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***Department of Infrastructure, Planning & Natural
Resources***

***Directlink
Best Alternate Route
Environmental Assessment***

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1. Introduction

1.1 Study Overview and Context

The existing Directlink DC power line extends over 65 km from Mullumbimby to Terranora in Northern NSW, forming a connection between the NSW and Queensland electricity grids. The cable is either buried underground or encased in a galvanised steel trough and has a nominal transfer capability of 180MW. In operation since July 2001, the line predominantly follows existing road and rail corridors between the Mullumbimby substation at Laverty's Gap and the Terranora substation (see **Figure 1**).

The NSW Department of Infrastructure, Planning and Natural Resources (DIPNR) commissioned Connell Wagner to undertake this study, to identify the most cost-effective and environmentally acceptable route for a "confirmed best alternative" transmission line connection between Mullumbimby and Terranora. The key objectives of the study brief were to identify the "best alternative" that is capable of achieving planning approval, and to prepare a preliminary cost estimate and timeframe for its construction.

The brief from DIPNR to carry out this study was unusual in that only limited background to the project was made available. The study undertaken has been a hypothetical exercise, and it is understood that there is no intention on the part of Country Energy to actually construct an alternative transmission line. The study has also been undertaken with a high level of confidentiality, meaning that Connell Wagner has been limited in terms of the stakeholders and agencies with whom consultations could be undertaken.

Previous work by consultants URS in their report *Alternative Projects to the Directlink Transmission Line – Environmental Review: Mullumbimby to Terranora (NSW)* (March 2004) on behalf of Country Energy had already identified two potential alternative alignments, and it is evident that other corridors such as the new Pacific Highway route from Yelgun to Chinderah also warrant consideration.

1.2 Study Objectives and Scope

There are two main objectives in carrying out this study:

1. to identify the most cost-effective and environmentally acceptable route for a 'confirmed best alternative' transmission line between Mullumbimby and Terranora that would be capable of achieving planning approval; and
2. to identify a preliminary cost estimate and likely timeframe for construction of the above.

In pursuing these objectives, the study has relied upon a number of key assumptions, the main assumption being that the 'confirmed best alternative' transmission line route would have the same function as the existing Directlink transmission line. Another important assumption was that the study would be undertaken in the context of available data sets which have been gathered in the available time and which are not expressly 'tailor-made' for the study.

The study has been undertaken in three key steps:

1. data compilation, consultation with limited key stakeholders, study area visit, review of previous work on route options (ie. Directlink REF and the URS investigation of alternatives), determination of desired project outcomes, and development of assessment criteria;
2. constraints identification and analysis, route identification and optimisation, assessment of potential community issues and expectations, constraints mapping, investigation of statutory planning / approval issues, and elimination of inferior and non-performing options; and
3. determination of mitigation measures for options, comparative assessment against pre-determined criteria and project objectives, development of indicative construction and delivery plan, preparation of preliminary cost estimate, and documentation of outcomes and findings.

1.3 The Study Area

The study area comprises land within the two northernmost local government areas, Tweed Shire and Byron Shire, on the New South Wales north coast. Within a broad north-south corridor between Mullumbimby and Terranora, the study area displays a diverse range of planning circumstances. The study corridor encompasses:

- lands of high value biodiversity;
- National Parks, Nature Reserves and forests;
- expansive floodplains and assorted hydrological features;
- rugged range lands;
- agricultural lands, including high-value intensive horticulture; and
- patterns of human settlement ranging from sub-regional centres (eg Murwillumbah, Mullumbimby) to rural villages and expanses of rural residential / hobby farms.

The study area is experiencing an array of land use and development pressures commensurate with its status as one of the fastest growing regions in NSW. The community is highly protective of the region's qualities in terms of lifestyle and character, and vocal in communicating its concerns and demands for protection of the very qualities that make the region an attractive area to live and work. There is general resistance to large scale development, as reflected in the high level of community interest and participation that is typically seen in relation to major planning projects and related processes.

As such, this combination of biophysical characteristics with the social and economic pressures being experienced by the region translates to a complex mosaic of conditions that can strongly influence the planning and assessment of new infrastructure proposals. Many of these issues are central to the investigation and assessment undertaken under this study.

Key socio-economic and biophysical features within the study corridor include:

- The two towns of Mullumbimby and Murwillumbah;
- Smaller settlements such as Billinudgel, Burringbar / Mooball, Tumbulgum;
- Major transport infrastructure including the Pacific Highway, the old Pacific Highway (now named the Tweed Valley Way) and the North Coast Railway;
- Brunswick River, Tweed River and numerous smaller waterways;
- The coastal ranges, in particular the Chincogan Mountains and the Burringbar Range;
- Mt Jerusalem and Mooball National Parks, and numerous coastal nature reserves;
- The Cudgen Plateau, designated as agricultural land of State significance;
- The Tweed River floodplain and the broader coastal floodplain, mostly under intensive sugar cane cultivation;
- Other agricultural and pastoral lands, including rural residential and hobby farm lands; and
- Dense forested areas (mostly on the steeper slopes of the ranges), many of which are identified as having high conservation value.

The study area is subject to influences and pressures largely dictated by external forces. The Tweed is heavily influenced by its proximity to south-east Queensland, while both Tweed and Byron Shires are experiencing the same heavy development pressures as most of the coastal LGAs in NSW. This is placing high demands on existing infrastructure, and generating pressure for new and upgraded infrastructure. The Pacific Highway is a case in point. The Yelgun – Chinderah upgrade, which created a new road corridor through the study area, is a major piece of infrastructure that will strongly influence future patterns of development, and bring new pressures to bear. Largely for these reasons, that

highway project generated considerable community interest and involvement, and the route selection process demanded extensive interaction with the community.

For the purposes of this study, the core corridor is bounded generally in the east by the coastal strip, in the west by the Mt Jerusalem National Park, the North Coast Railway and the Tweed River from Murwillumbah to Tumbulgum, and in the north and south by the respective sub-stations at Mullumbimby and Terranora. (see **Figure 1**).

1.4 The Proposal

As a result of the investigations undertaken, the study team has arrived at two potential 'preferred options' that are considered to satisfy the requirements of the study brief. Preferred Option 1 is primarily an overhead transmission line, with approximately 7km of underground installation at either end. Preferred Option 2 is a wholly underground transmission line. Each option follows a slightly different route.

Two options have been presented because while the existing Directlink cable is underground, this study has found that an overhead facility may be constructed for a significantly lower cost. The project brief suggests that the study should pursue an overhead facility, but as this study illustrates, an underground facility is likely to have less environmental impact, and be more acceptable to the community. It is considered that both options have the potential to achieve planning approval subject to further investigations as necessary to satisfy the relevant statutory requirements.

The two preferred route options are illustrated on the maps accompanying this report, which also show the route of the existing Directlink transmission line. Further discussions relating to the preferred options and the route selection process are contained in the following sections of the report.

2. Statutory Approvals Process

A discussion of the Commonwealth and State planning and environmental legislation applying to this project has been documented by URS in their *Alternative Projects to the Directlink Transmission Line – Environmental Review: Mullumbimby to Terranora (NSW)* (March 2004). As noted by URS, a limitation of this study is that there will remain a degree of uncertainty regarding the extent to which the identified legislation will apply. For example, where threatened species or Aboriginal archaeology are involved, the legal and statutory obligations are dependent on what may or may not be found in the field and the actual nature of impacts caused by the proposal. Rather than repeat the information provided in the URS report, the following summary of the relevant Commonwealth and State legislation is provided.

2.1 Commonwealth Legislation

2.1.1 Environmental Protection and Biodiversity Conservation Act 1999

The requirement for an approval under the EPBC Act 1999 is triggered by a proposal that potentially has a significant impact on a matter of national environmental significance, or a significant impact on the environment where Commonwealth involvement is required. Section 68 of the EPBC Act requires that a proposal be referred to the Commonwealth Environment Minister if the proponent believes that an approval under the EPBC Act is required. Such action may be triggered by potential impacts on habitat of migratory species, for example, where Australia's obligations under international treaties such as JAMBA and CAMBA are invoked, or where a proposal affects a World Heritage property.

Where a National Environmental Significance Assessment (NESA) is required under the EPBC Act, this can usually be achieved through the EIA process undertaken to satisfy State legislation.

2.2 State Legislation

2.2.1 Environmental Planning and Assessment Act 1979

The proposal would be assessed primarily in accordance with the requirements of the *Environmental Planning and Assessment Act 1979*. It is most likely that the assessment process would be as required under Part 5 of the EP&A Act in the form of an environmental impact statement (EIS) and that the proposal would need to be approved under Part 5.

The appropriate pathway for determining the need for a Part 5 environmental assessment begins with an examination of the requirements of the statutory planning instruments operating at local government level as well as any applicable state or regional environmental planning instruments.

The preferred alternative transmission line corridor would necessarily straddle the boundary between the two adjoining local government areas of Tweed Shire and Byron Shire, and would therefore be subject to the requirements of both the Tweed Local Environmental Plan (LEP) 2000 and the Byron LEP 1988. The linear nature of the corridor means that it would traverse a number of land use zones as defined under each Plan. The relevant statutory development standards and requirements of each LEP are discussed in detail in the following sections.

Tweed LEP 2000

The Tweed LEP 2000 defines proposals such as electricity transmission lines as a 'public utility undertaking', and generally adopts (with minor amendments) the definition of a 'public utility undertaking' as provided in the *Environmental Planning and Assessment Model Provisions 1980*. Tweed LEP 2000 also generally adopts (with minor amendments) the Model Provisions' definition for 'utility installation'. For the purposes of this assessment, all of the works likely to be required in the development of a transmission line may be defined as a 'public utility undertaking', including underground and/or overhead lines and associated structures, sub-stations, transformers, AC/DC converter stations and so on. Also for the purposes of this assessment, it is assumed that the

substations at Lavery's Gap (Mullumbimby) and Terranora are existing and that no new construction or 'utility installations' would be required along the route of a Directlink alternative.

'Public utility undertakings' and 'utility installations' are permissible with the consent of Council in all zones under the LEP, except for the 8(a) National Parks and Nature Reserves zone, where they are prohibited.

However, under the Savings provisions contained in clause 58 of the LEP, nothing in the LEP "is to be construed as restricting or prohibiting or enabling the consent authority to restrict or prohibit:

- (a) *the carrying out of development of any description specified in Schedule 5 other than that specified in clause 2 or 11 of that Schedule in respect of land to which clause 35 applies ..."*

Clause 2 of Schedule 5 includes the carrying out of 'public utility undertakings' including electricity undertakings such as Directlink. Schedule 5 and clause 58 in effect render the proposal as permissible without the consent of Council, and therefore trigger the application of Part 5 of the EP&A Act with regard to the overall statutory approval process.

Under Part 5 of the Act, the determining authority (in this case the proponent, Country Energy) has a duty to consider the likely environmental impacts of the activity being proposed. If the determining authority is of the opinion that the proposed activity is likely to have a significant environmental impact, the activity cannot be granted approval until the determining authority has received and considered an environmental impact statement in relation to the activity.

Given the length of the corridor for an alternative line and the environmental sensitivity of much of the land within the Tweed Shire through which the corridor passes, it is possible that the proposal would have a significant environmental impact. It is noted however, that the existing Directlink underground transmission line was constructed after preparation of a Review of Environmental Factors, and approved under Part 5 of the EP&A Act without the need for an environmental impact statement. The proposed Directlink alternative may require the preparation of an environmental impact statement under the requirements of Part 5 of the EP&A Act, pending full consideration of the likely impacts on the environment in accordance with section 111 of the Act.

Subject to further investigation as to the likely impacts on critical habitat or populations of threatened flora and fauna species, there is also a likelihood that the proposal would require the preparation of a species impact statement in accordance with the provisions of the *Threatened Species Conservation Act 1995*.

Clause 58(a) of the LEP as quoted above includes a reference to "...land to which clause 35 applies..." Clause 35 of Tweed LEP 2000 comprises the controls in relation to the identification and management of acid sulfate soils. The wording of clause 58(a) has the effect of requiring a proponent / applicant to seek the consent of Council in respect of any works on land identified as being Class 1, 2, 3, 4 or 5 land on Council's "Acid Sulfate Soils Planning Map". Where a development comprises works as specified in the table to clause 35(3), the consent authority cannot grant consent to the works unless the requirements of subclause (4) in respect of soil assessment and acid sulfate soils management have been met.

The proposed corridor is likely to pass through parts of Tweed Shire that are identified as Class 1, 2, 3, 4 or 5 on Council's Acid Sulfate Soils Planning Map. Given the wording of clause 58(a), it would appear that for the purposes of assessment of any works on these lands, Part 4 of the EP&A Act applies and the Council is the consent authority. However, this is negated by the provisions of *State Environmental Planning Policy No. 4 – Development Without Consent and Miscellaneous Exempt and*

Complying Development (SEPP 4). Clause 11(1) of SEPP 4, dealing with ‘certain development by public authorities’ allows that:

“Where, in the absence of this clause, development, being the construction of ... electricity transmission lines by or on behalf of a public authority may be carried out only with development consent being obtained therefor, that development may be carried out without that consent.”

Therefore, SEPP 4 allows the proposed development to be assessed wholly under Part 5 of the EP&A Act within Tweed Shire. The requirements of clause 35 of the Tweed LEP, in respect of the management of acid sulfate soils, would be addressed as part of the environmental assessment, and would likely be incorporated into Director-General’s Requirements for the preparation of an EIS, should an EIS be required.

Byron LEP 1988

The Byron Local Environmental Plan 1988 also defines the proposal as a ‘public utility undertaking’, but adopts a different definition to that provided under the EP&A *Model Provisions*:

Public utility undertaking means any of the following undertakings carried on or permitted or suffered to be carried on by or by authority of any Government department or under the authority of or in pursuance of any Commonwealth or State Act:

- a) *Railway, road transport, water transport, air transport, wharf or river undertakings,*
- b) *Undertakings for the supply of water, hydraulic power, electricity or gas or the provision of sewerage or drainage services,*

and a reference to a person carrying on a public utility undertaking shall be construed as including a reference to a council, county council, Government department, corporation, firm or authority carrying on the undertaking.

The Byron LEP also adopts a different definition of ‘utility installation’ to that of the Model Provisions, as “a building or work used by a public utility undertaking, but does not include a building designed wholly or principally as administrative or business premises or as a showroom.” Again it is assumed that the proposal would not involve the erection or construction of any new ‘utility installations’ within the Byron Shire area in the development of a Directlink alternative. However, should the proposal require additional ‘utility installations’, such installations would require development consent from Council under the Byron LEP.

Under the Byron LEP 1988, ‘public utility undertakings’ are permissible with development consent, or prohibited, in designated land use zones as shown in the following table:

Permissible with Development Consent	Prohibited
<ul style="list-style-type: none"> ▪ Rural 1(a) General Rural Zone ▪ Rural 1(b1) Agricultural Protection (b1) Zone ▪ Rural 1(b2) Agricultural Protection (b2) Zone ▪ Rural 1(c1) Small Holdings Zone ▪ Rural 1(c2) Small Holdings (c2) Zone ▪ 2(a) Residential Zone ▪ 2(t) Tourist Area Zone 	<ul style="list-style-type: none"> ▪ Rural 1(d) Investigation Zone ▪ Rural 1(e) Extractive Resources Zone ▪ Rural 1(f) Forestry Zone ▪ 5(a) Special Uses Zone ▪ 5(b) High Hazard Flood Liable Zone ▪ 6(a) Open Space Zone ▪ 6(b) Private Open Space Zone

Cont.

Permissible with Development Consent	Prohibited
<ul style="list-style-type: none"> ▪ 2(v) Village Zone ▪ 3(a) Business Zone ▪ 4(a) Industrial Zone ▪ 7(c) Water Catchment Zone ▪ 7(f2) Urban Coastal Land Zone 	<ul style="list-style-type: none"> ▪ 7(a) Wetlands Zone ▪ 7(b) Coastal Habitat Zone ▪ 7(d) Scenic/Escarpment Zone. ▪ 7(f1) Coastal Land Zone ▪ 7(j) Environmental Protection Scientific Zone ▪ 7(k) Habitat Zone ▪ 8(a) National Parks & Nature Reserves Zone ▪ 9(a) Proposed Road Zone

Notwithstanding the provisions of the zoning table, Clause 62 of Byron LEP 1988 adopts a Savings provision whereby “*nothing in this plan prohibits or requires consent for ... the carrying out of development of any description specified in Schedule 12 ...*”

Clause 2 of Schedule 12 specifies public utility undertakings, including electricity undertakings, as therefore being saved from any restriction or prohibition imposed by the zoning table or any other requirement of the LEP. The proposal is considered as being development not requiring consent, and therefore becomes assessable under Part 5 of the EP&A Act.

2.2.2 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* does not directly affect the statutory approvals process for a project such as Directlink, except in relation to the management of aboriginal cultural heritage, and any potential aboriginal archaeological material discovered along the preferred route. Under the NPW Act, the Director-General of the National Parks and Wildlife Service (now NSW Department of Environment and Conservation) has jurisdiction over Aboriginal cultural heritage matters. The NPW Act provides that in the course of excavation or other construction activities for a project such as a Directlink alternative, the knowing discovery of any Aboriginal object must be notified to the Director-General of National Parks and Wildlife. Aboriginal objects may not be disturbed or removed from land without a Permit (known as a permit to destroy) issued under section 87 of the Act.

In the course of carrying out a Part 5 environmental assessment of the proposed Directlink alternative, accepted practice would be to commission an appropriately qualified archaeologist to carry out an assessment of the potential impacts of the project on Aboriginal cultural heritage, including an assessment of the likelihood of discovering Aboriginal objects along the route. This activity would involve, as a first step, searching NPWS databases and consultation with local Aboriginal communities and the local Land Council. If deemed necessary following this initial investigation, a detailed field survey would be undertaken of the route or parts thereof, during the environmental assessment process.

Should the preferred route traverse or encroach upon a national park or nature reserve, the NPW Act also contains statutory provisions for obtaining easements over such lands.

Statutory provisions relating to flora and fauna protection, and protection and preservation of habitat, are contained in the Threatened Species Conservation Act.

2.2.3 Threatened Species Conservation Act 1995

The TSC Act provides a framework for the assessment of impacts on threatened species of flora and fauna, or on critical habitat, arising from an activity such as Directlink. Section 5A of the EP&A Act requires the carrying out of an “8-part test” to determine whether a proposal is likely to have a significant impact on threatened species or critical habitat. Where an activity is proposed under Part 5

of the EP&A Act, it must be accompanied by a species impact statement (SIS) where that activity is over critical habitat, or is likely to significantly affect threatened species, populations and ecological communities, or their habitats. The 8-part test is the first step in determining whether a SIS will be required.

The same requirements of the TSC Act will apply, in respect of a SIS, should the proposal be assessed under Part 4 of the EP&A Act.

2.2.4 Rivers and Foreshores Improvement Act 1948

Section 22B of the *Rivers and Foreshores Improvement (RFI) Act 1948* requires a person to obtain a permit from the NSW Department of Land and Water Conservation (now DIPNR) prior to undertaking an excavation on protected land. Section 22A defines protected land to include:

- a) *land that is the bank, shore or bed of protected waters; or*
- b) *land that is not more than 40 metres from the top of the bank or shore of protected waters (measured horizontally from the top of the bank or shore); or*
- c) *material at any time deposited, naturally or otherwise and whether or not in layers, on or under land referred to in paragraph (a) or (b).*

Protected waters means “a river, lake into or from which a river flows, coastal lake or lagoon (including any permanent or temporary channel between a coastal lake or lagoon and the sea).”

A number of watercourses which could be defined as protected waters would be crossed along the proposed Directlink alternative route between Mullumbimby and Terranora. Land within 40 metres of the top of the bank of protected waters is defined as protected land.

Section 22H of the RFI Act exempts a public authority, such as Country Energy, from requiring a permit under Section 22B to carry out works on protected land. However, it is usual practice to consult with DIPNR to advise of the proposed works in respect of protected land and water, and to advise of the proposed mitigation measures to be employed in the construction process.

Consultations were undertaken with Natural Resource Management NSW (formerly DLWC; now part of DIPNR) in the course of this project, and are documented in **section 4.6** below.

2.2.5 Fisheries Management Act 1994

The objectives of the *Fisheries Management Act 1994* are generally to conserve fish stocks and habitats and to allow certain activities to occur only after issue of a permit.

Under this Act, it is an offence to dredge or reclaim land in any waters in NSW without a permit from NSW Fisheries or another NSW Government Department. A permit is also required where damage will be caused to mangroves, seagrasses and other vegetation.

Some of the cable laying and construction procedures associated with this proposal have the potential to disturb vegetation in or adjacent to watercourses. Cable laying procedures may include creation of trenches across small intermittent streams, and underboring of larger watercourses. Assessment of these activities would be carried out in the process of the Part 5 environmental assessment of the project under the EP&A Act, in accordance with the procedure required under Section 5.1.5 of the *NSW Fisheries Policy and Guidelines 1988*.

Country Energy as a public authority is exempt from the provisions of the *Fisheries Management Act* in respect to dredging and reclamation except where mangroves and seagrasses are affected. For this project, a permit under the *Fisheries Management Act* would therefore not be required.

Consultations were undertaken with NSW Fisheries in the course of this project, and are documented in **section 4.3** below.

2.3 Other Environmental Planning Instruments

2.3.1 State Environmental Planning Policy No. 14 – Coastal Wetlands

SEPP 14 identifies sensitive wetland areas along the entire NSW coast, and establishes a statutory mechanism for their preservation and protection. All SEPP 14 wetlands are identified on maps which form part of the Policy, and for the purposes of this study are illustrated on the map in **Figure 2**. Under the SEPP, in respect of land to which the policy applies, a person shall not:

- a) clear that land,
- b) construct a levee on that land,
- c) drain that land, or
- d) fill that land,

except with the consent of the council and the concurrence of the Director. Such developments (as listed in accordance with clause 7(1) of the SEPP) are 'designated development' as defined under the EP&A Act. Under clause 7(5) of the SEPP, 'Restoration works' as defined in clause 3 are not designated development, but do however require the consent of Council and the concurrence of the Director.

SEPP 14 nominates the respective local Council as the consent authority in respect of development. Development assessments undertaken in accordance with SEPP 14 would be carried out under Part 4 of the EP&A Act, as the Policy does not consider or list any types of development that would, under the terms of the policy, be permissible without development consent.

As discussed above in **section 2**, the subject development would most likely be assessed under Part 5 of the EP&A Act, partly due to the wording of clause 11(1) of SEPP 4 – *Development Without Consent and Miscellaneous Exempt and Complying Development*. For the purposes of this study, it appears that the wording of clause 11(1) of SEPP 4 (which specifically mentions 'electrical transmission lines by or on behalf of a public authority') has the effect of rendering those developments listed under clause 7(1) of SEPP 14 as permissible without consent. Therefore, to the extent to which the provisions of SEPP 14 are relevant to the assessment of a Directlink alternative, the assessment shall be carried out under Part 5 of the EP&A Act, 1979. This matter however is subject to clarification. Clause 5 of SEPP 4 provides that:

'Subject to section 74 (1) of the Act, in the event of any inconsistency between this Policy and another environmental planning instrument, whether made before or after this Policy, this Policy shall prevail to the extent of the inconsistency.'

Clause 5 of SEPP 14 reads more or less identically to its counterpart under SEPP 4. Therefore, it remains unclear as to which Policy would prevail, and therefore whether works in respect of SEPP 14 wetlands requires consent under Part 4 or Part 5 of the EP&A Act.

The question may require resolution before any detailed environmental assessment of the proposed Directlink alternative may proceed. However, for the purposes of this study, the question is largely

academic because all of the potential route corridors considered would avoid encroachment on SEPP 14 wetlands as mapped under the Policy.

2.3.2 State Environmental Planning Policy No. 26 – Littoral Rainforests

The aim of SEPP 26 – *Littoral Rainforests* is to “provide a mechanism for the consideration of applications for development that is likely to damage or destroy littoral rainforest areas with a view to the preservation of those areas in their natural state”.

Littoral Rainforest is a distinct type of rainforest well suited to harsh salt-laden and drying coastal winds. SEPP 26 requires that the likely effects of proposed development on lands covered by the SEPP be thoroughly considered in an environmental impact statement. SEPP 26 lands in the study area are illustrated in **Figure 2**. The policy applies to 'core' areas of littoral rainforest as well as a 100 metre wide 'buffer' area surrounding these core areas, except for residential land and areas to which SEPP No. 14 - *Coastal Wetlands* applies.

SEPP 26 bears similarities with SEPP 14 in that development as listed in clause 7(1) of the policy is designated development, and for the purposes of all development under the policy, the Council is the consent authority, and the concurrence of the Director is required.

All development to which SEPP 26 relates is classified as “development requiring consent” and is therefore assessed under Part 4 of the EP&A Act 1979. Clause 10(1) of SEPP 26 specifically amends clause 4(1) of SEPP 4 – *Development Without Consent and Miscellaneous Exempt and Complying Development* such that SEPP 4 does *not* apply to land to which SEPP 26 applies.

Therefore, should the proposed Directlink alternative include works as listed in clause 7(1) of SEPP 26, those works will require development consent from the relevant council under Part 4 of the EP&A Act 1979.

2.3.3 State Environmental Planning Policy No. 44 – Koala Habitat Protection

The aim of SEPP 44 – *Koala Habitat Protection* is to encourage the conservation and management of natural vegetation areas that provide habitat for koalas, to ensure permanent free-living populations will be maintained over their present range. The policy applies to 107 local government areas including Tweed and Byron. Local councils cannot approve development in an area affected by the policy without an investigation of core koala habitat. The policy provides the state-wide approach needed to enable appropriate development to continue, while ensuring there is ongoing protection of koalas and their habitat.

While the provisions of SEPP 44 would hold for the proposed Directlink alternative, this policy would not affect the assessment of the proposal under Part 5 of the EP&A Act 1979. **Figure 3** shows koala habitat classes as mapped for Tweed Shire. No data was available regarding koala habitat in Byron Shire.

2.3.4 State Environmental Planning Policy No. 71 – Coastal Development

The aim of SEPP 71 is to protect and manage the natural, cultural, recreational and economic attributes of the New South Wales coast, and to protect and improve existing public access to and along coastal foreshores. SEPP 71 applies only to the 'coastal zone' as defined under the *Coastal Protection Act 1979*. In general terms, this means the zone under influence of coastal processes.

The potential routes for a proposed Directlink alternative are likely to avoid land that is subject to the requirements of the *Coastal Protection Act* or SEPP 71. Therefore, it is considered that the requirements of SEPP 71 will not be relevant to any assessment of the proposal.

2.3.5 North Coast Regional Environmental Plan

The North Coast Regional Environmental Plan (REP) covers all of the North Coast local government areas except Greater Taree. It identifies environmental features that are important to the region and provides a basis for new urban and rural development. With an emphasis on careful assessment, the plan sets requirements for and guides the preparation and processing of local environmental plans and some forms of development.

The aims of the North Coast REP are:

- a) to develop regional policies that protect the natural environment, encourage an efficient and attractive built environment and guide development into a productive yet environmentally sound future,
- b) to consolidate and amend various existing policies applying to the region, make them more appropriate to regional needs and place them in an overall context of regional policy,
- c) to provide a basis for the co-ordination of activities related to growth in the region and encourage optimum economic and social benefit to the local community and visitors to the region, and
- d) to initiate a regional planning process that will serve as a framework for identifying priorities for further investigation to be carried out by the Department and other agencies.

Aside from the broad aims and objectives of the Plan, the North Coast REP is not directly relevant to this project. However, the Northern Region office of DIPNR advises that a review of the Plan, which was gazetted in 1988, is imminent. Certain preliminary studies and initiatives are underway that will inform the revision of the REP, such as the Northern Rivers Regional Strategy and the Far North Coast Farmland Protection Project. These initiatives are discussed further in **Section 4.5** of this report.

2.4 Conclusion and Statutory Pathway

The potential alternate Directlink proposal/s would therefore most likely be described as an 'activity' as defined under Part 5 of the *Environmental Planning and Assessment Act 1979*, and would be assessed in its entirety under Part 5. However, should the preferred route affect land that is subject to the provisions of SEPP 26 – *Littoral Rainforests*, those parts of the development affecting the SEPP 26 land will be assessed under Part 4 of the Act, and will require the preparation and lodgement of a development application with the respective Council. Under SEPP 26, the works will be 'designated development' for the purposes of the EP&A Act, and therefore will require the preparation of an environmental impact statement to accompany the development application.

Subject to clarification as to the relationship between SEPP 14 – *Coastal Wetlands* and SEPP 4 - *Development Without Consent and Miscellaneous Exempt and Complying Development*, as discussed in **Section 2.3** above, a similar approach may be required in respect of works affecting SEPP 14 lands.

The determining authority under section 111 of the EP&A Act is required to “*examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity.*” DIPNR has published *Is an EIS Required?*, an evaluation framework and best practice guideline to assist in the process of project evaluation under Part 5 of the EP&A Act.

If the determining authority considers that the activity is likely to have a significant environmental impact, an EIS will be required to be prepared and exhibited in accordance with the requirements of sections 112 and 113 of the EP&A Act, and clauses 228 – 237 of the EP&A Regulation. If an EIS is required, the requirements of the Director-General of Infrastructure, Planning and Natural Resources are to be sought as to the form and content of the EIS.

Should an EIS be required to satisfy the requirements of SEPP 26 – *Littoral Rainforests* and/or SEPP 14 – *Coastal Wetlands*, it is considered that the EIS prepared in respect of the whole project (should it be required) would satisfy these requirements and it would not be necessary to prepare two separate environmental impact statements.

Subject to the requirements of the *Threatened Species Conservation Act 1995*, a species impact statement may also be required in respect of the likely impacts of the activity on critical habitat. If a SIS is required, the requirements of the Director-General of National Parks and Wildlife are to be sought with regard to the form and content of that document.

3. Key Constraints

The following sections provide details of the key environmental, biophysical, social and economic constraints to development of a Directlink alternative, as identified through this study. Through building thematic layers on a map, a picture emerges of the areas that are least constrained in terms of the identified key criteria.

From the stakeholder and agency consultations carried out in the course of the study (see **section 4** below), it is possible, within limitations, to apply different weighting to the constraints according to the perceived relative importance ascribed to each (in this case, based on the perceptions of the study team). For example, the occurrence of acid sulfate soils or the existence of rivers and streams, may generally be given less weight in the assessment because these constraints can be largely negated through engineered solutions. By comparison, topography is a key constraint because, in the context of the study area, it potentially affects scenic values and environmental protection values, which are two criteria that would have high sensitivity in terms of community perceptions and expectations. Topography also implies potential construction and access issues which, while not insurmountable, will contribute to higher project costs.

The following discussion of key constraints is in no particular order of weighting.

3.1 Landforms and Topography

In the most general terms, the topography of the study area grades from the flat lands of the coastal plain, to the steep and rugged terrain of the coastal ranges. In between, the footslopes of the ranges are interspersed with long and narrow, flat to undulating valleys. Seven classes of slope have been mapped, as illustrated in **Figure 4**.

The map clearly illustrates the major landforms of this sequence of ridges and valleys, in particular the barrier posed by the Burringbar Ranges. The map also clearly illustrates the flat lands of the Tweed River floodplain, and the coastal plain stretching the full length of the study area. In addition to the topographic and landform obstacles, the slope classes are also an indicator of land stability and potential erosion hazard.

The topography / landform map clearly illustrates the relationship between landforms and the three major existing transport infrastructure corridors: the North Coast Railway, the Tweed Valley Way (old Pacific Highway), and the Yelgun – Chinderah motorway. The old highway and railway corridors cross the Burringbar Range at its narrowest point, and avoid the steepest country between Murwillumbah and the coast. The motorway, which bypasses Murwillumbah, generally hugs the footslopes of the coastal range and avoids the steeper terrain altogether.

From a topographic perspective, the Yelgun – Chinderah motorway corridor would be an optimum solution. Not only does that corridor generally avoid very rugged terrain, it also represents a direct route and therefore one of the shortest routes available.

3.2 Land Use and Settlement Patterns

3.2.1 Human Settlement

The Tweed and Byron LGAs comprise diverse patterns of settlement and land use. There is a distinct pattern of continuing urban growth along the coastal strip in locations such as Kingscliff, Cudgen, Bogangar, Pottsville, Ocean Shores and Brunswick Heads. Away from the coast, settlement is more dispersed, with few settlements of any note and large tracts of rural land.

Advice from Tweed Shire Council indicates that projected new urban release areas are also primarily along the coastal strip, between Tweed Heads and Cabarita. Also within this coastal strip, although not

on the coast, are the identified growth / release areas of Tanglewood, West Kingscliff / Cudgen, and Duranbah. All of these localities are east of the Pacific Motorway, in close proximity to the coastline.

Other identified growth areas are north of the Tweed River, centred around the Terranora Broadwater at Cobaki Lakes, Bilambil Heights, Banora Point and Terranora. However, these areas are of little or no relevance to the project in terms of likely impacts.

3.2.2 Rural Residential

Away from the narrow coastal strip, there are few major settlements within the study area other than Mullumbimby and Murwillumbah. There is a handful of rural villages such as Billinudgel, Burringbar / Mooball, and Tumbulgum, and numerous localities that almost achieve 'village' status. However, within the "rural" and "rural living" zones in both LGAs, a large number of small landholdings give a settlement pattern that is highly dispersed. The traverse of the study area undertaken in the course of this study revealed in places a relatively dense pattern of rural residential development, particularly in the valleys between the footslopes of the ranges as referred to in **section 3.1** above.

Much of the existing rural residential development has occurred under planning controls that have until now done little to discourage the creation of small rural allotments in productive agricultural areas. Much of the far north coast hinterland is now characterised by small (ie. 40 ha or less) rural residential allotments. Indeed this aspect of the study area has been a factor in creating the 'lifestyle' that has attracted so many people to the area. However, advice from Tweed Shire Council (see **section 4.1** below) is that steps are being taken to tighten up the planning controls in respect of productive agricultural land, to encourage viable rural landholdings and to protect and sustain the agricultural and pastoral industry. General land use patterns across the study area are illustrated in **Figure 5**.

3.2.3 Agriculture, Grazing and Horticulture

Rural lands have been developed for a range of pastoral and horticultural activities including grazing, poultry farming, banana growing, intensive horticulture such as macadamias, and sugar cane farming.

Sugar cane dominates the rural landscape on the Tweed floodplain and most other low-lying areas along the coastal strip between the Tweed and Brunswick Rivers. While this is not a major physical constraint to the construction of a transmission line, the preferred Directlink alternative route is to traverse an area of the Tweed River floodplain with underground cable. This is more likely to be a land use issue, with potential difficulties in obtaining easements through private cane farming land. Sugar cane lands (and some other lands) also pose the added risk of exposure of acid sulfate soils (see **section 3.3.5** below).

The lower footslopes above the floodplain are generally used for grazing purposes, except for areas such as the Cudgen Plateau and Duranbah, where the combination of soils, topography and climate has resulted in agricultural land recognised as having 'state significance'. These agricultural lands, identified on the agricultural land map in **Figure 6**, are suitable for intensive cultivation, in some cases of a single crop or a narrow range of crops. Accordingly, they are protected within the 'Agricultural Protection' zones under the Tweed LEP 2000.

The Department of Primary Industries (formerly NSW Agriculture; see **Section 4.4** below) has recently undertaken extensive mapping and classification of farmlands on the north coast under the 'Farmland Protection Program', one of many concurrent activities leading up to a comprehensive review of the North Coast Regional Environmental Plan. Advice from DPI is that the protection afforded to these high-value agricultural lands under the Tweed LEP is likely to be strengthened under a revised REP.

In the higher country away from the coastal plain and the Tweed floodplain, agriculture, grazing and horticulture become restricted by topography. North-facing slopes are well suited to banana growing. However, as shown on the agricultural land classes map, the study area away from the coast and floodplain is mostly only suitable for grazing or light grazing.

3.3 Natural Features

3.3.1 National Parks and Nature Reserves

The study area contains a number of protected lands in the form of national parks and nature reserves, as illustrated in **Figure 7**. Mooball and Mount Jerusalem National Parks, situated on the ranges, are two of the largest single parcels of land in the study area. While Mooball National Park is situated in the centre of the study area, Mount Jerusalem National Park is peripheral and along with Goonengerry and Nightcap National Parks, does not pose any obstacle in terms of the proposed Directlink alternative.

Nature reserves are primarily coastal. Stotts Island, Cudgen, Wooyung, Billinudgel, Brunswick Heads and Tyagarah Nature Reserves cover portions of the coast and/or coastal wetlands, or in the case of Stotts Island, a significant mangrove community. To the south, the Inner Pocket Nature Reserve protects a small area of remnant rainforest vegetation on high ground at the head of Lacks Creek.

Of the national parks and nature reserves in the study area, only Mooball National Park, because of its location, is considered a significant constraint. Situated in the Burringbar Range, the Park occupies 1,160 ha of heavily vegetated mountainous country, which rises to approximately 300m above sea level. Although easements for electricity transmission lines may be obtained through national parks and nature reserves (under section 153 of the *National Parks and Wildlife Act 1974*) the proposed Directlink alternative (both preferred options) would avoid any encroachment on the Mooball National Park or any Nature Reserve within the study area.

3.3.2 Vegetation, Habitat and Conservation Value

Parts of the study area, particularly through the ranges, are heavily vegetated. A significant proportion of the vegetated area in both Byron and Tweed Shires has been identified as having high conservation value in terms of flora and fauna (see **Figures 8A and 8B**). As previous studies (URS 2004, ERM 1999) have documented, the study area is known to exhibit high biodiversity, with a high number of rare, vulnerable and endangered species. There are nine endangered and 83 vulnerable fauna species recorded in the Tweed Shire, along with 89 Rare or Threatened Australian Plants (*ROTAP* scheduled species), one of which is considered extinct, 16 endangered, and 25 vulnerable. Further, the Tweed Vegetation Management Plan 1999 identified 58 significant species that are endemic to the Tweed Shire and its immediate surroundings.

Byron Shire exhibits a similar ecological profile, with 87 terrestrial animals (including birds and bats) listed as endangered or vulnerable. There are also 54 flora species listed as endangered or vulnerable, in addition to two endangered ecological communities. Furthermore, Byron Shire has also recorded two endangered freshwater fish species and one vulnerable fish species.

It is not known from the data available whether or to what extent the endangered, vulnerable or threatened flora and fauna species discussed above are present in the study area, particularly in respect of Byron Shire. However, it must be assumed that the more densely vegetated and mountainous country in and around the Chincogan Mountains, Marshalls Ridge, Yelgun Creek, the Burringbar Range, the Condong Range, as well as the coastal wetlands and the riparian zones, will support diverse ecological communities to a greater or lesser degree. Therefore, any significant

disturbance of vegetation is likely to result in further loss or fragmentation of habitat, and increase the risk of further impacts on threatened species.

These matters would require extensive and detailed investigation, including field surveys along any proposed Directlink alternative route, in the course of a full environmental assessment of such proposal. For Preferred Option 1, a significant proportion of the proposed route is an overhead facility, which would be likely to require some vegetation clearing for a corridor in certain areas. This aspect of the route selection process has been one of the most critical in terms of ecological impacts. However, for the purposes of this study, the preferred route options have been selected as far as possible to avoid those areas within Byron and Tweed Shires that the respective councils have identified as having high conservation or habitat value.

3.3.3 Visual and Scenic Attributes

The coastal escarpment provides a dramatic backdrop to the low country on the coastal plain and the Tweed floodplain. Topographic features such as Mount Warning, the Burringbar Range and Mount Chincogan dominate the landscape and contribute to the region's character and its scenic values. Conversely, the escarpment comprises a number of elevated vantage points that command sweeping views over the lowlands and the valleys. In both cases these scenic attributes of the study area are highly valued and highly sought after.

Given the scenic values of large portions of the study area, this attribute is considered a significant planning constraint. Route selection for an overhead transmission line through visually sensitive areas needs to have particular regard for:

- views of prominent ridge lines, horizons and skylines;
- views across valleys from elevated vantage points and lookouts, in particular those valleys currently unaffected by visual encroachment of transmission lines, major roads and other linear or large scale infrastructure development;
- views enjoyed by residents, particularly in rural and rural residential areas, along valleys and from valleys into the surrounding hills; and
- views of the surrounding countryside from major roads and highways.

At least part of the proposed Directlink alternative (Preferred Option 1) could be constructed as an overhead transmission line without having an unacceptable visual impact. It is considered, particularly in sparsely populated rural areas with variable topography, that visual impacts can largely be mitigated without great difficulty. Even though a transmission line would be visible, it need not be visually intrusive or dominant. It was noted during the visit to the study area that there is already an extensive network of existing power and telecommunications lines throughout the area, and for the most part these facilities are not visually intrusive or dominant. Their visual impacts are mitigated by, for example:

- avoiding alignments that interrupt the horizon or ridge lines from significant vantage points;
- the facilities being located against a background of substantial landforms or visually dominant landscapes;
- the facilities being located in the background rather than the foreground of landscapes as viewed from common vantage points, to achieve 'distance attenuation';
- the facilities being located away from heavily populated or trafficked areas (eg highway and motorway corridors);
- using single poles rather than multiple or lattice structures, in natural or neutral tones; and
- minimising pole height and/or maximising the span distance between poles.

These aspects give existing facilities a relatively low visual prominence in the overall landscape, and the mitigation principles are largely self-evident. Other deliberate mitigation techniques can include such measures as strategic screen planting, to reduce visual prominence from individual properties or other common vantage points.

Potential community expectations (see **section 5** below) are likely to be high in respect of the potential visual impacts of the proposed Directlink alternative. It is likely that the community would demand that the facility be constructed underground. However, it is considered that other bio-physical constraints will carry higher weight than visual impacts, in terms of assessment criteria especially when the associated statutory provisions are taken into account (refer **section 2** above). An underground facility may, for example, have a more damaging ecological footprint than an overhead facility in some locations. However, with proper construction techniques and due regard for location, the likely ecological footprint of the project can be managed and minimised to a large extent, and issues relating to community expectations may also be more readily managed as a result.

Preferred Option 2, which is fully underground, is considered to have a minimal ecological footprint due to its location in or adjacent to existing infrastructure corridors and built-up areas (see **section 6** below for further discussion).

3.3.4 Rivers, Streams, Lakes and Wetlands

There are two significant rivers in the study area, the Tweed in the north, and the Brunswick in the south. In between, there are a number of smaller watercourses that traverse the study area including Clothiers, Reserve, Christies, Cudgera, Burringbar, Crabbes, Yelgun, Marshalls, Chinbible and Mullumbimby Creeks. The only significant 'still' body of water in the study area is Cudgen Lake, within the Cudgen Nature Reserve in the north of the study area. There are also significant areas of coastal swamp and wetland, along the coastal strip.

Both of the preferred options for a proposed Directlink alternative generally avoid the coastal wetlands and swamps, but would have to negotiate crossings of the two major rivers and a number of creeks. The preference for crossing the Tweed River would most likely be for the preferred route to utilise the existing bridge at Tumbulgum. Both of the preferred route options would be underground across the cane fields between Eviron and the Tweed River, and between the river and the Bungalora Converter Station. Therefore, attaching the cable to the side or the underside of the bridge is likely to be a practical, cost-effective and low-impact solution.

Throughout the majority of the study area between Eviron and the northern side of the Chincogan Mountains, Preferred Option 1 would be an overhead line. Creek crossings would therefore pose few obstacles as the poles can easily be located so as to avoid any impacts on the creek beds or banks.

3.3.5 Acid Sulfate Soils

The GIS data collected shows a strong correlation between low lying floodplain land, high-value agricultural land and potential acid sulfate soils (see **Figure 9**). The high risk acid sulfate soil areas are generally the sugar cane fields along the Tweed Valley, and parts of the coastal strip in the vicinity of Bogangar and Pottsville.

Both of the preferred options generally avoid the acid sulfate risk areas along the coastal strip. However, both options include placing the cable underground across approximately 4.5km of high risk soils on the Tweed River floodplain. Any development on or disturbance of acid sulfate soils has the potential to release acid, with potentially harmful impacts on the biodiversity of coastal wetlands and shallow freshwater aquifer systems (where they exist).

While the potential impacts of acid sulfate soils may be significant, there are well established and documented procedures for the management of acid sulfates. The *Acid Sulfate Soils Management Guidelines* (Ahern, Stone and Blunden, 1998), published by the Acid Sulfate Soil Management Advisory Committee, outlines the principles of and the most common approaches to mitigation, as follows:

- avoid disturbing acid sulfate soils by not undertaking works on land where they are located;
- if acid sulfate soils are present on the land, avoid disturbing them by not digging up the soil or lowering the watertable;
- if acid sulfate soils are to be disturbed, manage the acid generation potential, neutralise any acid produced, prevent any acid water leaving the site and use acid resistant construction materials;
- if acid sulfate soils have previously been disturbed, undertake works which will manage any acid already being produced, will minimise further production and will remediate any degradation in the long term;
- avoid using acid sulfate soils for land formation – if these soils are to be used, manage the acid generation potential before the material leaves the site where it originates;
- if material is very sandy, separation of pyrite by sluicing; and
- burial below the permanent water table.

The Guidelines include a section on sugar cane farming in acid sulfate soil, which would be directly relevant to the Tweed floodplain. A key element of acid sulfate management is drainage, and a basic principle is that (in the case of sugar cane farming), where the sulfidic layer is between 0.5m and 2.0m from the ground surface, any drainage will produce acid and these areas are therefore best left waterlogged.

Acid sulfate soils can vary in their physical and chemical characteristics, and do not all respond to mitigation strategies in a consistent way. The *Acid Sulfate Soils Management Guidelines* recommend that detailed soil investigations be undertaken prior to development of mitigation strategies. Of relevance to this project, the recommended management strategies include undertaking shallow soil disturbance so as not to disturb acid sulfate soils, and generally to avoid activities which result in lowering or fluctuation of the water table.

Trenching for the laying of cables across sugar cane land is most likely to be carried out at a depth of at least 1m, so as not to interfere with the crop or pose a risk to agricultural machinery. By minimising the amount of exposed soil at any one time, keeping the ground wet during construction, and covering the soils promptly after construction, risks can largely be avoided.

If the *Acid Sulfate Soils Management Guidelines* are adhered to, it is considered that the areas mapped as being at high risk of exposing acid sulfate soils can be managed effectively, without significant risk and without adding significantly to the overall costs of construction.

4. Key Stakeholder Consultations

The project brief required consultations with a number of key stakeholder agencies at State and local government level. During the visit to the study area, face to face meetings were arranged where possible, while other agencies were contacted by telephone. The list of agencies contacted is as follows:

- Tweed Shire Council (meeting)
- Byron Shire Council (meeting)
- Department of Primary Industries (former NSW Fisheries) (meeting)
- Department of Primary Industries (former NSW Agriculture) (meeting)
- Department of Infrastructure, Planning and Natural Resources, North Coast Region (telephone consultation)
- Department of Infrastructure, Planning and Natural Resources – Natural Resource Management NSW (telephone consultation)
- Department of Environment and Conservation (former National Parks and Wildlife Service) (telephone consultation)
- Roads and Traffic Authority (telephone consultation)

The following sections comprise a summary of the discussions held with each of these stakeholders.

4.1 Tweed Shire Council

The Tweed is undergoing sustained growth, with continuing high levels of migration into the Shire. At current rates of development there appears to be sufficient zoned land in the Tweed for 20-25 years residential development, or an additional population of 50,000. In the short term at least (up to 10 years), there appears to be no need for further major rezonings beyond 'Area E' at Terranora, which forms part of the current Residential Development Strategy.

The locations that are currently identified as residential / urban growth areas include Cobaki Lakes, Bilambil Heights, Banora Point, West Kingscliff, Duranbah and Tanglewood. Murwillumbah is also identified as being able to accommodate some growth. It is worth noting that, with the exception of Murwillumbah, all of the major growth areas are on or near the coast and waterways.

Demand for rural living is growing, and significant numbers of people moving in from the major cities can afford to buy whole farms or at least the current minimum lot size of 40 hectares. This can be a wasteful use of rural land, although it can also offer a way for farmers to realise the value of their properties. Suitable areas need to be identified for more intensive rural residential subdivision. Amendment of the minimum permissible lot sizes for rural subdivision in recent times has curbed the rate at which rural land is being 'lost' to rural residential development. Since the mid-1990s it is no longer possible to subdivide rural land for 'rural residential' development.

About two-thirds of the Shire is zoned for rural uses, including plantation forests and rural residential areas. Most farmland is used for grazing of beef and dairy cattle. Sugar cane occupies about 7% of the Shire, mostly floodplains. Banana growing accounts for 2%, mainly on elevated, steep land. Significant areas for horticulture are at Duranbah, Bilambil and Burringbar, whilst Cudgen has the greatest concentration of market gardens.

The Tweed area has the highest native plant diversity along the eastern coastline of Australia between Townsville and the NSW/Victoria border. It includes a number of rare, threatened and vulnerable fauna and flora, with a high concentration of threatened vertebrates. Since European settlement the Tweed has experienced widespread loss of natural habitat on the lowlands and coastal plains, but in recent times there has been considerable re-growth on agriculturally unproductive slopes. Council has recently undertaken an extensive program of identification and digital mapping of natural vegetation, to

update the Tweed Vegetation Management Plan 1999. The 2004 Tweed Vegetation Management Plan, which is due to be publicly exhibited in late 2004, will inform the preparation of a draft amendment to the Tweed LEP 2000, to strengthen the zoning and land use controls for the Environmental Protection Zones within the Shire.

An approach was made to Tweed Shire Council for permission to use data gathered for the draft 2004 Tweed Vegetation Management Plan, for inclusion in the GIS constraints mapping by Connell Wagner for the purposes of this study. However, Council declined the request as the information had not, at the time of preparing this report, yet been made public. Therefore, this study has relied upon vegetation mapping dating from the Tweed Vegetation Management Plan 1999, and other sources such as National Parks and Wildlife data. Council's advice is that the accuracy of this available data is not great due to its age and the methods of its collection and preparation. However, in the absence of more recent and more accurate data, this study's conclusions are qualified on the basis that they must be accepted subject to further investigation and analysis before any recommendations can be acted upon.

4.2 Byron Shire Council

Consultation with Byron Shire Council involved a senior member of Council's planning staff, and Council's Biodiversity Conservation Officer. General advice from Council is that any proposal for a new transmission line would be controversial, and obtaining community acceptance would be difficult. Further, the elected Council is generally known to sympathise with the community in such cases.

The issues identified by Council staff in terms of community perceptions of the project include visual impacts, particularly in rural and rural residential areas, and the impacts of electric and magnetic fields. Therefore, any proposed route through rural areas is likely to meet community resistance unless it can be located underground, and/or remote from any populated areas.

In terms of physical constraints, Byron Shire exhibits similar characteristics to the Tweed, in that the coastal escarpment features difficult topography and significant areas that have been identified as either high conservation value vegetation or habitat. Within the study area (which includes only that portion of Byron Shire north of Mullumbimby), the main biophysical barriers are the Chincogan Mountains, Marshalls Ridge and Yelgun Creek.

Byron Council has recently undertaken further detailed mapping and identification of biodiversity, in preparation of a draft Biodiversity Conservation Strategy. The Strategy has identified that the biodiversity of Byron LGA has been, and continues to be impacted as a result of:

- loss of habitat and essential ecological processes resulting from habitat fragmentation, modification and disturbance;
- the introduction and establishment of exotic species;
- loss of local genetic vigour for certain species;
- direct exploitation of species and habitats; and
- impacts associated with pollution.

The Strategy seeks to reverse the problems of biodiversity loss and decline by working toward:

- identification, protection and management of lands of High Conservation Value (including wildlife corridors);
- accessing reliable funding to implement a range of actions;

- undertaking on ground actions that lead to improved management of biodiversity resources (eg undertake ecological restoration initiatives on Council and privately owned and managed lands); and
- identification and implementation of incentives, educational materials, training and on ground extension that leads to a greater understanding of biodiversity issues and solutions.

The Strategy has identified lands of High Conservation Value across the Shire and ranked them in order of conservation priority. The strategy maps (an extract of which is shown in **Figure 8B**) highlight the areas mentioned above, distinctly illustrating the ridges extending east from the main escarpment.

The areas mapped as having high conservation value also share scenic values, in particular along the escarpment. Ridgelines are in some cases identified as fauna corridors, and vegetation along ridges is noted as a considerable constraint. The scenic escarpment is also defined in places by the alignment of Coolamon Scenic Drive. As its name suggests, this road has scenic importance and a high number of rural residential properties along Coolamon Scenic Drive are positioned to take advantage of the views available along either side. Hence, any development that affects scenic values is also likely to be opposed.

Council's advice included a strong recommendation that opportunities be sought for co-location with other linear utilities or infrastructure. Alternately, Council's advice was to avoid any areas of conservation value or significance, and keep to those less sensitive areas such as the 1(a) General Rural zone, which comprises most of the grazing or pastoral lands within the rural area.

In response to the advice from Byron Shire Council, the preferred route option alignments place the transmission line underground for the majority of the respective corridors through Byron Shire. For Preferred Option 1, an underground configuration is recommended until the line reaches the Marshalls Creek Valley on the northern side of the Chincogan Mountains. From the eastern end of Marshalls Creek Valley, in the vicinity of Walkers Lane, Preferred Option 1 would convert to overhead and continue overhead until reaching the Tweed Valley. It is considered that this approach will have minimal impact and minimal ecological footprint, as well as being more acceptable in terms of community expectations (see **section 5** below).

4.3 NSW Fisheries (Department of Primary Industries)

The Regional office of DPI/NSW Fisheries, Ballina, was consulted in relation to potential impacts on resources under Fisheries' control. Fisheries is responsible for managing fish (including aquatic invertebrates), and fish habitat throughout NSW. The Department's goals encompass protecting wetlands, mangroves and seagrasses, and promoting rehabilitation of degraded aquatic environments. This includes protecting rare and threatened species and maintaining aquatic biodiversity. Any water body, lake or stream denoted by a blue line on the 1:25,000 series of topographic maps is defined as a watercourse for the purposes of Fisheries' management of these resources.

Fisheries' major concerns were in relation to the likely impacts of construction, where any trenching or under-boring of rivers and streams may be required. In general, this applies only to those areas of the preferred route that are proposed to be constructed underground. At the southern end of the route corridor, this would potentially involve crossings of up to four creeks, as well as the Brunswick River. As discussed above, it is recommended that the Tweed River crossing be achieved via the existing Alexander Toohill Bridge, at Tumbulgum. In the southern section, the crossings would be achieved either by trenching, under-boring or direct drilling.

Fisheries' approach to the project is that under-boring of streams should be the minimum standard adopted. Trenching is less acceptable because of the potential for harm to stream banks and beds. Where no feasible alternative to trenching exists, Fisheries advises that works should take place only

during drier periods (ie avoid summer months where rainfall is normally highest), where possible and practical. When all factors involved in trenching are considered, including the costs associated with impact mitigation such as sediment and erosion control, ongoing maintenance and repair, it was noted that under-boring may be more cost-effective, as well as avoiding any significant biophysical impacts.

NSW Fisheries administers compliance with the provisions of the *Fisheries Management Act 1994*. Under the Act, separate approvals may be required from Fisheries, as outlined above in **section 2.2.5**.

Fisheries advised the study team that for a project such as Directlink, there would be no need for approval under the *Fisheries Management Act* where it is proposed to under-bore streams, wetlands and riparian vegetation communities, and maintain buffer zones. The requirement for Fisheries approval hinges upon whether the proposal is likely to result in any impact on the health of water bodies, watercourses and catchments. The test adopted by Fisheries is based generally on defined buffer zones around riparian vegetation, derived from NSW Fisheries *Policy and Guidelines for Aquatic Habitat Management and Fish Conservation 1999*. A key requirement under the policy is that:

“Terrestrial areas adjoining freshwater, estuarine or coastal habitats be carefully managed in order to minimise land use impacts on these aquatic habitats. As a precautionary approach, foreshore buffer zones at least 50 metres wide should be established and maintained, with their natural features and vegetation preserved. Such buffer zones may need to be fenced or marked by signs. The width of these buffer zones may need to be increased to 100 metres or more where they are adjacent to ecologically sensitive areas.”

NSW Fisheries adopts, as guidelines, the following environmental standards for buffer zones for maintaining healthy catchments:

- 50m to 100m either side of major rivers and wetlands;
- 20m to 50m either side of creeks; and
- 10m to 20m either side of streams.

No specific locations were identified by NSW Fisheries in the course of these consultations as being of particular environmental or habitat sensitivity.

4.4 NSW Agriculture (Department of Primary Industries)

Potential issues raised through consultation with DPI/NSW Agriculture can be divided into three categories: impacts during construction; long term impacts on agricultural resources; and impacts on communities. The consultation also included discussions in relation to the classes of agricultural land in the study area, and the Department’s general preferences in terms of route selection.

4.4.1 Construction Issues

NSW Agriculture highlighted potential issues that would need to be addressed in construction of the proposed Directlink alternative. The spread of noxious weeds is an issue, given the overall fertility of the study area and its climate being highly conducive to plant propagation. Where a project involves any significant disturbance of soil, the time of year that the works are undertaken is directly relevant to the range of plant species that are in flower, and therefore to what is likely to propagate as a result of that disturbance. Bearing in mind the advice from NSW Fisheries, above, this generally suggests that any substantial construction earthworks should take place during the autumn and winter months, when most plant species are dormant.

A related issue is that of plant disease. Banana plantations are prone to a soil-borne fungal disease, *fusarium oxysporum* or Panama Disease, that is spread by the movement of banana plants or infected

soil. Panama kills banana plants by infecting the root system and blocking the transport of water through the plant.

There are two 'races' of the disease in NSW. Race 1 affects Ladyfinger and Ducasse species, among others, but not Cavendish. Race 4 also kills Cavendish plants. Both races are present in the Tweed and Brunswick growing districts, and in excess of 70% of banana plantations in Tweed and Brunswick are estimated to have panama disease. Panama spores can survive in soil for up to 30 years, and there is no cure once a plantation is infected.

NSW Agriculture policy is to assume that every banana plantation is a risk. The Department's management policy involves strict protocols for ensuring that soil is not transported off site from plantations, such as:

- avoiding movement of plants, soil or mud between properties;
- removing all soil from machinery and vehicles when leaving banana growing properties by wash down with uncontaminated water and a quaternary ammonium compound, in designated wash down areas;
- protecting disturbed or excavated soils from erosion so as to avoid movement into drainage channels for dams, watercourses or banana plantations;
- using only clean (ie town) water for drilling;
- importing only clean fill or roadbase materials, and avoiding stockpiles in potential contamination areas;
- cleaning of muddy boots and vehicles between visits to different farms;
- appropriate staff training; and
- working in dry weather wherever possible and practical.

4.4.2 Impacts on Agricultural Resources

NSW Agriculture raised the issue of potential impacts on individual agricultural landowners, in terms of compulsory land acquisitions, easements and other potential impacts on real property. It was suggested that the preferred route may result in limitations on the use of land through such effects as alienation, severance and limitations on trafficability over private land.

The proposed Directlink alternative may require easements to be obtained over private property, including agricultural holdings (see **section 8.9** below). Should easements be required, they would be sought on the basis that they would not affect any existing rights of access or use of a piece of land.

This issue also goes to potential limitations on the working of land by machinery. For example, where the proposal is located underground across the cane fields in the Tweed Valley, the trenching would have to be located with sufficient depth of cover to ensure not only that the facility does not interfere with root penetration, but also that any machinery used for cultivation does not pose a risk either to the facility, the farm machinery or the machinery operator. Therefore, in such situations a minimum trench depth of 1.5m below soil surface level would be considered necessary.

4.4.3 Impacts on Rural Residents and Communities

Rural communities and the highly dispersed nature of rural residential development in the study area were raised as a significant issue by a number of stakeholders. As discussed, and as confirmed in discussion with Tweed and Byron Shire Councils (see **section 5**), settlement within the study area, whether agricultural or purely residential, is a constraint to development such as the proposed Directlink alternative. The resident population within the study area is environmentally aware and highly protective of environmental values and the north coast lifestyle. The community is likely to perceive that the proposed Directlink alternative will have a negative impact visually, environmentally

and in terms of impacts on human health. These issues are dealt with in detail individually in **sections 6 and 7** below. However, the key issue is that the planning of any high-voltage power line route through the study area must take the community's expectations and perceptions into account. As discussed elsewhere in this report, community issues are best managed through an inclusive and consultative planning process, and a thorough and balanced assessment of all environmental and ecological issues.

4.4.4 Classes of Agricultural Land

DPI/NSW Agriculture outlined the significance of the agricultural land classifications adopted throughout the study area, and potential implications for the project. The most valuable agricultural lands in the study area have been identified under the NSW Far North Coast Farmland Protection Project (see **section 4.5.2** below) as being 'State Significant Farmland Protection Area'. Only the Cudgen – Durambah area, which is defined as Class 1 and Class 2 land under the Tweed LEP 2000, achieves State Significance within the study area, and both of the preferred route options avoid these lands.

Class 3 agricultural land is defined as grazing land or land well suited to pasture improvement, or cultivated or cropped in rotation with pasture. Most of the sugar cane lands and floodplains are designated as Class 3 land. Classes 4 and 5 are suited for grazing or light grazing, but not for cultivation. Class 4 land sustains some banana plantations, while NSW Agriculture advises that Class 5 land generally denotes steep or low-lying country that is generally unsustainable for agricultural activity.

Within the above constraints, DPI/NSW Agriculture stated a preference for a route that follows existing infrastructure corridors, or other "least disturbance" or "least annoyance" options. It was suggested that agricultural landowners, through involvement in infrastructure projects such as the Yelgun – Chinderah Motorway, have become something of a force in negotiations over corridor route selections, which may have implications for further refinement of the preferred route option.

4.5 Department of Infrastructure, Planning and Natural Resources

The Department of Infrastructure, Planning and Natural Resources (DIPNR) North Coast Regional Office, Grafton, provided advice in relation to relevant strategic planning initiatives currently under way in the region. Three specific initiatives were raised as potentially being of relevance to route selection for a Directlink alternative. These are the Northern Rivers Regional Strategy, the Far North Coast Farmland Protection Project, and the review of the North Coast Regional Environmental Plan.

4.5.1 Northern Rivers Regional Strategy

The Northern Rivers Regional Strategy is the result of a partnership between the Northern Rivers Regional Economic Development Organisation (NOREDO), the Northern Rivers Regional Organisation of Councils (NOROC) and DIPNR. It was developed in consultation with interest groups and the community. The strategy is based on the principles of sustainable development and builds on the findings of the North Coast Urban Planning Strategy. It integrates land use planning, economic development and environmental management in a framework for managing sustainable growth and development in the Northern Rivers area. This strategy covers 10 local government areas from the Queensland border in the north to the Clarence valley in the south. The strategy is used by organisations planning and developing the region, including government, development and industry groups, and community and environmental organisations.

The Northern Rivers Regional Strategy will inform the early stages of the review of the North Coast Regional Environmental Plan (see below), and is not of direct or specific relevance to the proposed Directlink alternative, other than in helping to establish a strategic regional framework.

4.5.2 Far North Coast Farmland Protection Project

The Farmland Protection Project (FPP) has been undertaken by DIPNR and the Department of Primary Industries, to identify important farmlands for strategic planning purposes. The project has been undertaken in Ballina, Byron, Kyogle, Lismore, Richmond Valley and Tweed Councils. The draft report, which is due to be placed on public exhibition, identifies rural land capabilities based on new mapping of soil landscapes. In this regard, the FPP achieves a finer, more thorough assessment of agricultural land capability than the 'traditional' agricultural land classification, and will eventually result in the replacement of the existing agricultural land classes. Land classification will be based on a broader range of criteria, and will include classifications of 'State Significance' and 'Regional Significance'.

The FPP draft report (which was not available at the time of writing and was not viewed) also includes draft planning controls, which will eventually become statutory controls, in relation to permissible uses in these areas. DIPNR has advised that, in respect of a Directlink alternative, the draft controls do not preclude the location of public infrastructure facilities in either State or Regionally significant land. However, an objective of the classification would be to avoid land such as the Cudgen – Duranbah area, which is the only State Significant land identified within the study area. As previously stated, both of the preferred route options avoid these lands.

Concurrently with the FPP, a Section 117 Direction was issued by the Minister Assisting the Minister for Infrastructure and Planning, on 12 January 2004. The S.117 Direction sets objectives for protection of the best large contiguous areas of agricultural land in the Far North Coast from rezoning for urban or rural residential uses, while the FPP strategic planning is completed. The specific objectives are:

- i) To ensure that the best agricultural land will be available for current and future generations to grow food and fibre; and
- ii) To provide more certainty on the status of the best agricultural land, thereby assisting councils with their local strategic settlement planning.

The S.117 Direction applies when one of the councils that is signatory to the FPP prepares a draft local environmental plan for land mapped as State or Regionally Significant Farmland Protection Area. A draft LEP prepared in respect of these lands must not, under this Direction, *rezone land or change the provisions applying to a zone, if that rezoning or change would result in the land becoming available for urban or rural residential use*. 'Urban use' in this context includes residential housing, retailing, and other uses normally located within towns. 'Urban use' does not include a use which adds value to agriculture without consuming a significant area of agricultural land.

4.5.3 North Coast Regional Environmental Plan

The North Coast REP was gazetted in 1988 and is not considered to be of particular relevance to the proposed Directlink alternative. However, the strategic planning initiatives discussed above and elsewhere in this report will inform a comprehensive review of the REP. DIPNR's North Coast Regional office has advised that this review is in its early stages, and the draft revised REP will not be exhibited before 2005.

4.6 Natural Resource Management NSW

The former Department of Land and Water Conservation was consulted with regard to issues relating to land and water resource management. Natural Resource Management NSW (NRM), now part of

DIPNR, gave advice in relation to specific project-related issues, and also put the project into the organisation's strategic framework.

NRM raised issues generally in relation to the project's interaction with natural processes, and the advice was consistent with that received from other agencies, and discussed in this report. It was recommended that steep lands be avoided, and that crossing of watercourses also be avoided, to minimise impacts of erosion, sedimentation and stream damage. NRM also advised avoidance of known acid sulfate soil risk areas, although acknowledging that this issue can be managed. It was also recommended that the preferred route avoid disturbance of surface and ground water, and disturbance of vegetation in environmental protection zones.

At the strategic level, NRM discussed the role of the Northern Rivers Catchment Management Authority, whose role it is to implement the Upper North Coast Catchment Blueprint, which is one of three such 'blueprints' that have been exhibited for the north coast. The Blueprint sets targets for stream and river health, habitat and biodiversity, land use planning, and land management. Its objectives are:

- a) *Human population impacts managed through effective land-use planning that minimises future land-use conflict over our diminishing natural resources. This land-use planning requires active community participation to incorporate the spiritual and cultural values of the whole community, including indigenous peoples.*
- b) *The retention and restoration of our wildlife habitats, to protect our biodiversity from threatening processes and to secure diverse and resilient eco-systems.*
- c) *Our land managed in accordance with land capability in order to prevent further degradation, to ensure appropriate land-use and to rehabilitate the environmental attributes of our land's resources.*
- d) *Achieve water quality throughout the catchments and within receiving estuarine and marine waters that meets both human and environmental requirements.*
- e) *A community with adequate resources and capacity to implement best land management practices and ensure the effective stewardship [care and management] of our environment.*

These objectives are broadly consistent with other advice received in the course of the consultations, and do not present any significant issues or conflicts in relation to the proposed Directlink alternative.

4.7 Department of Environment and Conservation

4.7.1 National Parks and Wildlife Service

The National Parks and Wildlife Service, now part of the NSW Department of Environment and Conservation, was consulted in relation to issues of relevance to the DEC/NPWS estate and matters over which DEC or NPWS has jurisdiction under the *National Parks and Wildlife Act 1974* and the *Threatened Species Conservation Act 1995*.

It was recommended by DEC/NPWS as a first priority to avoid national parks, nature reserves and state forests, and that the preferred route avoid environmental protection zones and areas identified as having high conservation value or significance. It was further recommended that the project focus on defining a route that utilises an existing infrastructure corridor such as the Yelgun – Chinderah Motorway corridor.

With regard to fulfilling statutory obligations under the NPW Act, the NPWS also referred to the need to carry out appropriate studies of indigenous cultural heritage through the Aboriginal Heritage Information Management System (AHIMS), and consultations with local Land Councils. Subject to this

initial information search and review, it is likely that a full assessment of the project would include a detailed ground survey of Aboriginal archaeology.

Other matters relating to statutory compliance issues under the NPW Act and the TSC Act are discussed above in **section 2.2**.

Under the TSC Act, flora, fauna and cultural surveys and assessments would be required, along with searches of the appropriate DEC databases, such as the Wildlife Atlas and/or the Rare or Threatened Australian Plants (ROTAP) databases. As discussed above in **section 2.2**, subject to completion of an '8-part test' under section 5A of the EPA Act, a species impact statement may be required as part of the overall environmental assessment of the project.

4.7.2 Environment Protection Authority

Approaches were made to the EPA to discuss issues relating to pollution and protection of environmental health, as they might arise with a project such as the Directlink alternative. However, despite numerous attempts at contact, the DEC's EPA representative in the study area was not available to discuss the project during the study period.

4.8 Roads and Traffic Authority

Advice was sought from the Roads and Traffic Authority regarding the opportunities for co-location of a transmission line within the Yelgun – Chinderah Motorway corridor. The RTA has advised that it will not, as a matter of policy, permit the sharing of freeway/motorway corridors for co-location of electricity or other utilities. Reasons given in support of this policy position include:

- Safety and logistical issues of having non-collapsible hazards within the motorway 'cleared zone' of approximately 11m either side of the road shoulders;
- Visual impacts of an overhead transmission line, particularly in the context of the scenic values of the Tweed River floodplain and the open coastal plain; and
- Potential conflicts in terms of providing access for service and maintenance to a facility located within the motorway corridor.

5. Community Issues and Expectations

No consultations with the community were conducted in the course of this study. However, from discussions with key council and government stakeholders as documented in **section 4** above, from a cursory understanding of the demographic profile of the study area, and from experience with similar projects in the past, it is possible to make certain informed assumptions and judgements as to the likely issues that might arise if a Directlink alternative proposal was opened to public scrutiny.

The far north coast community is known to be environmentally aware and highly protective of the environmental values and qualities that attract people to the region. The community is also empowered by sympathetic local political representation. It is well-informed, with high expectations in relation to developments and their impact upon those environmental qualities. The community resists development pressures and is averse to change, particularly where that change represents further incremental erosion, perceived or real, of quality of life.

The community now expects that planning processes for large projects will be inclusive, open and transparent, and that community input will be given genuine status in decision making. Experiences such as Yelgun – Chinderah have also strengthened the community in terms of organisational structure and ability. For example, the sugar industry is recognised as presenting a well-organised co-operative front, representing the interests of a significant proportion of the population in Tweed Shire.

Some of these community traits are now accepted as the norm throughout New South Wales in relation to development and infrastructure projects. Specific to the far north coast region however is a general resistance to development that is not seen as delivering direct benefit to local communities. In this regard, a transmission line connecting the NSW grid to Queensland might not be seen as being in the interests of the region. Therefore, as advised by Tweed and Byron Shire Councils, it is considered prudent to assume that there would be substantial and general resistance to the project. Specific issues likely to be raised are:

- Visual and scenic qualities and character of the study area, and the incompatibility with these qualities of an overhead transmission line across the landscape;
- Impacts on property, particularly productive rural lands, resulting from compulsory acquisition and the obtainment of easements through private land;
- Property severance and impacts on access across a utility corridor;
- The proposal does not deliver tangible benefits to communities along the corridor;
- Impacts on sensitive ecological areas, terrestrial and aquatic vegetation and habitat;
- The planning and decision making process in terms of community involvement and the value of community input;
- The effects of electric and magnetic fields;
- Mitigation of impacts; and
- The overall need and justification for the proposal.

The approach to the proposal in relation to community issues and expectations should begin with the assumption that, for the project to achieve community acceptance, it must have minimal impacts, and be approached with a high commitment to impact mitigation. The approach must also emphasise inclusion of affected communities in information gathering and dissemination, and in decision making. As a general conclusion, a proposal that has minimal ecological and environmental footprint, and minimal impacts on human activity and real property, will provide the best opportunity for achieving community acceptance for the project. The existing Directlink is an underground facility and therefore sets a precedent in this area. The community could therefore reasonably expect that the current best practice method of building power transmission lines is to avoid and/or mitigate potential impacts by burying the lines underground.

6. The Preferred Route and Impacts

This study has identified two alternative routes that are considered to meet the necessary criteria for achieving planning approval. One is an underground facility, the other a combination of overhead and underground cable. Two options have been presented because, as discussed in **section 8** below, there are significant cost implications for locating the facility underground. Given the magnitude of the cost savings achievable by choosing an overhead route and the high likelihood that it could be concluded to represent overall best value for money, this option is considered to be preferred. However, should it not be possible to secure a route for an overhead facility, the underground route has been identified as being potentially feasible.

6.1 Option 1 - The Preferred Option

6.1.1 Option 1 – Route Description

Preferred Option 1 is a combination of overhead and underground facilities. For the initial 7km (approximately) of the route from Lavertys Gap, the transmission line would be laid underground. The final 10km (approximately) of the route from Eviron to Terranora would also be underground, while the remainder of the route would be constructed as an overhead facility. The proposed route, which is illustrated on the maps including the Composite Constraints map in **Figure 10**, follows a similar corridor in places to that selected by URS as their ‘Best Potential Route’, with modifications in order to further minimise likely impacts. The proposed route for Preferred Option 1 is described as follows.

From Lavertys Gap Substation, the route travels underground in trench towards the north east, crossing Alidenes Road, Yankee Creek, Yankee Creek Road, Mullumbimby Creek and Mullumbimby Creek Road, then turning to the north across the Mooibal Spur and Maori Creek. Continuing north across Main Arm Road, the route skirts around the western end of the Chincogan Mountains towards The Pocket. The transition from underground to overhead would occur at the base of Mt Chincogan on its northern side. From the transition point, the overhead alignment travels parallel to The Pocket Road, then turns north before the junction with Middle Pocket Road.

The route continues overhead, north towards Yelgun Creek, Crabbes Creek and Mooball, keeping to the lower flanks of the range. After crossing the Pottsville Road in the vicinity of Quinns Bridge, the route turns east, further keeping to the lower flanks of the hills, then north again across Sleepy Hollow and continuing to Cudgera Creek. From Cabbage Gum Road the route keeps to the lower slopes, crossing Charltons Road, Christies Creek, Reserve Creek and Clothiers Creek.

Preferred Option 1 meets the canefields of the Tweed Floodplain at the northern base of the Condong Range near Eviron, where it returns underground for the remainder of the route to Terranora. The proposed underground corridor utilises existing roads and farm tracks across the canefields to Tumbulgum, where it joins the Tweed Valley Way. From Tumbulgum the route crosses the Tweed River via the existing Alexander Toohill Bridge, then follows Terranora Road via Bungalora Converter Station, up the escarpment to the Terranora Substation.

The existing substations at Mullumbimby and Terranora are typical installations, occupying sites of approximately 2 hectares each. The Bungalora Converter Station, which is located approximately 1.5km north of the Tweed River, has the appearance of a small substation, occupying a site approximately one-third the size of the respective substations, and comprising less infrastructure accordingly.

6.1.2 Option 1 – Impacts

The preferred option largely creates a new route corridor through open country, and therefore poses risks in terms of impacts on sensitive lands and on private property. The underground section at the southern end of the route crosses the Brunswick River and four other creeks, as well as four roads,

and traverses a number of private properties. The underground section of the route avoids the steepest terrain and keeps largely to open country, also avoiding any impact on densely vegetated land.

Similarly, the overhead route through The Pocket and Middle Pocket also avoids identified habitat areas and steep terrain. The general principle adopted in locating the power poles and overhead power lines through open country is to locate the infrastructure as much as possible away from primary roads, on low ground where the higher country can form a backdrop against which the transmission line is less readily visible. In this way the visual impact is minimised, and the facility is not viewed as a dominant feature on the horizon or skyline.

Between Yelgun Creek and Crabbes Creek, the route traverses a narrow band of vegetation that Byron Council has identified as being of high conservation and habitat value. This land is illustrated in **Figure 8B** as a solid band of green across the northern boundary of Byron Shire. The preferred option would cross the ridge at its lowest point, thereby requiring minimal rise in elevation from the valley floor, the shortest route and the least disturbance in terms of power pole locations and clearance beneath the cables. Once over this ridge, the route re-enters cleared land extending through Crabbes Creek, Mooball and across Pottsville Road. This area is primarily low-lying or footslopes, does not contain prime agricultural land, has favourable topography, and is not identified as having high scenic sensitivity.

From Mooball via Sleepy Hollow and Cudgera Creek, the route remains mostly in cleared land. There are narrow bands of vegetation on either side of the valley of Sleepy Hollow, but these are narrow and do not rise to any significant height. Therefore, this location does not present a significant constraint or likely high impacts.

From Cudgera Creek, the Preferred Option 1 skirts the lower footslopes of the ranges, and avoids any further impacts on significant vegetation or habitat areas. The route also avoids impacts on the higher quality agricultural lands, by keeping out of the coastal plain, high enough into the footslopes to avoid the canefields, and low enough to facilitate construction without significant impacts on visual quality or sensitive lands. This approach continues via Reserve Creek, Clothiers Creek, Farrants Hill and Eviron, to the edge of the sugar canefields and the Tweed floodplain.

A matrix of minor roads and farm tracks traverses the Tweed floodplain between Eviron and Tumbulgum. Preferred Option 1 therefore follows these roads from the transition underground at the base of the Condong Range. This route therefore avoids any significant impact on the canefields or private cane farms, and also allows potential acid sulfate soil issues to be more easily managed. The route also facilitates easy access to the transmission line route for maintenance, without the need to further disturb the canefields.

For the remainder of the route, Preferred Option 1 continues underground, following primary roads and the existing bridge across the Tweed River. This route has been chosen so as to avoid further impacts on sensitive land or on private property. It is considered that the underground section at the northern end of the route is relatively free of obstacles and constraints.

6.2 Option 2 – Underground Alternative

6.2.1 Option 2 - Route Description

Preferred Option 2 largely relies upon existing infrastructure corridors such as roads and railway between Lavertys Gap and the Yelgun – Chinderah motorway corridor adjacent to Crabbes Creek.. For a substantial proportion of the route, it parallels the motorway corridor but does not encroach into the

road reserve. The description of the route, which is also illustrated on the Composite Constraints Map in **Figure 10**, is as follows.

From Lavertys Gap, the cable would follow the existing Directlink route underground via Wilsons Creek Road, Coolamon Scenic Drive, and through the eastern side of Mullumbimby to meet with the Casino – Murwillumbah Railway Corridor. It would follow the railway corridor as far as Wooyung Road, Crabbes Creek, where it would diverge, crossing beneath the motorway and running along its eastern side for approximately 11.5km as far as Kanes Road, which passes beneath the motorway. Approximately 2.5km south of Kanes Road, a short diversion is proposed in order to avoid an area of remnant vegetation between Pottsville Road and the motorway.

At Kanes Road, the route would pass beneath the motorway and follow the western side of the corridor for approximately 7.5km, to Eviron Road. Approximately 300m north of Eviron Road, the route meets the edge of the Tweed River Floodplain at the base of the Condong Range. From this point, the route diverges, following the foot of the range in a north-west direction, until it crosses the Main Trust Canal on the small bridge at Leddays Creek Road. From this point, the route would follow Bartletts Road and other unsealed minor farm roads to the Tweed Valley Way at Tumbulgum, from where it would cross the Tweed River via the Alexander Toohill Bridge.

The RTA's objection to co-location with the motorway assumes that a proposed Directlink alternative would be an overhead facility. However, accepting that the motorway corridor itself must be discounted as a possible preferred route, there remain potential opportunities for location of an underground facility in places alongside the motorway corridor. Subject to resolution of other identified planning constraints, particularly land use and land ownership, the route illustrated on the maps is considered achievable for an underground facility notwithstanding the cost of construction of an underground DC facility (see **section 8** below).

From the northern side of the Tweed River, the underground route would follow the existing Directlink route via Terranora Road and Bungalora Converter Station, to the Terranora Substation.

6.2.2 Option 2 - Impacts

Being an underground route that primarily follows existing infrastructure corridors, this route will have minimal long term impacts, but some construction impacts. A number of road and creek crossings are required, which will involve short spans of direct drilling. However, the number of creek crossings is minimised by following existing road and rail corridors, which provide ready made crossings in many locations. Subject to space and structural considerations, it is feasible to attach ducts or troughs to the existing structures. For the larger rivers such as the Brunswick and the Tweed, there are potential issues of drag, which would be significant during floods, on the ducts/troughs. There are precedents however for the attachment of cable troughs to road bridges and for the construction of purpose-built cable bridges.

From Lavertys Gap to Crabbes Creek, the route would be in road or railway corridor, and would result in no new substantial disturbance of private property or environmentally sensitive land.

From Crabbes Creek, Preferred Option 2 potentially impacts on approximately 2.5km of sugar cane farmland. Depending on the precise route chosen, the alignment could be positioned closer to the motorway, lengthening the route slightly but reducing the extent of encroachment into private land.

From Burringbar Creek, the route again parallels the motorway in cleared land at the base of the Burringbar Range. There are no identified sensitive lands between Burringbar Creek and Cudgera Creek Road, except for a small area of remnant vegetation located approximately 1km south of

Cudgera Creek Road. The proposed route therefore diverts around this site via Pottsville Road and Kudgere Avenue.

From Cudgera Creek, the route is again in cleared land at the base of the range, avoiding or skirting sugar cane fields until reaching Kaners Road. North of Kaners Road and east of the motorway, the Round Mountain – Tanglewood area is designated by Tweed Shire Council as future urban growth area. Preferred Option 2 avoids this area by crossing beneath the motorway at Kaners Road and running parallel to the motorway on its western side through cleared land, including the edge of some sugar cane farmland, until it diverges from the motorway corridor approximately 300m north of Eviron Road.

This section of the route between Kaners Road and Eviron Road would impact upon a narrow strip of private rural land, most of which is sugar canefields. However, by remaining in close proximity to the motorway this impact can be minimised. Further, the western side of the motorway avoids sensitive lands in or close to the Cudgen Nature Reserve, and the State significant agricultural land on the Cudgen – Duranbah Plateau.

After diverging from the motorway corridor, the route hugs the base of the Condong Range on the margin of the Tweed Floodplain and canefields. This section of the route avoids sensitive lands, but requires a small encroachment into private land. The canefields also present a risk in relation to acid sulfate soils. However, these can be managed in accordance with the Acid Sulfate Soils Guidelines as discussed above in **section 3.3.5**.

From the edge of the Condong Range, the route travels across the canefields for approximately 3.5km to Tumbulgam. This section of the route would be indirect, via farm roads and tracks rather than directly crossing the canefields, in order to avoid direct impacts on the resource, and to reduce acid sulfate soil risks. The Main Trust Canal would be crossed via an existing bridge rather than trenching or drilling, thus avoiding significant disturbance of soils. While a direct (and slightly shorter) trench could be constructed in the fallow period between cane harvest and plantation times, access to the trench for maintenance or repair to cables may still be an issue. It is considered that the additional length of cable is not significant in terms of overall cost, and a route that follows farm roads is likely to be more acceptable to cane farmers.

From Tumbulgam, the underground option again follows existing roads for the remainder of the route, using the same corridor and construction as the existing Directlink facility. This section of the route, from Tumbulgam to the Terranora Substation, is within the existing road corridor and would have no long term impact on property or on any sensitive lands.

6.3 Comparisons With the URS Preferred Route

As previously discussed, consultants URS Australia Pty Ltd have also undertaken an assessment of possible alternatives for Directlink. The URS preferred route (see **Figure 11**) bears similarities with Option 1 as outlined in **section 6.1** above. The differences are minimal, and may be accounted for by the fact that URS have presented their preferred route as a 'corridor' whose width potentially allows any closer assessment to achieve further refinements in terms of optimising conditions for construction and minimising impacts.

However, for the purposes of this report, the only notable differences between Preferred Option 1 and the URS preferred route are:

- The URS route is located further to the west in the area between Middle Pocket and Mooball, and therefore traverses marginally steeper terrain through this section;

- The URS route takes a more direct route across the cane fields between Eviron Road and the Bungalora Converter Station; and
- The URS route would require construction of a new crossing of the Tweed River, between Stotts Island and the Tumbulgum bridge.

From reviewing the URS proposal in the course of undertaking this study, it is understood that URS relied largely upon the same or similar data to that used for this study, and made similar assumptions. The URS proposal was largely the product of a desktop constraints mapping exercise, and identified many of the same issues, constraints and impacts that have been described in this report.

Lastly, in respect of the comparison between the URS preferred route and Preferred Option 1, the similarity between the two shows clearly that both studies have reached similar conclusions as to the most likely viable corridor for a combined above ground/underground alignment between Mullumbimby and Terranora. In the circumstances therefore, the conclusions drawn by each report can be seen to support the conclusions of the other, confirming that the selected alignment corridor can withstand a certain level of scrutiny as applied in the relative studies.

7. Impact Mitigation

Impacts of both Preferred Options 1 and 2 fall into two categories, construction impacts and operational impacts. The two categories, and the proposed measures to mitigate them, are discussed in the following section. Most of these measures would apply to both options, hence the following discussion on impact mitigation does not differentiate between Preferred Options 1 and 2.

7.1 Construction Impacts

7.1.1 Water Quality, Erosion and Sedimentation

Construction of stream crossings has the potential to disturb stream flows and impact on water quality. For this reason, it is recommended that all stream crossings be constructed by direct drilling or under-boring. As discussed in consultation with NSW Fisheries, this method presents the least risk in terms of impacts, and also requires the least amount of land clearing on either side of streams. NSW Fisheries recommend that minimum buffer zones be established on either side of stream banks, from 20m to 50m, depending upon the size of the stream, the steepness of the banks and the amount of vegetation along the banks.

Construction activities also have the potential to promote erosion and sedimentation along the preferred cable route(s). Mitigation measures would include the following.

Each stream crossing should be designed with appropriate attention to details such as:

- Minimising the removal of riparian vegetation. Where vegetation does have to be removed, ensure that a ground layer remains to minimise erosion; and
- Implementing erosion control measures to ensure that if erosion does occur, impacts on aquatic habitats are minimal.
- Minimising the width of disturbance on creek banks;
- Installation of sediment fences and/or hay bales prior to disturbance of soils, especially at creek banks, to reduce sediment loads entering streams;
- Re-shaping and seeding disturbed areas with appropriate native plant species after construction works are complete;
- Adequate stabilisation of banks or slopes immediately following construction. On steep banks or slopes, there is potential for scouring. In such locations, stabilisation works such as rock armouring or buried sandbags may be required;
- Limiting the length of cable trench excavated at any one time;
- No unauthorised storage of fuel or oils along the cable route; and
- Placing of sediment controls downstream from excavation areas, including creek beds where necessary and/or appropriate. Such controls could include silt fences weighed down at the base (generally limited to shallow, slow velocity creeks) and sediment traps or basins.

7.1.2 Noise

Noise associated with construction activities would mostly occur in remote locations away from human settlements, and because of the linear nature of the proposal, would be of short duration. At individual locations, it would be expected that noise impacts would last no longer than four weeks. It is therefore assumed that exceedance of noise criteria is unlikely along the majority of the route. However, should further investigations result in findings of more significant impacts, measures can be adopted to either treat the noise at its source, or to shield any sensitive receptors through screening or other temporary devices.

7.1.3 Traffic and Access

In certain locations the installation of cable along main roads has the potential to result in traffic delays. This may be an issue between Lavertys Gap and Mullumbimby, and between Tumbulgum and

Terranora. More significant delays may be likely where cable crosses main roads, for example at Pottsville Road, Cudgera Creek Road, Clothiers Creek Road and Eviron Road (for the underground Option 2). On other roads affected in the study area, traffic frequency and volumes are such that impacts would not be significant.

Where traffic flows on main roads are interrupted, construction would be subject to:

- preparation of traffic management plans in accordance with RTA codes and policies;
- appropriate adoption of measures such as stop/go signs, tidal flows, temporary traffic signals, and direction of traffic by construction personnel;
- adequate prior notification in local media of construction activities;
- use of RailCorp personnel where control of rail traffic is necessary to facilitate cable installation in the railway corridor; and
- liaison with cane farmers to determine appropriate access points for the section of the preferred route between Eviron/Condong and Tumbulgum.

The preferred route options have been developed with consideration for access to construction sites. Where the proposed corridor is located in remote areas, construction sites would be accessible by four-wheel drive vehicles, and suitably equipped trucks. It is envisaged that erection of power poles and cables would require one standard four-wheel drive vehicle and one truck at each site. The preferred route has therefore been selected to avoid inaccessible or heavily vegetated terrain, where local roads can provide access in the majority of cases.

Some local access roads would be affected by the project, and would be used by construction vehicles. At most locations, traffic volumes on local access roads would be sufficiently low such that the additional traffic generated by construction activities would not impact significantly on accessibility or road capacity.

7.1.4 Waste Management

The majority of waste identified as likely to be generated through the project is from the removal of spoil from trenching and direct drilling. Most of the material excavated during trenching will be used to backfill after cables have been laid. Where backfilling is not possible, as with under-boring of streams, excavated material would be removed from the site for disposal or use as fill elsewhere. In areas that are potentially prone to acid sulfate soil exposure, excavated spoil that cannot be used for backfilling would be removed and disposed of in accordance with the *Acid Sulfate Soil Management Guidelines* discussed in **section 3.3.5** above.

Other waste management measures during construction include:

- Harvesting where possible of any trees removed during construction. Other plant material should be chipped/mulched and spread to assist in stabilising disturbed areas;
- Collection and segregation of all waste generated from construction personnel such as paper, plastics, metals, and recycling of same where practicable; and
- Removal off site of all other waste products and disposal at an appropriate waste depot.

7.1.5 Ecology

Both of the preferred options has the potential for impacts on ecology along the proposed routes. For the respective sections of the underground and overhead installations, the following measures are proposed.

Road and rail corridors:

- Ensure that a suitably qualified person accompanies the cable route surveyors prior to clearing vegetation, in order to detect threatened plant species, and identify minor alterations to the route where necessary to avoid them;
- In areas where threatened or *ROTAP* plant species are identified, ensure that cables are laid far enough away from the base of plants to minimise risk of root damage; and
- Utilise both sides of the rail or road corridors where appropriate, to avoid any sensitive locations identified during detailed route survey.

Creek crossings:

In addition to the measures discussed for water quality, above:

- Under-bore all new crossings of rivers and creeks;
- Minimise disturbance to macrophyte beds;
- check creek banks for platypus burrows at each crossing; and
- check reed beds for waterbird nests, eg bush hen and black bittern, at each crossing location.

7.1.6 Archaeology

As discussed in this report, the proposal will be subject to requirements under the *National Parks and Wildlife Act 1974*, in respect of Aboriginal archaeology. Measures likely to be required under conditions of permits under the Act include:

- Areas that may contain potential archaeological deposits to be identified by a qualified archaeologist prior to commencement of cable laying or erection of poles;
- Cable laying or erection of poles at sites of potential archaeological deposits should be monitored by a qualified archaeologist and representatives of the Tweed Byron Local Aboriginal Land Council; and
- If cultural material is found during construction works, works should cease in that location and the NPWS and Tweed Byron LALC contacted to assess and advise as to further actions.

7.1.7 Acid Sulfate Soils

Measures for the management of potential acid sulfate soils will be adopted in accordance with the *Acid Sulfate Soil Management Guidelines* discussed in **section 3.3.5** of this report, above.

7.1.8 Air Quality (dust control)

Measures to reduce dust generation at construction sites include:

- Use of water carts to spray unsealed access roads and any exposed or excavated areas;
- Covering of loads of raw materials;
- Prompt re-vegetation and stabilisation of disturbed areas;
- No burning of cleared vegetation;
- Informing residents in advance of construction activities that may be likely to generate dust; and
- Ensuring that all construction machinery is properly maintained, to manage exhaust emissions and pollutants.

7.2 Operational Impacts

7.2.1 Electric and Magnetic Fields

Electric fields are caused by an electric charge on an object. The strength of the field increases as voltage increases, but reduces quickly as distance from the source increases. The field is readily shielded or reduced by conducting objects such as trees, buildings and the earth.

Magnetic fields are caused by electric current. The magnetic field strength increases as the current increases, and also decreases quickly with distance from the source. Unlike electric fields they are not readily shielded.

Electric and magnetic fields (EMF) are generated by virtually all electric equipment and occur wherever electrical equipment is used including high and low voltage power lines, and in homes. EMF exposure is experienced by all people and is not limited to those working or living near transmission lines or facilities.

Much research, debate and discussion has occurred around the world in relation to the impacts of EMF on human health. There is broad consensus that:

- adverse health effects have not been established or proven;
- the possibility of adverse impacts on health cannot be ruled out;
- there is need for further detailed research;
- if there is a risk to human health, it is likely to be small; and
- if any adverse effect exists, it is not exclusively confined to power transmission lines.

Two major public enquiries have been carried out in Australia into the effects of EMF, and concluded that 'prudent avoidance' of risk of exposure to EMF was advisable.

Preferred Options 1 and 2 are largely located in sparsely populated areas, remote from urban centres. Where possible, the route options avoid coming in close proximity with residential dwellings, although this aspect of the proposal could be improved with more detailed investigation and refinement of route options. Underground cable construction has been proposed for the relatively highly populated areas at each end of the route, and the use of direct current (DC) eliminates alternating or fluctuating fields.

The National Health and Medical Research Council (NHMRC) has issued guidelines on exposure to EMF, based not on possible health impacts, but on established or predicted effects of the flow of electric current through the body. The likely EMF levels that would be experienced near the proposed cable route would be low compared to the NHMRC guidelines, and become insignificant at only short distances away from the cable route. Exposure of residents at the nearest homes would be dominated by the background EMF levels already existing in those homes.

It is therefore concluded that no adverse health impacts would be expected arising from electric and magnetic fields generated by the proposed Directlink alternative.

7.2.2 Line Maintenance

Operation of the proposed Directlink alternative would require periodic maintenance activities, and occasional repair of damaged or faulty equipment. This may require occasional access by maintenance staff onto private land. Where construction of the proposal requires the obtaining of easements over private property, or compulsory acquisition, the terms of the easement or acquisition would include the necessary rights of access being established, where appropriate, to enable the facility to be suitably serviced and maintained without undue inconvenience to landowners.

The frequency of line maintenance and servicing episodes would be low, and of short duration. In the normal course of events, no more than one service vehicle would be in attendance for service or routine maintenance of the line, and the number of service or maintenance personnel would be low. It is not considered that the maintenance and/or servicing of the facility would result in any significant impacts on the environment or on the use and enjoyment of private property, and no specific mitigation measures are considered to be necessary.

8. Engineering Feasibility and Cost Estimates

8.1 Alternating Current Versus Direct Current

The project brief required that this study pursue an alternative to Directlink that would achieve an identical functionality to the existing facility. Therefore, the options presented have been developed to satisfy the brief and therefore are presented as being for the transfer of 180MW of direct current (DC) power between the Mullumbimby and Terranora substations.

It is useful however, to place the Directlink facility (and its proposed alternative options) in the context of the overall NSW and Queensland electricity grids within which it operates. The NSW and Queensland grids operate almost exclusively with alternating current (AC), as do the overwhelming majority of power systems throughout the world. This is for two main reasons:

- AC voltages can readily be stepped up for long distance transmission and stepped down for distribution and utilisation by means of transformers; and
- AC is more suited to rotating electrical machines such as the generators in power stations and electric motors in appliances and machinery.

DC power is generally not preferred for the transmission of moderate amounts of power over short or medium distances. This is because DC links normally operate within an AC network, creating a need for converter stations to be installed at both ends of any DC link. Converter stations are required to convert current from AC to DC and vice versa, and are extremely costly but necessary items of infrastructure in a transmission facility such as Directlink.

On the other hand, DC also has certain advantages:

- It is superior where large blocks of power need to be transmitted over long distances, whereas AC systems can become unstable;
- It facilitates the control of power flows within a system. Due to the controllability of DC, it can be used to interconnect large power systems which are not otherwise interconnected, without introducing control/stability/operational constraints; and
- Due to its charging characteristics, it enables the use of long runs of underground or undersea cable whereas, due to the effects of capacitance, AC underground (or underwater) cables are only suitable for relatively short runs, say, up to 30 km.

8.2 Structures

For the purposes of this report, an overhead facility would be constructed using single concrete poles. No lattice towers would be required to support the type of facility as proposed for Preferred Option 1.

8.3 Directional Drilling

In recent times directional drilling has emerged as a convenient means of installing underground services. Directional drilling has advantages in that it can be undertaken with minimal surface disturbance. On the other hand, it is limited in the length between end points. For high voltage underground cables, it is normally only used over short lengths, eg to under cross an expressway or a river.

Directional drilling also has limitations in relation to the manner in which the cable is laid within the drilled conduit. The safest way to install cable of this type by directional drilling would be to install ducts and then draw the cable in. However, this may adversely affect the rating of the cable. Furthermore, the heat transfer characteristics of the surrounding soil may not be ideal and could require the cable to

be further down-rated, or heavier cable installed. The extent to which this matter is an actual concern for the line in question could only be determined by testing the soils along the route for thermal resistivity.

8.4 Ancillary Infrastructure

All underground cable installations involve costs for ancillary infrastructure such as jointing and terminations. In the case of DC lines, whether overhead or underground, there is, in addition, the need for converter stations to convert AC to DC and back to AC. Despite repeated requests, the suppliers of such equipment have been unwilling to provide a general cost estimate for a 180 MW unit, but it could be assumed to be some tens of millions of dollars (say, up to \$50m) at each end.

8.5 Cost of Undergrounding

Disregarding the cost of converter stations and other ancillary infrastructure, the cost of DC underground cables of the required capacity is of the order of 0.7 million dollars per kilometre. Of this, approximately 10% is for the installation and 90% for the equipment.

8.6 Combined Overhead/Underground Systems

In years gone by, most high voltage underground cables were of the oil filled variety and were complex entities in themselves as well as requiring sophisticated and relatively expensive terminations. These requirements have traditionally militated against the undergrounding of short sections of line to avoid sensitive areas. In more recent times, cross linked polyethylene insulation has replaced the oil filled concept. This has resulted in cheaper cabling costs and significantly reduced jointing and termination costs. Accordingly, for the type of line now under consideration, it is considered feasible to underground sections of a few kilometres in length should this be necessary in order to enable a route to be secured.

Apart from the cable terminations themselves, an overhead to underground transmission point requires the installation of lightning protection devices to protect the cable from lightning surges which may propagate along the overhead section of the line. Again, in recent years, with advances in technology, the necessary equipment is readily available. Whilst it may be undesirable to have repeated overhead to underground transitions along the route, it is quite feasible to underground sections (eg. through the urban areas at each end of a line connecting two towns).

8.7 Climatic Impact

All electrical equipment is subject to thermal limits. Operating electrical equipment produces heat and, accordingly, its temperature rises. Any such temperature rise is over and above the ambient temperature and, accordingly, the hotter the ambient conditions, the hotter the equipment's operating temperature will be. In the case of terminal equipment and insulated cables, the operating temperature needs to be limited to a level that will not result in deterioration of insulation or overheating of equipment. In the case of overhead lines, the higher the temperature, the more the lines sag and, for every line, there are design limits. Typically, an overhead line would be designed to operate at 85°C or less. The amount of load that can be carried without exceeding this temperature will be influenced by the ambient air temperature, the amount of solar radiation and the wind speed. The ambient operating conditions are fundamental design parameters for all electrical equipment. Installations are designed to perform their required function within the environment in which they are to be located.

8.8 Transfer Capacity

As noted previously, DC is well suited to the transfer of large blocks of power over long distances. Although a DC link of 180 MW capacity and 60 kilometres in length would be unusual, there is no technical reason why an overhead DC line could not be installed with short sections of underground

cable at its ends. DC power enables long runs of underground cable and therefore strengthens the case in support of Preferred Option 2.

8.9 Easements

The type of overhead line proposed would normally be located within a 45 metre easement. However, there are many examples of such lines being located in easements as narrow as 30 metres within New South Wales. There is little precedent for underground cables in rural areas and, to some extent, the width of easement required would vary with terrain, vegetation cover etc. However, an indicative width of 10 metres would not be unreasonable.

Easements are normally acquired through negotiation with the affected property owner, leading to a transfer and grant. In such cases, the property owner receives compensation which must comply with the *Land Acquisition (Just Terms Compensation) Act 1991*. Although it is not used as a first choice, supply authorities have the power to compulsorily acquire easements should this be necessary. In general, easements confer upon the asset owner the right to enter the property to erect, maintain or replace the asset. The property owner can continue to use the land within the easement provided that no activity, which could endanger persons or interfere with the safety or security of the asset, is carried out.

8.10 Cost Estimates

Approximate cost estimates for the proposed facility are as follows:

Description	Estimated Cost
DC underground cable (conservative estimate based on available quotations)	\$0.7m per km
DC underground, 60km	Cable \$42m Converter Stns \$50m each Total \$142m
DC Overhead line, 60km	\$10m for 60km Converter Stations \$50m each Total \$110m
DC overhead, with 8km underground cable at each end (16km x underground cable @ \$0.7m / km; 44km x overhead cable @ \$1m / 6km)	Cable cost \$18.5m Converter Stations \$50m each Total \$118.5m

Using the above table, the preferred options discussed in this report would have estimated costs of:

Preferred Option 1:	\$120m
Preferred Option 2:	\$142m

The above cost estimates do not include 'incidental' costs such as transition points between underground and overhead sections of a route, and specific costs of trenching and direct drilling. However, these items would not add significantly to the overall costs, and would make little difference in terms of the overall cost comparisons.

In respect of the above, it must be noted that detailed accurate costings for each of the possible options is beyond the scope of the brief. Further, suppliers of equipment were reluctant to provide quotations in the absence of a 'real' project. Therefore, the costs quoted above cannot be relied upon for accuracy and should be used as a guide only.

However, the above table indicates clearly the magnitude of the difference between the costs for underground cable versus overhead cable, and the cost of conversion to AC at either end. There is also the broader question of weighing the costs against the benefits, including the non-cost benefits. An underground facility is likely to have benefits that cannot be quantified in dollar terms, such as minimal environmental and social impact. Conversely, a detailed assessment of the combined overhead / underground option may reveal environmental and property impacts with the potential to jeopardise the project. Therefore, the overall decision as to which would be the most acceptable option in the long term cannot be made on cost grounds alone.

9. Conclusions and Recommendations

9.1 Recommended Preferred Option

Each of the two options presented is considered able to withstand a rigorous assessment of all relevant environmental, social and economic factors. Such assessment would inevitably include refinement of route alignments, but as concepts, these options are considered to have addressed the issues and constraints, and the requirements of the brief, as far as can be reasonably achieved within the scope of the project. Therefore, each of the two preferred options is considered to have the potential to achieve planning approval.

The selection of a recommended preferred option is largely an exercise of weighing costs against impacts. The underground option (Preferred Option 2) would be more costly to build, but would have a substantially smaller 'footprint' in terms of disturbance of environmentally sensitive areas and visual impacts. This option would utilise or adjoin existing infrastructure corridors for much of its length, and any easements or acquisition of private land would be minimal. When completed, the facility would be largely invisible and would not result in any permanent effects in terms of land severance or socio-economic impacts. An underground facility is therefore likely to represent best practice from the community's viewpoint, and to be the community's preferred option.

Preferred Option 1 represents a more 'traditional' approach to building a transmission line, and would likely result in significantly greater impacts on private land in rural areas than Option 2. However, as discussed in this report these impacts are considered to be manageable and in the longer term would not result in any significant losses in terms of landowners' rights, entitlements or productivity. Visual impacts can also be managed and subject to further detailed route investigations, adjustments and mitigation, would be acceptable.

Preferred Option 1 follows a route that has been selected so as to minimise the requirement for corridor clearing, and to minimise impacts on identified habitat corridors and other sensitive lands. This option also avoids the most difficult terrain, crossing ridges and saddles at low points, and keeping to cleared land wherever possible. Preferred Option 1 is considered to have minimal long term impacts, and while it would not be as likely to receive community support, it is considered that community issues could be successfully managed in the planning and assessment process.

Preferred Option 1 could also be built for a lower price than Preferred Option 2. Therefore, this study has concluded that Preferred Option 1 is the preferred option, because the additional impacts, by comparison with Preferred Option 2, are considered to be manageable and do not justify the additional costs that would be associated with building the line underground.

9.2 Conclusions and Recommendations

This report represents the findings of a desktop study to investigate the potential for a feasible alternative to the Directlink electricity transmission line between Mullumbimby and Terranora in northern NSW. Based on a reconnaissance visit to the study area, limited consultation with local and State government agencies, and collection, review and analysis of relevant available data, it has been possible to draw certain conclusions regarding the likely opportunities and constraints to securing an alternative transmission line route. It has also been possible to prepare 'order of' cost estimates for establishing an alternative route, and to assess the relevant statutory framework within which a project such as a Directlink alternative would be planned and assessed.

The primary outcome of this study is the identification of two possible alternative route alignment options, one of which has been identified as being the 'preferred' option. The brief for the study sought a recommendation for a route or routes that achieve the same functionality in transmission capability and capacity as the existing Directlink transmission line, an underground DC facility with a nominal transfer capacity of 180 megawatts.

This study has investigated all of the available transmission options for achieving the required functionality. From the identification and assessment of relevant planning issues, and through identification and mapping of constraints, this study has arrived at two potential route options that could form the basis of further investigations and assessment if a proposal were to be progressed to actual project planning stage.

It is considered that these two options, one of which is underground, the other mostly overhead, could be further developed for the purpose of achieving planning approval. Planning and assessment of either option would most likely be undertaken under Part 5 of the *Environmental Planning and Assessment Act, 1979*. However, aspects of the proposal may be subject to assessment and approval under Part 4 of the EP&A Act, if the requirements of *State Environmental Planning Policy No. 14 – Coastal Wetlands*, or *State Environmental Planning Policy No. 26 – Littoral Rainforests*, are triggered.

The proposal is also likely to trigger statutory mechanisms under the *National Parks and Wildlife Act 1974*, the *Threatened Species Conservation Act 1995*, the *Rivers and Foreshores Improvement Act 1948*, and the *Fisheries Management Act 1994*. The process will necessarily involve assessment and approvals by a number of agencies charged with administering these statutes, with the overall authority for statutory approval being vested in the Minister for Infrastructure and Planning. As a 'public authority', Country Energy being the proponent would also be the determining authority for the project.

The two preferred route options are described in detail in this report, along with the likely impacts and proposed measures for mitigation of impacts. The report also discusses the issue of community acceptance and / or opposition to the project. As discussed, the community within the study area is likely to have high expectations as to how the project is approached. The community would be reasonably entitled to expect a facility such as a Directlink alternative to be built underground, if at all. Therefore, the prospect of achieving community acceptance would be dependent upon management of community issues within a comprehensive consultative process, as a key component in the successful realisation of this project.

It is therefore considered that Preferred Option 1, being an overhead facility with sections of underground cable at either end, as outlined and discussed in this report, may be adopted as the recommended Directlink Alternative. Subject to further detailed assessment, and subject to the development and implementation of a comprehensive consultative process, it is considered that Preferred Option 1 satisfies the requirements of the project brief, and possesses the necessary attributes to achieve planning approval.

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Appendix A

Extract from DIPNR Directlink Consultants Brief

