moderate-High	Moderate	Low
TD-ST1	Modified Tree	Moderate-High	Low	Low-Moderate
TD-ST2	Modified Tree	Moderate-High	Low	Low-Moderate
TD-ST3	Modified Tree	Moderate-High	Low	Low-Moderate
TD-ST4	Modified Tree	Moderate	Low	Low-Moderate
TD-ST5	Modified Tree	Moderate	Low	Low-Moderate
TD-ST6	Modified Tree	Moderate	Low	Low-Moderate
TD-ARG1	Aboriginal resource gathering site	Moderate	Low	Low-Moderate

10.6 Assessment of Impacts

Each of the sites recorded during the survey was categorised into one of four groups according to the criteria outlined in **Table 10-6**. The table includes all sites for the alignment, substations, switching station and access tracks.

Table 10-6 Potential impact on Site Groups

Group	Location and Potential Impact	Sites	Mitigation measures
Group A	Located within the easement close to structure locations and/or access tracks, or are located off the easement on the location of access tracks. These sites would be directly impacted by the proposed works and would require active management in the face of potential impacts.	LT-IF1, TD-IF7, LT-PAD1, LT-PAD2, LT-PAD3, TD-IF7, TD-IF9, TD-OS7, TD-OS9 with PAD, TD-OS13, TD-OS20 with PAD, TD-ST2, TD-ST3.	See **Section 10.7.2** below
Group B	Located either closely adjacent to the proposed easement or access track or are within the easement but would be spanned by the transmission line. These sites would be revisited by a qualified archaeologist to determine that the sites are, in fact, going to be avoided and the sites fenced off/flagged to ensure no inadvertent impact.	LT-IF2, LT-OS1 with PAD, LT-OS2 with PAD, LT-PAD4, TD-IF1, TDIF2, TD-OS2, TD-IF6, TD-IF8, TD-OS2, TD-OS11 with PAD, TD-ST5, TD-ST6	See **Section 10.7.3** below

Group	Location and Potential Impact	Sites	Mitigation measures
Group C	Generally located some distance, typically more than 50m from the proposed easement and do not require any management options at present.	LT-OS3, LT-PAD5*, LT-ST1, LT-ST2, TD-IF3, TD-IF4, TD-IF5, TD-IF13, TD-OS3, TD-OS8, TD-ST1, TG-ARG1, TD-ST4.	See **Section 10.7.4** below
Group D	Located in the vicinity of access tracks and may be directly or inadvertently impacted by the proposed works.	TD-IF10, TD-IF11, TDIF12, TD-OS1, TD-OS4 with PAD, TD-OS5 with PAD, TD-OS10, TD-OS12, TD-OS14, TD-OS16, TD-OS17, TD-OS18, TD-OS19 with PAD.	See **Section 10.7.5** below

*Note: LT–PAD5 is located where the OPGW would be replaced between Tenterfield 330kV Substation and Tenterfield 132kV Substation. The OPGW would require three work sites 4-5km apart to re-string the line. Measures to avoid this site would be incorporated into the AHHMP.

Potentially all sites recorded during the access tracks surveys could be impacted by the placement of the access track in their vicinity.

It is assumed that access tracks would be placed in their currently assessed location and would intersect with the site. However, a number of sites may be avoided by careful placement of the access tracks in the field.

As discussed in **Section 10.4.2,** the survey methodology designated a number of properties that should be assessed (including easement and access tracks). However, access was not granted for all of these properties. These locations are to be assessed when access is resolved. Any sites identified once access is granted would be subject to the same suite of management identified as part of the assessment.

10.7 Mitigation Measures

Appropriate management of cultural heritage items is primarily determined on the basis of their assessed significance as well as the likely impacts of the Project.

The management options are based on general principles, in terms of best practice and desired outcomes. There are two methods available to manage potential impact on sites:

- **Step 1:** where possible, impact would be avoided on known locations of sites during detailed design of the alignment and access tracks. A suitable curtilage around recorded sites would be determined in consultation with a heritage specialist and the sites would be fenced to ensure protection during the construction phase. Further specific mitigation measures would be developed as part of the Aboriginal and Historical Heritage Management Plan (AHHMP) for the Project and incorporated into a CEMP.
- **Step 2:** where impact is unavoidable, the AHHMP would be prepared and would include methods for the management of sites to be impacted. Local Aboriginal communities would be consulted regarding collection and relocation of artefacts.

The Project had been designed to avoid the majority of known Aboriginal sites (almost 80% of the recorded locations (based on 12 known impacts from 61 locations) have been avoided)

Project constraints prevent avoidance of every site and due to the nature and scale of the Project, each time a change is made to the impact footprint, this may either jeopardise previously avoided sites, or shift impacts into areas not previously assessed and therefore possibly containing other constraints.

10.7.1 Management of recorded sites and Potential Archaeological Deposits

As discussed above, as a result of the heritage assessment for the Project, 50 Aboriginal sites were recorded, as well as 11 sensitive archaeological landforms.

Of the 50 recorded sites:

- twelve are likely to be directly impacted by the Project;
- twelve would require mitigation measures to ensure their protection;
- thirteen sites would be outside Project impacts and do not require mitigation against inadvertent disturbance; and
- thirteen sites would be located in the vicinity of access tracks and may be impacted depending on the precise location of the access track (they would be avoided where possible).

For the purpose of site management in the face of potential impacts, sites have been grouped according to the anticipated impacts as a result of the Project. These management measures provide the basis for the draft Statement of Commitments.

10.7.2 Management of Group A

Group A sites are located within the easement close to structure locations and would require active management in the face of potential impacts during construction. This group can be further subdivided into three subgroups in terms of the management currently proposed.

Sub-Group A1: Artefact Collection

Sub-group A1 comprises three sites being, LT-IF1, TD-IF7, TD-IF9. The collection/relocation of artefacts is proposed at one location. As these sites are isolated artefacts which are located at the site of a structure or access track, they would be removed from impact to a safe place mutually agreed to by the Registered Stakeholders. This consultation would form part of the AHHMP.

Sub-Group A2: Salvage Excavation

Sub-group A2 comprises six sites being LT-PAD1, LT-PAD3, TD-OS7, TD-OS9 with PAD, TD-OS13, TD-OS20 with PAD. Salvage excavations are proposed at these six locations along the easement as these locations have all been assessed as having the potential to bear intact archaeological deposits. The exact number of pits would be refined at an individual site level based on the impacts at each structure. All salvage and recording works would be undertaken prior to the commencement of construction.

Sub-Group A3: Modified tree mitigation

Sub-group A3 comprises two sites being TD-ST2 and TD-ST3. These two sites are likely to be impacted by vegetation clearing within the easement. These sites would need to be re-inspected by both a qualified archaeologist and project engineer to determine if the sites can be avoided (i.e. the trees can be left standing). If the sites can be avoided, they would be temporarily fenced and appropriately sign posted before vegetation clearing takes place. If they are not able to be avoided and the trees need to be cut, then consultation with stakeholders would be undertaken regarding appropriate management measures. The final selection of the most appropriate management options would occur as part of the development of the AHHMP.

10.7.3 Management of Group B

Group B sites incur no direct impact from the proposed works. These sites are either located within the easement but would be spanned by the transmission line (LT-IF2, LT-OS1 with PAD, LT-OS2 with PAD, LT-PAD4, TD-OS11 with PAD, TD-IF1, TD-IF2, TD-OS2, TD-IF6, TD-IF8) or they are located in close proximity to the easement (TD-ST5 and TD-ST6). The following mitigations would form part of the AHHMP and would be undertaken for these sites:

- all Group B sites would be clearly identified on construction phase site plans and maps;
- all workers in the vicinity of these sites would be made aware of the site's location and informed that the sites are to remain undisturbed;
- sites LT-IF2, LT-OS1 with PAD, LT-OS2 with PAD, LT-PAD4, TD-IF1, TD-IF2, TD-IF6, TD-IF8, TD-OS2, TD-OS11 with PAD would be revisited by a qualified archaeologist prior to any disturbance within the easement to ascertain the location of the sites and to ensure site boundaries would be clearly fenced prior to commencement of construction works; and
- the boundary of the easement in the vicinity of TD-ST5 and TD-ST6 would be temporarily fenced in the vicinity of these sites during the construction phase to ensure that all personnel and vehicles remain within the assessed easement.

10.7.4 Management of Group C

Group C sites are located at least 50m from the boundary of the proposed easement. Therefore, no further management of these sites is required regarding the construction and maintenance of the easement.

10.7.5 Management of Group D

Group D sites potentially could be impacted directly or inadvertently by the placement of the access tracks. In some instances, these impacts could be avoided by re-routing access tracks around the Group D sites. In most cases, the re-routing of access tracks 100m from the designed location could avoid a site altogether.

Where a re-routed access track passes through un-surveyed land, this land would be visited by a qualified archaeologist and a representative of the Aboriginal community stakeholder groups prior to construction, to confirm the avoidance of aboriginal sites. Subject to design and landowner considerations, significant aboriginal heritage constraints would be avoided wherever possible. If the sites cannot be avoided by the access tracks, management strategies would be developed as part of the AHHMP and implemented during construction.

Sub-group D1: Sites requiring a surface collection of artefacts

If the site cannot be avoided by the access track, and the site has been assessed as holding low scientific significance, a recording and collection of surface artefacts would take place. The artefacts collected would be recorded in a report to preserve the findings.

Sub-group D2: Sites requiring salvage excavation

If the site cannot be avoided by the access track, and they are expected to have either subsurface deposits or low-moderate scientific significance, then limited salvage excavation would take place in the direct impact footprint of the access track to determine the nature of these deposits.

10.7.6 Management of Sensitive Archaeological Landforms

The following management protocols would form the basis of management of the SALs and would be included in the AHHMP.

Step 1: ground disturbing works, placement of work compounds, placement of re-fuelling areas, parking of vehicles and placement of access tracks would be avoided where possible within the identified SALs.

Step 2: if avoidance is not possible:

- SALs would be identified on site plans and maps;
- work would be designed to limit impact to the area of the SAL as much as practical;
- induction training would include Cultural Awareness Training for anyone working in an area of SAL (including printed information to aid the recognition of Aboriginal cultural material) and training records would be kept;
- flagged access tracks would be used through SALs to limit vehicle movement to one corridor; and
- should Aboriginal relics be uncovered, then work would cease and advice sought from a suitably qualified archaeologist on how to best to proceed.

10.7.7 Management of properties yet un-assessed

Areas modelled as having moderate to high archaeological sensitivity (alignment survey)

There are a small number of properties, where the survey methodology (as part of desktop assessments) designated that survey should take place. However, access was not made available to the survey team. These properties would be surveyed when access is resolved. As these properties contain areas of archaeological potential, they may contain additional sites. Any sites identified once access is granted would be subject to the same suite of management recommendations as outlined in **Appendix G Heritage**.

Areas modelled as having low archaeological sensitivity (alignment survey)

Approximately 44% of the total easement area has not been assessed as it was designated in the survey methodology to hold low archaeological potential. However, it is possible that cultural material exists in areas that have not been assessed. Therefore, the following management options are proposed to be adopted:

- heritage sites would be identified on site plans and maps;
- all construction crews would be informed of the possibility of encountering items of cultural heritage during the course of their work;
- induction would include printed material to enable work crews to better recognise major sites that could be encountered; and
- if any items of cultural heritage are uncovered, then work would cease in the area of the find and advice sought from a suitably qualified archaeologist on how best to proceed.

Areas modelled as having archaeological sensitivity (access tracks survey)

There are a number of properties (approximately 3% of the total area) where the survey methodology (as part of desktop assessment) identified that survey should take place. However, access was not made available to the survey team. These properties would be surveyed when access is resolved. Any sites identified once access is granted would be subject to the same suite of management recommendations as outlined in this report.

10.8 Draft Statement of Commitments

Table 10-7 details the mitigation measures and commitments proposed for Indigenous heritage management.

Table 10-7 Draft Statement of Commitments – Indigenous Heritage

Mitigation Measure and Commitment		Implementation		
		Design	Construction	Operation
E1	Those properties modelled as having moderate to high archaeological sensitivity that could not be appropriately surveyed prior to completion of the EA due to access restrictions would be surveyed before construction activities commence. This survey work would be accordance with the approach outlined in the Heritage Assessment (refer to **Appendix G Heritage**).	✓	✓	
E2	The location of access tracks would take into account the recorded historic heritage sites as shown in the Heritage Assessment	✓	✓	
E3	An Aboriginal and Historic Heritage Management Plan (AHHMP) would be developed and would include the management of sites as presented in the Heritage Assessment.	✓	✓	
E4	The construction team would undergo site induction concerning Aboriginal and historic heritage issues, prior to working on the site		✓	
E5	A suitable curtilage around each recorded site would be determined so as to ensure its protection during construction		✓	
E6	If ground disturbing works or vehicle access is required in any area designated a Sensitive Archaeological Landform (SAL), recommendations outlined within the Heritage Assessment pertaining to SALs would be followed		✓	
E7	Should any previously unidentified Aboriginal objects or sites be uncovered during the course of construction, work in that area would cease and DECCW would be informed to seek advice on howto best proceed. If burials are uncovered, the NSW police would be informed immediately. Should the remains be then identified as archaeological in context, DECCW would be informed and consulted to clarify how to best proceed		✓	

11 Non-Indigenous Heritage

11.1 Introduction

This chapter provides a summary of the Non-Indigenous heritage assessment undertaken to address DGRs by DoP. A full copy of the assessment is provided in **Appendix G Heritage**.

11.2 Legislation

Non-Indigenous heritage is managed by a number of State and National statutes. The following section summarises the legislative requirements in relation to the Project.

No State or Nationally listed items are to be impacted by the Project.

The Project is governed by Part 3A of the *Environmental Planning and Assessment Act* 1979 (EP&A Act). Consequently, once planning approval has been granted, no approvals are required to move, damage or destroy a relic and no permits are required to excavate a relic that is likely to result in that relic being discovered, exposed, moved, damaged or destroyed under the Heritage Act. However, the management of heritage items and relics are to be regulated through the conditions of project approval, which includes the draft Statement of Commitments (outlined in **Chapter 19 Draft Statement of Commitments**) and a heritage management plan (to form part of a wider Aboriginal and Historic Heritage Management Plan (AHHMP)).

11.2.1 Commonwealth Legislation

Environmental Protection and Biodiversity Conservation Act 1999

Amendments in 2003 established the National Heritage List and the Commonwealth Heritage List, both administered by the Commonwealth Department of the Environment, Water, Heritage and the Arts (DEWHA, now the Department of Sustainability, Environment, Water, Population and Communities (SEWPAC)). Ministerial approval is required for proposals involving significant impacts to National/Commonwealth heritage places. Additionally, the Australian Heritage Council maintains the Register of the National Estate (RNE).

No heritage places or sites within the study area are regulated by the EPBC Act.

Australian Heritage Council Act 2003

This Act establishes the Australian Heritage Council as an independent advisory body regarding National/Commonwealth heritage places and mandates the Council to maintain the Register of the National Estate (RNE) to promote the assessment and conservation of heritage items. There are no items listed under the RNE within the study area.

11.2.2 State Legislation

Heritage Act 1977

This Act establishes the Heritage Council of NSW to assess proposals involving modification to heritage items or places listed on the State Heritage Register.

Where an item that is the subject of an interim heritage order or listing on the State Heritage Register is likely to be moved, damaged or destroyed an approval is required under the *Heritage Act* 1977 (Heritage Act). A permit is also required to excavate land where it is likely to result in a relic being discovered, exposed, moved, damaged or destroyed. Part 3A of the *Environmental Planning and Assessment Act 1979* exempts the need for the Applicant to apply for an approval or an excavation permit under the Heritage Act. The draft Statement of Commitments requires TransGrid to undertake works in a manner that avoids, protects and preserves heritage items where possible.

11.3 Assessment Methodology

11.3.1 Baseline Surveys

A desktop assessment was undertaken during the non-Indigenous Heritage review (**Appendix G Heritage**). The following databases were searched as part of the desktop study:

- Australian Heritage Database;
- The NSW Heritage Office State Heritage Register and State Heritage Inventory;
- DEWHA, now SEWPAC, Protected Matters (EPBC Act) Database;
- Local Environment Plans for Inverell, Tenterfield, Kyogle, Richmond Valley and Lismore LGAs; and
- S170 RTA Heritage and Conservation Register.

No heritage items were identified from the database searches that were likely to be impacted by the Project.

The field surveys for both the indigenous heritage assessment and the non-indigenous heritage assessment were conducted at the same time and are described in **Chapter 10 Indigenous Heritage** and **Appendix G Heritage**.

11.3.2 Assessment of Significance

Significance assessment of historic sites was conducted in accordance with the Heritage Act and guided by the Heritage Council of NSW manual *Assessing Heritage Significance* (2001). The significance assessment process included the following steps:

- Step 1: Investigate significance;
- Step 2: Assess significance; and
- Step 3: Manage significance.

Significance assessments were carried out in accordance with the Australian ICOMOS Burra Charter (Australia ICOMOS, 1999) and the Heritage Council of NSW guidelines (2001).

On the basis that decisions about the future of heritage items must be informed by an understanding of these items' heritage values. Four categories of heritage value are recognised in the Australia International Council on Monuments and Sites' Burra Charter (Australia ICOMOS, 1999):

- historic significance;
- aesthetic significance;
- scientific significance; and
- social significance.

Under the Heritage Council of NSW guidelines (2001), these values have been adjusted to conform to seven criteria for assessment:

- Criterion (a): An item is important in the course, or pattern, of NSW's cultural or natural history (or the cultural or natural history of the local area);
- Criterion (b): An item has strong or special association with the life or works of a person, or group of persons, of importance in NSW's cultural or natural history (or the cultural or natural history of the local area);
- Criterion (c): An item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW (or the local area);
- Criterion (d): An item has strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons;
- Criterion (e): An item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area);
- Criterion (f): An item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history (or the cultural or natural history of the local area);
- Criterion (g): An item is important in demonstrating the principal characteristics of a class of NSW's cultural or natural places; or cultural or natural environments.

These criteria are therefore used to help understand the 'value' of a particular heritage item.

In addition to value, items are categorised as having Local or State levels of significance. The level of significance is assessed in accordance with the geographical extent of the item's value. An item of State significance is one that is important to the people of NSW whilst an item of Local significance is one that is principally important to the people of a specific LGA.

In addition to the two levels of Local or State level significance, items were assessed as having one of the following grades of significance (Heritage Office of NSW, 2001):

- Exceptional: an item whose elements are rare or outstanding and contribute directly to its heritage value;
- High: an item that retains a high level of original fabric and where the significance is not reduced by alterations;
- Moderate: an item whose elements are not themselves of heritage value but which contribute to the overall significance of the item; contains alterations and modifications;
- Low: an item that is difficult to interpret and whose altered/modified elements detract from significance; or
- Intrusive: an item whose elements damage its heritage value.

Thus, an item may be said to hold High State significance if it satisfies one or more of the above criteria, is important to the people of NSW as a whole and retains most of its original fabric.

11.4 Existing Environment

11.4.1 Survey Results

No heritage items were identified from the database searches that were likely to be impacted by the Project. Eight historic sites were identified during the course of the alignment surveys, and one site was identified as part of the access track surveys. **Table 11-1** presents the location details for these sites.. Maps showing the location of these sites are provided in **Appendix G Heritage** and at A3 scale in **Section 4**, **Volume 3** of the EA.

Table 11-1 Historic Sites Recorded During the Alignment Surveys

Site Reference	Figure Reference	Comments
TD-HS01	**Appendix G Heritage,** Appendix 4**, Figure Heritage 2**.	Structure Post and rail Post and rail House ruins
TD-HS02	**Appendix G Heritage,** Appendix 4**, Figure Heritage 11**	Collapsed Sheppard's hut
TD-HS03	**Appendix G Heritage,** Appendix 4**, Figure Heritage 11**	Fence posts associated with TD-HS02
TD-HS04	**Appendix G Heritage,** Appendix 4**, Figure Heritage 12**	House ruin
TD-HS05	**Appendix G Heritage,** Appendix 4**, Figure Heritage 13**	Ruined tobacco drying shed
TD-HS06	**Appendix G Heritage,** Appendix 4**, Figure Heritage 13**	Sheppard's hut ruin
TD-HS07	**Appendix G Heritage,** Appendix 4**, Figure Heritage 14**	WWII dry stone wall
TD-HS08	**Appendix G Heritage,** Appendix 4**, Figure Heritage 14**	WWII dry stone wall
LT-HS01	**Appendix G Heritage,** Appendix 4**, Figure Heritage 16**	Modified tree. Located approx. 2m off the access track to Structure E3

Full details of each of these sites can be found in **Appendix G Heritage**.

11.4.2 Discussion

The majority of historic items recorded as part of this assessment are representative of a broad collection of items located across the region. The majority of sites are ruined farm houses and their related infrastructure (TD-HS01, TD-HS02, TD-HS-03, TD-HS04 and TD-HS06). While interesting on a local level, these sites are replicated frequently across rural Australia and none of the sites recorded here displayed features such as uniqueness or intactness. They are not assessed as contributing greatly to an understanding of the region's history. All house sites are heavily ruined and are not obvious manifestations in the landscape.

TD-HS05 is a ruined tobacco drying barn. While more intact examples of this item exist in the general vicinity, these sheds represent historic agricultural practices to those practiced in the region today. TD-HS05 also displays local building techniques in the hand-hewn logs used in its construction.

TD-HS07 and TD-HS08 are two dry-stone walls perhaps used during military exercises in World War Two. It was impossible to determine a construction date for the walls by inspection.

11.5 Assessment of Impacts

Nine Historic sites were recorded as a result of the current assessment. **Table 11-2** summarises the assessment of significance of each recorded historic site according to the seven criteria set out in **Section 11.3.2**.

Table 11-2 Assessment of Significance for the Recorded Historic Sites

Site	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F	Criterion G
TD-HS01	No	No	No	No	No	No	No
TD-HS02	No	No	No	No	No	No	No
TD-HS03	No	No	No	No	No	No	No
TD-HS04	No	No	No	No	No	No	No
TD-HS05	No	No	No	No	**Yes**	**Yes**	No
TD-HS06	No	No	No	No	No	No	No
TD-HS07	**Yes**	No	No	No	No	**Yes**	No
TD-HS08	**Yes**	No	No	No	No	**Yes**	No
LT-HS01	No	No	No	No	No	No	No

As can be seen in **Table 11-2**, only TD-HS05, TD-HS07 and TD-HS08 satisfy any of the criteria set out to assess heritage significance.

All of the recorded sites are either located outside of the proposed easement, or on the very extremity of the easement.

Those sites recorded away from the easement (TD-HS02, TD-HS03 and TD-HS04) would not be impacted by the Project and would be left in situ. The sites would be avoided during the final design of access tracks.

The proximity of the Project to the remaining sites (TD-HS01, TD-HS05, TD-HS06, TD-HS07, TD-HS08 and LT-HS01) means that appropriate mitigation measures would be employed to avoid impacts. These are discussed below.

11.6 Mitigation Measures

Table 11-3 outlines the management options that would be required to mitigate any impact the Project may have on sites TD-HS01, TD-HS05, TD-HS06, TD-HS07, TD-HS08 and LT-HS01.

Table 11-3 Management of Potentially Impacted Sites

Site	Management Options
TD-HS01	Located adjacent to the access track to structure W36. The site would be avoided by the access track and the site temporarily fenced for the duration of construction work in its vicinity.
TD-HS05	Located off-easement to the south west. The boundary of the easement in the vicinity of the site would be fenced and avoided.
TD-HS06	Located off-easement to the north. The boundary of the easement in the vicinity of the site would be fenced and avoided.
TD-HS07	Located on the southern edge of the easement. Spanned by proposed structures. The site would be fenced to avoid inadvertent damage.
TD-HS08	Located on the southern edge of the easement. Spanned by proposed structures. The site would be fenced to avoid inadvertent damage. Where practical access tracks would be located on the northern side of the easement in the vicinity of the site.
LT-HS01	Located adjacent to an access track to structure E3. The site would be fenced and signed for the duration of construction and where possible, it would be avoided by access tracks.

Should workers employed during the construction phase of the Project notice any further historic relics during the course of their work, work would cease in that area and the NSW Heritage Office be consulted on how to best proceed.

Provided measures listed above are followed, the Project is not expected to have any impacts on non-indigenous heritage.

11.7 Draft Statement of Commitments

In order to mitigate any impacts on sites of non-indigenous heritage value, the following management and mitigation strategies would be implemented.

Table 11-4 Draft Statement of Commitments – Non - Indigenous Heritage

Mitigation Measure and Commitment		Implementation		
		Design	Construction	Operation
E9	The location of access tracks would take into account the recorded historic heritage sites as shown in the Heritage Assessment.	✓	✓	
E10	An Aboriginal and Historic Heritage Management Plan (AHHMP) would be developed and would include the management of sites as presented in the Heritage Assessment.	✓	✓	
E11	An appropriate curtilage would be delineated around any identified historic heritage locations to ensure no inadvertent impacts occur. Should any previously unidentified archaeological finds (historic heritage) or evidence be uncovered during the course of construction, work in that area shall cease and advice obtained from the NSW Heritage Office on how to best proceed.		✓	

12 Visual Assessment

12.1 Introduction

The DGRs for the Project require an assessment of its visual impacts including the following aspects:

- impact on local and regional views by transmission lines and substations;
- impacts on the values of adjacent wilderness area; and
- alternative pole designs should be presented and assessed and the potential for undergrounding in sensitive locations should also be assessed.

A visual impact assessment has been undertaken and the full report can be found in **Appendix H Visual Assessment**. This chapter summarises that report. **Appendix H Visual Assessment** and **Chapter 2 Project Need and Alternatives (Section 2.5.2)** address these DGRs.

12.2 Existing Environment

12.2.1 Visual Character

The majority of the landscape along the alignment supports rural and semi rural activities, and includes areas of timbered wilderness as well as small rural townships and larger urban conurbations. The alignment would cross a number of regional roads in the area including the Bruxner Highway, New England Highway, Mount Lindesay Highway and the Summerland Way. The alignment would also cross a number of unsealed roads and access tracks leading to farms and private residential properties.

Plates 5 - 30 (labelled **P1 to P26**) in **Section 5.1** of **Appendix H Visual Assessment** illustrate the landscape character within and surrounding portions of the proposed transmission line through the west and east alignments.

12.2.2 View Catchment

The potential view catchment is the extent to which the proposed transmission line would be visible from surrounding areas. Identification of the view catchment considers the character of the landscape, landform and existing structural elements with regard to their potential for localised visual screening effects.

The view catchment has been determined within a one kilometre offset from each side of the transmission line and a 1km radius around each of the substations/switching station. Beyond which the views may have a greater tendency to be screened by undulating landform or the presence of vegetation for portions of the alignment. It is also considered that whilst the Project would be noticeable from areas beyond a 1km distance, the transmission line itself, as the largest part of the Project, is unlikely to appear as a dominant visual element within the landscape beyond this distance.

It is accepted that views toward the Project could, in some situations, be blocked by buildings, vegetation or local landform features at specific points within the 1km offset, and similarly glimpses of the proposed transmission line could be available from isolated positions outside the view catchment area.

12.2.3 Visual Absorption Capability (VAC)

VAC is a classification system used to describe the relative ability of the landscape to accept modifications and alterations without the loss of landscape character or deterioration of visual amenity. The VAC is one of several criteria that are considered in combination to determine a visual impact rating for the surrounding receptor locations.

VAC relates to physical characteristics of the landscape that are often inherent and often quite static in the long term. Given the extent and combination of existing natural and cultural character along the route of the alignment, the capability of the landscape to absorb the Project is primarily dependent upon vegetation cover and landform.

For the purpose of this environmental assessment, the VAC ratings have been determined as:

- **High** - the Project would be extensively screened by surrounding vegetation and undulating landform.
- **Medium** – the Project would be visible but existing vegetation and surrounding landform would provide some screening or background to reduce visual contrast.
- **Low** - the Project would be highly visible either due to lack of screening by existing vegetation or surrounding landform (e.g. open flat farmland cleared of vegetation, or steep hillside crossing ridgeline).

The determination of the VAC assessment is illustrated in **Figures 2** to **12** of **Appendix H Visual Assessment**. This assessment found that 53% of the alignment was considered to have a High VAC, 40% had a medium VAC and 7% had a low VAC.

12.3 Assessment Methodology

12.3.1 Introduction

The primary objective of the assessment was to determine the likely visual impact of the Project on people living and working in, or travelling through, the surrounding areas.

The assessment involved an evaluation of the visual landscape character along, and surrounding, the proposed alignment together with an assessment of the potential visual impact that may result from the construction and operation of the Project.

The visual assessment methodology adopts the principles outlined in the *Guidelines for Landscape and Visual Impact Assessment* (The Landscape Institute and Institute of Environmental Management and Assessment, 2002). The methodology comprised the following activities:

- desktop study addressing visual character of the proposed alignment and immediate surrounding area;
- site inspection and fieldwork;
- assessment of visual impact; and
- determination of the visual impact rating.

12.3.2 Desktop Study

A desktop study was carried out to identify the potential view catchment of the Project. This was undertaken by reference to 1:25,000 topographic maps as well as aerial photographs of the alignment and immediate surrounding areas.

The desktop study identified the visual character of the surrounding landscape including features such as the site context, landform and elevation. The desktop study also identified and mapped a number of potential receptor locations from which the Project may be visible.

Although it was not feasible to assess each and every view that may exist toward the Project, the desktop study did seek to identify and assess key receptor locations, including views from residences and road corridors. The receptor locations in proximity to the Project are shown in **Figures 13 to 23** of **Appendix H Visual Assessment.**

12.3.3 Fieldwork

The fieldwork involved:

- a detailed site inspection to determine the potential extent of visibility of the Project;
- verifying the various receptor locations from which the Project could potentially be visible; and
- preparation of a photographic and written record.

12.3.4 Assessment of Visibility and Visual Impact

The potential visibility of the Project is largely dependent on a number of criteria that include:

- the extent to which the Project structures would be visible from surrounding areas; and
- the degree of visual contrast between the Project structures and the capability of the surrounding landscape to visually accommodate the Project.

The overall visual impact is generally determined by a combination of factors including:

- the category and type of situation from which people may view the Project (e.g. resident, motorist or from a wilderness/recreational location);
- the number of people with a view toward the Project from any one view location;
- the distance between the receptor and the Project; and
- the duration of time that the receptor may view the Project.

An underlying rationale for the visual assessment is that if people are not recorded as having permanent residency at a particular building identified during desktop and field surveys, or if views toward the Project are screened, then there is likely to be a nil visual impact at that location. Further information regarding Visual Impact Assessment can be found in **Section 6.1** of **Appendix H Visual Assessment**.

12.3.5 Visual Impact Rating

The visual impact rating is the level of impact the Project would have from receptor locations. The overall potential visual impact rating was determined by considering the combined outcomes of visibility for each receptor location together with the VAC of the landscape within which the receptor is located. The visual impact rating is expressed as a rating of High, Moderate, Low or Nil, as follows:

- **High** – The construction of the Project may result in a very prominent physical change to the landscape, and includes the potential for proximate views toward extensive portions of the Project from sensitive receptor locations.
- **Moderate** – The construction of the Project may result in a noticeable physical change to the landscape although the Project would not appear to be substantially different in scale and character to the existing landscape from surrounding receptor locations.
- **Low** – The construction of the Project is unlikely to result in a prominent change to the landscape and views from surrounding receptor locations toward the Project may be difficult to distinguish from elements within the surrounding landscape.
- **Nil** – The construction of the Project would not create a noticeable change to the landscape and is unlikely to result in views toward the Project from surrounding receptor locations.

It should be noted that all residential dwellings identified through the desk top assessment of aerial photographs and mapping were assessed during the field work study. However, the visual assessment field work was undertaken from publicly accessible locations only. It is therefore possible that additional residential receptors may be identified once further access onto private property is obtained. Should additional receptor locations become known, these would be considered and assessed following exhibition of the EA.

12.4 Assessment of Impacts

12.4.1 Transmission Line Assessment

A total of 147 potential residential receptor locations were identified through the desk top aerial photograph and mapping study although one of these locations was determined to be unoccupied during the fieldwork study. An assessment of the Visual Impact Rating for each residential receptor determined that:

- 27 of the 147 (18%) view locations have been determined to have a NIL visual impact rating;
- 112 of the 147 (76%) view locations have been determined to have a LOW visual impact rating;
- 6 of the 147 (4%) view locations has been determined to have a MODERATE visual impact rating; and
- 2 of the 147 (2%) view locations have been determined to have a HIGH visual impact rating.

R12 and R18 residential receptor locations (as shown on **Figure 16** of **Appendix H Visual Assessment**) were determined to have a high visibility rating. R12 has potential views east to north east towards the Project, extending approximately 1 to 1.5km along the alignment. R18 has potential views west to north east towards the Project, extending approximately 1 to 1.5km along the alignment.

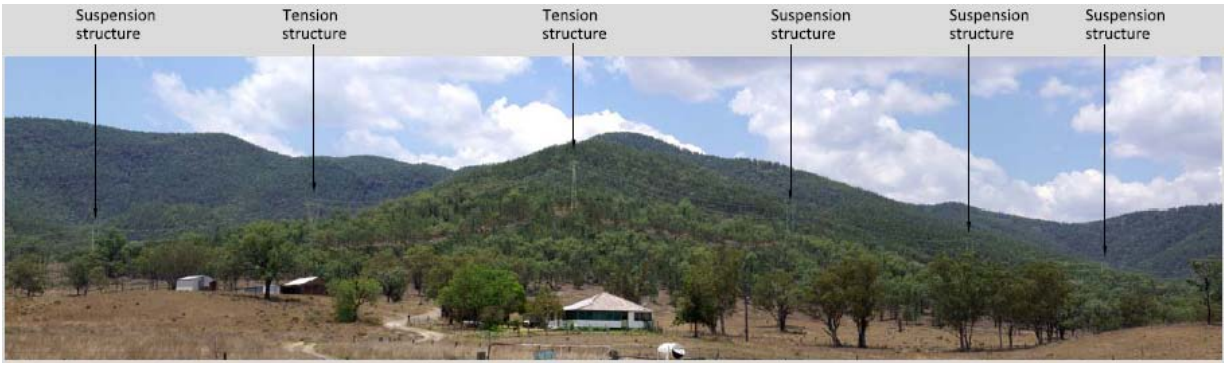
The visual assessment also considered potential visual impacts for motorists and rail passengers at 19 locations. The visual assessment determined that the potential visual impact for motorists and rail passengers travelling along local roads, main highways and portions of railway lines would be low. For motorists, the determination of a low visibility rating generally results from a combination of the very short period of view available from vehicles travelling at the permitted road speeds (generally between 80 and 100 kilometres per hour on the main roads and highways) and the partially restricted view beyond the majority of the road corridors due to roadside tree planting or tree cover.

The visual assessment also considered the visibility of the transmission line from a number of public recreation and conservation areas that include Wilderness Areas, National Parks, State Conservation Areas and State Forests (**Figure 1** of **Appendix H Visual Assessment)**. Some of these areas offer a range of recreational activities such as camping, bushwalking and four wheel drive facilities. It was determined there would be a nil visibility rating from most of these areas due to topography and vegetation except for the Girard State Forest which had a low visibility rating. In this location the transmission line would follow the alignment of the exiting 132kV transmission line which is generally screened from camping and day use areas within the State Forest.

The determination of visibility ratings for receptor locations along the alignment east has taken into account circumstances where views toward the existing 132kV transmission line structures would be replaced by views toward the proposed 330kV transmission line. The determination of visibility ratings also acknowledges the fact that the 330kV transmission line supporting structures would be capable of spanning greater distances than the existing 132kV transmission line and that there would be an overall reduction in the number of visible supporting structures along the alignment east.

The location of residential receptors as well as the main sealed road and rail corridors crossing the alignment are shown in **Figures 13** to **23 Appendix H Visual Assessment**. A series of photomontages has also been produced for a number of locations along the alignment. The photomontage locations are listed in **Section 8.1** and shown in **Figures 2** to **12** of **Appendix H Visual Assessment**. The photomontages themselves can be found in **Figures 24** to **33** of **Appendix H Visual Assessment**. **Figure 12-1** below provides an example photomontage, showing the proposed view from the Bruxner Highway (Alignment West).

Figure 12-1 Proposed View South from the Bruxner Highway (Alignment West)



Minimising visual impact has been considered in the design of structures for this Project. Options for the designs are detailed in **Chapter 2 Project Need and Alternatives** and **Chapter 4 Project Description**. Suspension structures would predominately be H-frame arrangements with an average height of 30m. Tension structures would be rectangular or square based steel lattice towers with typical tower heights ranging from 25m to 37m[1]. These are a heavier construction than suspension structures and would typically only be used at Angle Positions and where engineering requirements dictate the use of a more robust support structure.

The option of placing the transmission lines underground has been addressed in **Section 2.5.2** of **Chapter 2 Project Need and Alternatives** of the EA.

12.4.2 Tenterfield 330kV Substation Assessment

The main visual components of the Tenterfield 330kV Substation would likely comprise:

- a single storey control building;
- a sealed access road;
- various switch bays and transformers;
- a communications pole;
- lightning masts;
- water tank;
- lighting for security and maintenance;
- security fencing including a 3.2m high palisade fence and internal chainmesh fence; and
- landscape works including tree, shrub and groundcover planting.

The Tenterfield 330kV Substation may be visible from a small number of residences located on high ground to the south of the proposed site (at a distance of around 1.5 to 2km). However the visibility rating has been determined as Low for all of these residences i.e. R31 and R31a (refer to **Sections 6.2** and **8.3** in **Appendix H Visual Assessment**). Similarly views from the Bruxner Highway are likely to be for a short duration and would be potentially screened by scattered tree cover alongside the road corridor. **Figure 12-2** provides a photomontage for the proposed Tenterfield 330kV Substation (please note this does not show final landscaping design).

[1] The last two tension structures coming into Lismore Substation would be structures that support both the 132kV and 330kV lines. The height of these structures would be between 46m – 54m.

Figure 12-2 Photomontage of the proposed Tenterfield 330kV Substation

12.4.3 Other Project Components

Works associated with the upgrade of the existing Dumaresq and Lismore Substations are unlikely to result in any significant additional visual impact on surrounding receptor locations as all works are within the existing footprint. Equally there are no anticipated significant visual impacts associated with the establishment or maintenance of transmission line access tracks.

12.5 Mitigation Measures

The visual assessment determined that the construction of the Project would generally not result in any significant visual impacts on the majority of views from residential receptors, road and rail corridors near, approaching or passing beneath the transmission line. Nevertheless, mitigation measures outlined in this report would assist in minimising the potential visual impact of the Project.

Minimising visual impact and avoidance of sensitive receptors was an objective of the route selection process undertaken to determine the proposed alignment. Wherever possible, angle positions have been selected and placed in strategic locations to minimise potential visual impact (e.g. avoiding, where possible, skyline views) and to provide a maximum setback from residences and roads.

Where practical, the tension and support structures would be finished with a colour that would reduce the contrast between the structures and the overall rural and agricultural background views along the majority of the alignment. Where possible, conductors and insulators would incorporate materials with low reflective properties to reduce any visual impacts.

During construction, care would also be taken when handling soil and other spoil to ensure that worksites do not impact the visual amenity of the surrounding area.

Where high visual impacts have been identified for residents, priority would be given for visual screening or other relevant mitigations, in consultation with affected residents. Planting may be located between the receptor and transmission line, or located beyond the transmission line to form a backdrop against which the transmission line may be viewed. These treatments would require individual site assessment to achieve maximum screening benefits and would be a long term measure.

The Tenterfield 330kV Substation would generally be screened from surrounding view locations, including views from the Bruxner Highway, by a combination of undulating landform and tree cover. Distant views from a small number of residences to the south west of the proposed substation are likely to be mitigated in the medium term by existing wind break planting.

12.6 Draft Statement of Commitments

Overall the Dumaresq to Lismore 330kV transmission line and the Tenterfield 330kV Substation would generally have a low visual impact on the majority of people travelling through and residing in areas surrounding the transmission line and substation, and would not represent an unacceptable level of change to the existing landscape.

Table 12-1 Draft Statement of Commitments – Visual Assessment

Mitigation Measure and Commitment		Implementation of mitigation measures		
		Design	Construction	Operation
F1	A careful and considered route selection process has been undertaken to avoid sensitive receptors and the loss of existing vegetation wherever possible. Angle positions have been selected and placed in strategic locations to minimise potential visual impact (e.g. avoiding, where possible, skyline views) and to provide a maximum setback from residences and roads.	✓		
F2	Selection of suitable component materials and colour treatment with low reflective properties would be undertaken as part of the transmission line and substation structure detailed design.	✓		
F3	Material and plant storage and maintenance areas would be selected to minimise visual impact and would take into consideration visibility from residences and road	✓	✓	
F4	Where requested and identified by TransGrid as feasible, strategic tree or shrub planting would be undertaken between receptor locations and transmission line and substation structures		✓	

13 Traffic and Transportation

13.1 Introduction

This chapter addresses the traffic related impacts associated with the construction and operation of the Project as prescribed in the DGRs. Impacts on traffic volumes and road conditions are considered and assessed.

13.2 Assessment Methodology

This traffic and transport assessment was conducted as a desktop analysis using aerial photography and topographic information. Traffic count data for relevant locations along classified roads was obtained from the NSW Roads and Traffic Authority (RTA) database. Traffic generation during the construction and operational phases of the Project was estimated based on construction vehicle volumes and operational activities provided by TransGrid. These traffic generation estimates were applied to existing traffic volumes to determine the proportional increase arising as a result of the Project. For the purpose of this assessment, it is assumed that the alignment, access tracks and substations would predominantly be accessed via existing main roads in the locality including the Bruxner Highway and the New England Highway.

13.3 Existing Environment

The surrounding road network is dominated by the Bruxner Highway (State Highway Number 16) and the New England Highway (State Highway Number 9), which are classified RTA roads. The existing road network and the location of the 330kV transmission line, access tracks and substation/switching station works are shown in **Section 2** of **Volume 3** of this EA.

Bruxner Highway

The Bruxner Highway is approximately 420 kilometres (km) in length, and runs from the Pacific Highway, approximately seven kilometres west of Ballina, to the Newell Highway at Boggabilla. The Bruxner Highway is a key corridor serving the developing areas of Ballina, Alstonville, Wollongbar and Lismore. As illustrated in **Table 13-1**, west of Casino, traffic volumes on the Bruxner Highway decrease significantly.

Between the New England Highway and the Tenterfield Local Government Area (LGA) boundary, the Bruxner Highway is owned and maintained by NSW State Government. Within the Tenterfield LGA, the Bruxner Highway is a classified state road. The RTA has the responsibility to fund, prioritise and carry out works on the Bruxner Highway.

The Bruxner Highway comprises a sealed, two-lane, two-way configuration for the majority of its length. West of Tenterfield there is a 4.7km section of the Bruxner Highway that is unsealed between Yetman and Boggabilla.

New England Highway

The New England Highway, which is approximately 887km in length, serves as a key link between Sydney and Brisbane forming a major part of the national highway route. The New England Highway forms part of the National Highway system and is controlled by the RTA. Compared to the Pacific Highway, as a Sydney-Brisbane link, the New England Highway has significantly lower traffic volumes. Within the Project area, particularly through Tenterfield, the New England Highway generally comprises a sealed two-lane, two-way configuration.

Existing Traffic Volumes

Table 13-1 summarises the Annual Average Daily Traffic (AADT) volumes for relevant count stations. The AADTs recorded at the count stations along the Bruxner Highway and New England Highway between 1995 and 2004 indicate insignificant changes in traffic volumes. An estimate for the 2011 AADT has also been provided in **Table 13-1** based on the historical growth.

Table 13-1 AADT Traffic Volumes in the Region (Two-way)

Location	Station Number	1995 AADT	1998 AADT	2001 AADT	2004 AADT	2011 AADT Estimate[1]	2011 Estimated Peak Hour Volume[2]	2011 Estimated Level of Service[3]
New England Highway (SH9), at Tenterfield Creek Bridge, Tenterfield	91.029	3,482	3,482	3,578	3,131	3,747[4]	375	B
Bruxner Highway, 0.5km west of Rifle Range Road, Casino	04.102	3,530	3,448	3,560	3,664	3,695[5]	370	B
Bruxner Highway, 1.6km east of Tick Gate, Mallanganee	04.109	1,455	1,367	1,486	1,406	1,541[6]	155	A
Bruxner Highway, Tree Tick Gate, 6km west of Tabulam	91.162	873	899	885	921	962[7]	97	A
Bruxner Highway, 1km west of SH9, New England Highway	91.061	338	383	438	421	508[8]	51	A

Source: RTA Traffic Volume Data for Hunter and Northern Region 2004

1. *2011 AADT estimates have been calculated by looking at the historical data between 1995 and 2004 and applying the average growth factor to determine the future traffic. Where the 2004 AADT value is less than the previous years, it has been ignored in order for an increase in traffic volumes to be applied to create a 'worst-case' scenario for 2011.*
2. *Peak Hour Volume for 2011 has been conservatively estimated to represent 10% of the AADT.*
3. *Level of Service has been estimated based on the AustRoads Guide to Traffic Engineering Practice: Roadway Capacity under the following assumed parameters for the road section: each road section provides for one 3.5m width lane in each direction and up to a 1m shoulder; sight distances are of no concern (i.e no restrictions within 450 metres); a 50/50 directional split occurs due to its rural environment; heavy vehicles represent approximately 5% of all traffic; and all roads are not subject to hilly/mountainous terrain. LOS A = <330 vehicles, LOS B = 330-590 vehicles, LOS C = 590-930 vehicles, LOS D = 930-1400 vehicles, LOS E = 1400-2430 vehicles, and LOS F = 2430+*
4. *Based on 0.46%pa increase between 1995 and 2001 – 2004 data ignored.*
5. *Based on 0.12% pa increase between 1995 and 2004.*
6. *Based on 0.36% pa increase between 1995 and 2001 – 2004 data ignored.*
7. *Based on 0.61% pa increase between 1995 and 2004.*
8. Based on 2.7% pa increase between 1995 and 2004.

Level of Service 'A', 'B' or 'C' is considered to be acceptable along rural highways. A 'Level of Service C' represents that motorists are not impeded by any congestion issues and is an efficient level of operation for the road section (i.e. the posted speed limit can be maintained under normal conditions). The threshold range for a Level of Service C road length is between 590 and 930 vehicles per hour (two-way). The maximum two-way peak hour volume outlined in **Table 13-1** is 375 vehicles and is well below the thresholds for practical capacity (i.e. less than the upper limit of Level of Service C). Consequently, there are no capacity concerns of the existing traffic volumes along the analysed sections of the New England Highway and Bruxner Highway.

13.4 Traffic Generation

13.4.1 Construction Traffic

It is currently anticipated that construction of the transmission line would commence by mid 2012, subject to being granted Project Approval. For the purposes of this EA total construction time for the proposed works would be 32 months.

Construction works would be carried out during the standard daytime construction hours of 7.00am to 6.00pm Monday to Friday and 8.00am to 1.00pm Saturday, except when:

- the delivery of materials is required outside these hours as requested by the RTA or other authorities for safety reasons; and
- emergency work is required to avoid the loss of lives, property and/or prevent environmental harm.

Work outside standard hours would be in accordance with DECCW guidelines and would require the formal written consent of TransGrid.

The workforce required for the construction phase of the Project is likely to vary throughout the program. For the purpose of this traffic and transport assessment, it is assumed that:

- feature surveying for the whole line occurs prior to the commencement of construction (therefore not considered as part of construction phase activities);
- during construction the following activities would take place at a number of separate locations along the line concurrently:
  - clearing and access;
  - foundation and earthing;
  - structure erection;
  - substation works; and
  - stringing;
- a number of vehicle types would travel to the site during the establishment of the work area and would only be classified as a single vehicle movement (as they would remain within the site) and would include the following: truck/4WD with drill rig, boring machine, back hoes, cranes, winches/brakers, bulldozers, excavator, rock hammers and elevated work platforms. The remaining vehicle types would account for two vehicle movements per day (return trip to the site and from the site).

13.4.2 Transmission Line and Access Track Construction

Table 13-2 summarises the vehicle types and the estimated volumes required for peak construction activities for the transmission line and access track works. Based on the construction traffic generation estimates and the assumptions above, up to approximately 86 vehicles would be required on site at a given time during the peak construction period. Given that the road capacity analysis is undertaken for the peak hour (e.g. incoming to site at beginning of shift) it is assumed that all two-way vehicles would have one inbound trip to the site during the AM peak hour and one outbound trip from site during the PM peak. Although this may not be the case in reality, this would generate a 'worst-case' scenario in the event of all vehicles arriving to the site at the same time. It should be noted that the vehicle numbers outlined in **Table 13-2** are applicable for the entire corridor and these numbers may be proportioned where multiple teams would be working concurrently along the alignment during the construction phase.

Table 13-2 Construction Phase Plant and Vehicle Estimates for the Transmission Line and Access Tracks

Vehicle type	No. of vehicles required along corridor
Light Vehicles	
Cars / Utility Vehicles / 4 x 4s	30
Heavy Vehicles	
Multi-Wheel Drive Trucks	14
Steel Tower and H-Frame Delivery Trucks	4
Concrete Trucks	10
Truck Mounted Drilling Rig	2
Boring Machines	2
Winches / Brakes	2
Cranes	2
Franna Cranes	2
Roller Compactor	2
Bulldozer	2
Excavator	5
Bobcat / Backhoe	2
EWPs	4
Telehandler	1
Timber Mulchers	2
Total Heavy Vehicles	**56**
Total Vehicles	**86**

13.4.3 Substation Upgrades and Construction

The proposed works at the substation and switching station sites (Tenterfield, Lismore and Dumaresq) would include: civil and electrical works, the preparation of the switchyard, and the supply and installation of required busbar and transformer bays. Construction would follow the stages listed below:

- site preparation of the substation compound and set-up;
- bulk earthworks;
- civil, steel works, building works and electrical works;
- overhead transmission line connections;
- commissioning; and
- site landscaping and securing.

Works would include the construction of internal access roads, primary and secondary oil containment systems, a services building, the construction and installation of appropriate switchyard drainage, and the

installation of appropriate compound fencing, security and lighting. Similar plant and machinery would be utilised at the substation and switching station sites as at each work site along the alignment.

Table 13-3 summarises the vehicle types and the estimated volumes required for the construction phase at the Tenterfield 330kV Substation, Lismore 330kV Substation Upgrade and Dumaresq 330kV Switching Station Upgrade during the peak construction period. Based on the construction traffic generation estimates, between 47 and 102 vehicles would be required at a given time during the peak construction period depending on each individual site. This represents a 'worst-case' scenario as it assumes each of the peak construction activities would be taking place at the same time.

Table 13-3 Construction Phase Vehicle Generation for Substation Works

	Dumaresq 330kV Switching Station Upgrade	Lismore 330kV Substation Upgrade	Tenterfield 330kV Substation
	Cars / Utility Vehicles / 4x4s		
Maximum Staff Required	25	25	75 [1]
	Heavy Vehicles		
Bulldozers	1	-	1
Excavators	2	2	3
Roller Compactor	2	-	2
Trucks (articulated and non-articulated)	4	4	5
Whacker Rammers	4	-	4
Concrete Trucks and Pumps	2	2	2
Cable Trucks	2	2	2
Elevated Work Platforms	2	2	2
Cable Winch/Brake	1	1	-
Mobile Crane	2	2	3
Telehandler	1	-	1
Scraper	-	-	-
Bobcat	-	-	2
Cable Winch / Brake	-	-	1
	Total Vehicles[2]		
Total	***48***	***47***	***103***
Cars / Utes etc.	25	25	75
Heavy Vehicles	23	22	28

Notes:

1. *The peak construction generation for the Tenterfield site has been assumed to incorporate all stages once bulk earthworks have been completed (i.e. cumulative impact of: civil, steel, building and electrical works; transmission line connections; commissioning; and site landscaping and securing).*
2. *It is assumed that for the basis of the 'worst-case' scenario that all vehicles for each substation outlined in the table above would be on-site at one occasion and therefore are in included in the traffic impact assessment.*

13.4.4 Establishment of Access Tracks

Access to each structure location along the alignment would be required. On-easement and off-easement access tracks would be established to allow plant, machinery, equipment and materials to be transported from the road network to the structure locations. Access would be required for a truck-mounted auger and excavator, one or two structure erection cranes, trucks transporting the supporting structure components, concrete trucks and construction equipment carrying vehicles

Existing tracks would be used wherever possible, in particular along the Tenterfield to Lismore section where a number of tracks facilitate maintenance of the existing 132kV transmission line. A number of upgrades and new access tracks would be required. Access tracks would be up to 6m in width. (further detail provided in **Chapter 4 Project Description**). The location, condition and requirements of the off easement access tracks have been identified and are shown in **Section 2** of **Volume 3** of this EA.

13.4.5 Operation

Traffic associated with maintenance of the existing 132kV transmission line typically comprises one to two vehicle movements accessing the line on an infrequent basis, approximately two to three times per year. This level of activity would be largely unchanged for the proposed 330kV transmission line. Operation phase vehicle movements additional to existing levels on the road network would be limited to the western portion of the proposed alignment, as these movements are already occurring in the eastern alignment due to maintenance of the existing 132kV line. Traffic movements would be restricted to personnel inspecting and maintaining the transmission line. The existing traffic associated with the operations of the alignment would be included in the existing AADT traffic volumes collected by RTA and outlined in **Table 13-1**.

Operation of the proposed Tenterfield 330kV Substation, upgraded Dumaresq 330kV Switching Station and upgraded Lismore 330kV Substation would largely be remotely managed from the Newcastle Regional Centre. However, occasionally staff may need to visit the site in order to complete routine maintenance. These visits would range from minor adjustments of electronic equipment (daily attendance for one or two weeks) to major scheduled overhauling of equipment such as circuit breakers and transformers (up to ten personnel with trucks, small mobile crane and elevated work platforms). These works would be infrequent and would be on a smaller scale (indeed in the majority of cases a much smaller scale) than the construction works.

13.5 Assessment of Impacts

13.5.1 Construction

A cumulative impact assessment approach for construction vehicles generated by the access track, transmission line and substation works needs to be taken into consideration in order to understand a 'worst-case' scenario on the surrounding road network. The access track and transmission line construction vehicles would have an impact along the entire length of the proposed alignment, and as such, their volumes have been attributed to each of the road sections outlined in **Table 13-1**. It should be noted that this is a 'worst-case' scenario as the construction activities in reality may be split between two or more teams along the alignment.

The substation construction and upgrade works at Dumaresq, Lismore and Tenterfield are site-specific activities and as such, the volumes generated at these locations would only be applied to the closest (and appropriate) road sections in **Table 13-1**. For example, the vehicles generated by the construction of the

Tenterfield 330kV Substation have been applied to the New England Highway and Bruxner Highway at Tenterfield as there is potential that both of these roads may be used by the construction traffic.

Table 13-4 outlines the cumulative impact of all construction works occurring between Dumaresq Switching Station and Lismore Substation associated with the Project, along with an assessment of the Level of Service for each of the road sections from **Table 13-1**.

The cumulative impact outlined in **Table 13-4** illustrates that, in the unlikely event of the outlined 'worst-case' scenario, the performance of the road sections analysed would not be significantly changed based on the traffic generated during the construction phase. Despite these sections experiencing a large increase in traffic (between 50% and 563%), there is a significant amount of spare capacity available to ensure that the Level of Service does not deteriorate. The Level of Service for each section of road does not change between existing (pre-construction) and construction activities and remains within the Level of Service C threshold in determining the appropriate performance of the road. This analysis has demonstrated that the impact of constructing the transmission line (and associated access track and substation works) on the existing road network during the peak period of the construction phase would be negligible.

In terms of access track integrity, many of the existing access tracks would be used post-construction to carry out maintenance on the new 330kV transmission line. As a result these access tracks would be maintained both during and after construction. Prior to construction, more detailed access track condition work would be completed to ensure that the tracks would be able to carry the various construction plant and materials required. Where necessary this would require a number of access tracks to be upgraded. A minimum of 10 days notice would be provided prior to commencing any work that would affect the road network and all works would be at no cost to the RTA. Local councils would be contacted for concurrence to any work that would affect the public road network.

Table 13-4 Vehicle Generation Assessment for Road Network Surrounding Substations

Location	Station Number	Existing Conditions[1]		Construction Phase					
		2011 Peak Hour Volume	2011 Level of Service	Access track and Transmission Line	Dumaresq Switching Station Upgrade	Lismore Substation Upgrade	Tenterfield Substation Construction	Total Peak Hour Volume During Construction	Level of Service for Peak Hour During Construction[2]
New England Highway (SH9), at Tenterfield Creek Bridge, Tenterfield	91.029	**375**	**B**	86	-	-	103	**564** (50% increase)	**B**
Bruxner Highway, 0.5km west of Rifle Range Road, Casino	04.102	**370**	**B**	86	-	47	-	**503** (36% increase)	**B**
Bruxner Highway, 1.6km east of Tick Gate, Mallanganee	04.109	**155**	**A**	86	-	-	-	**241** (55% increase)	**A**
Bruxner Highway, Tree Tick Gate, 6km west of Tabulam	91.162	**97**	**A**	86	-	-	-	**183** (89% increase)	**A**
Bruxner Highway, 1km west of SH9, New England Highway	91.061	**51**	**A**	86	48	-	103	**288** (563% increase)	**A**

Notes:

1. *Refer to Table 13-1 for estimates for AADT volumes, peak hour volumes and existing Level of Service assessment.*
2. *LOS A = <330 vehicles, LOS B = 330-590 vehicles, LOS C = 590-930 vehicles, LOS D = 930-1400 vehicles, LOS E = 1400-2430 vehicles, and LOS F = 2430+.*

13.5.2 Operation

Traffic Generation – Transmission Line

During the operation of the transmission line, a small number of vehicles would need to access the line on a regular basis. Vehicles required for ongoing line maintenance would likely have a negligible impact on the existing transport network, with two to three vehicles accessing the line per year. Traffic movements would be restricted to personnel inspecting and maintaining the transmission line. Traffic movements in proximity to the eastern portion of the proposed alignment would essentially represent a continuation of existing movements associated with maintenance of the 132kV transmission line, whereas the small increase in traffic along roads within the western part of the line would be well within the road's built capacity. Therefore no traffic impacts are expected as a result of the operation of the transmission line.

Traffic Generation – Substations

Operation of the proposed substations (upgraded or newly constructed) would largely be remotely managed from the Newcastle Regional Centre. Occasionally staff may need to visit the site in order to complete routine maintenance. The need for these visits would range from minor adjustments of electronic equipment (daily attendance for one or two weeks) to major scheduled overhauling of equipment such as circuit breakers and transformers (up to ten personnel with trucks, small mobile crane and elevated work platforms). There would be no changes to the operations of the Lismore Substation and Dumaresq Switching Station as a result of the Project.

13.6 Mitigation Measures

Construction Phase

A Traffic Management Plan is required for the construction phase of the Project in accordance with *Traffic Control at Worksites, Version 3.1* (RTA, April 2006). The Traffic Management Plan would include:

- Hours of haulage for equipment and materials, which do not impose on peak periods and school pick-up and drop-off times, limiting the number of trips per day;
- Designated routes for construction traffic, including the source locations and their access points along the transmission line;
- A community consultation plan to ensure the residents in close proximity to the transmission line are informed prior to construction activities, and have a point of contact during construction;
- The design of temporary works on local roads where and if required, in order to accommodate heavy vehicles associated with the haulage of equipment and materials. These works may include intersection treatments, temporary speed zoning, traffic control devices (such as signage and linemarking) and modifications to street furniture and structures;
- Safety principles for hauling equipment and materials, such as speed limits along the access tracks and procedures for specific activities; and
- Drivers of construction and maintenance vehicles would be trained to drive in a safe and responsible manner at all times to reduce the risk of accidents occurring.

13.7 Draft Statement of Commitments

The measures outlined above are summarised and outlined below in **Table 13-7**.

Table 13-7 Draft Statement of Commitments – Traffic and Transportation

Mitigation Measure and Commitment		Project Stage		
		Design	Construction	Operation
G1	Vehicle movements would be limited to the designated route to minimise impacts to road users caused by the Project.		✓	
G2	All construction and operation staff would drive in a safe and responsible manner at all times to reduce the risk of accidents occurring.		✓	✓
G3	Local councils would be contacted for concurrence to any work that would affect the road network.		✓	
G4	A minimum of 10 days notice would be provided prior to commencing work that would affect the road network. All works are to be at no cost to the RTA.		✓	
G5	A Traffic Management Plan would be developed for the construction phase and would be included within the CEMP. The Traffic Management Plan would comply with all relevant Regulations and By-Laws and in particular address 'long' and 'heavy' load movement requirements and safe access and egress off the public road network.	✓		
G6	If a change is required to the proposed access tracks, the environmental management protocols and approval process outlined in **Chapter 19 Draft Statement of Commitments** of the EA would be followed.	✓	✓	