3.0 PROJECT DESCRIPTION

3.1 PROJECT LOCATION

This document addresses the acquisition and planning approval for a 275kV transmission line connection (the Connection) between the WDS and the existing QNI easement. This line forms one component of a larger overall development project which includes establishment of the WDS, and the linking of this substation to the existing transmission network at Halys Substation near Kumbia, in the South Burnett.

The western end of the Connection is located at the WDS site adjacent to the Kogan Creek Power Station approximately 53km north west of Dalby on the Darling Downs. The eastern end of the Connection is the existing easement containing the QNI in the vicinity of the Condamine River, south of the town of Warra.

The Connection is located within the Local Authority of the Western Downs Regional Council.

Figure 1.1 indicates the Braemar / Kogan Creek / Tarong locality. This area lies within Powerlink's South West Queensland (SWQ) network sector.

Previous environmental documentation and approvals have been prepared for the Western Downs Substation site (Conics 2010) and the existing easement containing the QNI (ERM 1998).

3.2 DESCRIPTION OF THE PROPOSED DEVELOPMENT

The proposed development is classified as Electrical Works in accordance with Schedule 2 of the Sustainable Planning Regulations 2010. These works include the acquisition of the easement between the WDS site, and a partially vacant easement containing the QNI, near Warra. This easement may be cleared and will contain a 275kV, double circuit, transmission line which will predominantly utilise steel lattice towers, but may include steel or concrete poles. The project will also include on and off easement access tracks, creek and stream crossings, fencing as required and other works necessary for construction, operation and maintenance of the electrical works.

High voltage transmission lines consist of a series of towers between which conductors and earth wires are strung. For the purposes of this project, a 275kV double circuit transmission line with two earth wires will be constructed within a 60 m wide easement.

3.2.1 Physical Details of Structures

3.2.1.1 Transmission Towers

Transmission towers are used to keep the high voltage conductors (wires) separate from each other, and clear of the ground and other obstacles. Requirements for minimum clearance between energised conductors and various types of obstacles are specified in the Electrical Safety Regulation 2002.

The span distance between adjacent towers and the height of the towers is determined by the surrounding topography, clearance requirements and structural loading limits. Towers are fabricated in a range of designs to allow for the most optimum height to be provided at each site. Typically, shorter towers are found on elevated areas such as hills, with taller towers being used near gullies, on flatter terrain or where additional clearance is required over mid-span obstacles such as roads or sensitive areas such as Regional Ecosystems, riparian vegetation or rare and threatened flora/fauna.

Various designs of conventional self-supporting lattice steel towers have been used in Queensland for over 50 years and are the standard form of support structure for high voltage infrastructure construction adopted throughout the state. Individual structure components are fabricated from galvanised steel angle sections (members) and steel plate and are bolted together. Each tower leg is supported by its own foundation. The two principle structure types in use are suspension and tension towers.

3.2.1.2 Suspension Towers

Suspension towers are used where the transmission line follows a straight route or has a very small deviation angle (up to 2 degrees). They are designed to carry the weight (vertical load) of the conductors, and withstand transverse (horizontal) wind load on the conductors, and conductor tension resulting from the small angles, earth wires and the structure itself. The structural details of a typical double circuit suspension tower are shown in Figure 3.1. Features of the conventional suspension towers are relatively light construction, with cross-arms on each side of the upper tower (superstructure) and vertical insulator strings supporting the conductors. The standard foundation for suspension towers is shown in Figure 3.1. Special foundation types such as driven piles and screw anchors are used in poor load bearing soils or other situations where conditions are not suitable for standard foundations.

3.2.1.3 Tension (Angle) Towers

Tension towers are characterised by a 'heavier' appearance due to the larger steel section sizes and conductors 'terminated' onto the cross-arms using insulators in a near horizontal orientation. Tension towers are designed to carry the weight (vertical load) of the conductors, and transverse (horizontal) load from wind on the conductors, longitudinal conductor tension loads, earth wires and the tower structure itself. The design for a typical tension structure is shown in Figure 3.1. Tension towers are required where changes in direction of the transmission line of greater than 2° occurs, or where termination sites have been predetermined to facilitate line construction and operation. These towers are designed to withstand high longitudinal loading on the structure which cannot be accommodated by the lighter suspension towers.

Tension towers are used for line deviation angles exceeding the limitations of the suspension tower (2°), 'uplift' positions and at line terminations. Uplift is a term used to describe the loading condition where in the absence of sufficient vertical gravity loads would cause a suspension insulator string to swing unacceptably close to the body of the tower under certain loading conditions, thus reducing electrical clearance. This situation can occur where a tower is located at the base of a hill or on steep terrain, and is resolved by using a tension tower with its different insulation configuration even though the loading conditions would not normally require a suspension tower at this location. A suite of structures may be designed for a particular project to cover a range of angle duties. For example, an intermediate type may be designed for angles of up to 40° and a 'heavy duty' type provided for angles up to 90°, as well as termination positions, such as those that occur at each end of the transmission line.

Either tower type can be raised or lowered in increments of three metres (based on sectional lengths used in the tower design). This ensures that appropriate ground clearance is maintained. A typical foundation for the tension towers is shown in; it is larger in diameter and depth than foundations for suspension towers in order to support the higher mass and lateral loading. Similar to suspension towers, special foundation types are also used where a standard foundation design is not appropriate to the prevailing ground conditions.

3.2.1.4 Conductors

Conductors to be used on 275kV transmission lines are all aluminium alloy. For simplicity, the industry has adopted code names to differentiate between the different combinations of size and strand numbers for the conductors most frequently used. For instance, a typical conductor for this line is code named 'sulphur' and comprises 61 strands each 3.75 mm diameter with a total diameter of 33.8 mm. Each structure will support twelve individual conductors, configured in three pairs of (twin) conductors on each side of the tower.

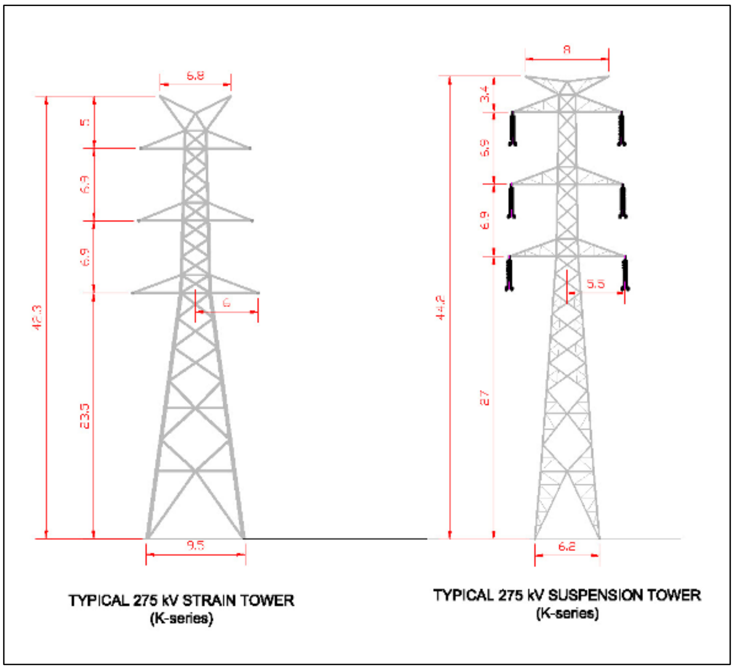
3.2.1.5 Earth Wires

Overhead earth wires provide protection to the conductors from direct lightning strikes, to safely dissipate earth fault currents and are also used as a support for optical fibre cables for communication purposes. Each optical fibre earth wire will typically be 14 mm diameter with 48 optic fibres protected within the middle of the cable.

3.2.1.6 Insulators and Fittings

Insulators are used to provide a connection between conductors and structures and to provide electrical insulation between the high voltage of the conductors and the (earthed) tower. The length of insulators in a string is determined by line voltage, clearance requirements and environmental (e.g. pollution) considerations. For this project, insulators will be the ceramic or glass type. Special galvanised steel or aluminium fittings connect both the line end of the insulator to the conductors and the tower end to the structure. A typical insulator string for 275kV lines is shown in Figure 3.1.

FIGURE 3.1 INDICATIVE TOWER STRUCTURES



3.2.1.7 Easements

Where tenure allows, all Powerlink transmission lines are constructed on easements. An easement is a registered interest within a parcel of land for which Powerlink pays compensation to the owner. An easement allows the transmission line to be built and operated on a part of a property while ownership of the entire property remains with the current owner. Restrictions are placed on certain activities permitted on an easement to ensure that the safety of the public is maintained and the line can operate reliably. Compensation is paid for the easement acquisition for the encumbrance that the easement represents on that land. The easement width is determined by the size, voltage and type of line and the need to maintain safe electrical clearance between the high voltage conductors and any object or structure adjacent to the line, under all conditions.

Clearing of vegetation within the easement is necessary to ensure that adequate safety clearance is maintained to energised conductors. It is Powerlink's practice to remove only that vegetation which infringes or is likely to infringe this safety clearance. In practice, this means that a significant proportion of trees and taller vegetation is cleared from the easement area. Where the new line parallels the existing Kogan – Braemar Transmission line, an easement widening of 40m is required. New 60 metre wide easements will be acquired for the balance of the connection between the WDS and the QNI.

3.2.1.8 Access Tracks

Access to the full length of the transmission line will not be required during construction, but construction and maintenance access is required to each structure site. To reduce impacts to landuse operations, Powerlink prefers, with consent of respective landowners, to use existing property access tracks. In steeper terrain or where the easement is dissected by creeks or gullies, tracks may need to detour off the easement. Where access is needed by heavy construction vehicles (including delivery trucks, cranes and concrete trucks), a higher standard of access is generally required. This may result in existing tracks being upgraded to improve access for such heavy vehicles. All track construction will be undertaken in accordance with Powerlink's Transmission Line Access Tracks Standard, which is contained in Appendix D.

During the service life of the proposed transmission line, access maintenance is conducted as required to ensure that tracks are passable by the range of vehicles and machinery employed to service the easement and tower sites. This maintenance addresses matters including erosion and sediment runoff, and ensures that sensitive areas such as watercourses or remnant vegetation are maintained in a healthy condition. Erosion and sediment control measures will be implemented to appropriately manage water runoff, particularly in areas of erodible soils and where heavy rainfall is expected. Any temporary diversion structures or access tracks shall be designed in accordance with the protocols outlined in the manual: Best Practice Erosion and Sediment Control (Australasian Chapter of International Erosion and Sediment Control Association, 2008).

3.2.2 Construction Process

Construction of the transmission line will involve a series of field activities, which are broadly categorised as follows:

- Site surveys;
- Vegetation clearing;
- Access tracks;

- Foundation installation;
- Structure erection;
- Conductor and earth wire stringing; and
- Site rehabilitation.

3.2.2.1 Site Surveys

Easement surveys are carried out by ground-based surveyors. Survey Plans are prepared and pegs are placed at appropriate locations to accurately define the position of the easements on each property crossed. Profile surveys involve an aerial survey of the ground profile along the final alignment. The purpose of the profile (or centre-line) survey is to obtain information necessary to aid the design of the transmission line in a precise and efficient manner. Data that is collected includes ground elevation along the centre-line (depicting topographical relief), cross-fall of the easement, location and extent of gullies and watercourses, the height range of vegetation (including in some instances, individual trees), roads, powerlines, and other information that could be pertinent or potentially influence the final transmission line layout.

Structure locations are based on the technical characteristics of the structures and conductors as well as management requirements that include environmental considerations. Upon completion of the design of the transmission line, surveyors revisit the site and place pegs at the proposed tower sites to identify the location of the foundation for the construction crews.

3.2.2.2 Vegetation Clearing

Areas of vegetation that may need to be cleared or modified will be defined once the precise location of each tower and the respective conductor height are known. The extent and type of clearing required is dependent upon terrain, vegetation type, presence of waterways and to some extent landowner and land use requirements.

Clearing methods may vary from selective vegetation removal using chainsaws and other hand tools, bulldozer and stickrake in heavier vegetation, through to megamulching to minimize soil disturbance. At tower sites, sufficient area will be cleared to allow tower assembly and erection. This area should be sufficient to cater for cranes and elevated work platform trucks. The tower footprint will also be “grubbed” for stumps. Clearing within and adjacent to waterways is discussed in Section 7.0 of this EIS.

Approximately 40% of the preliminary alignment for the new line parallels the existing alignment between Kogan Creek Power station and the Braemar Substation. This section will require incremental widening of approximately 40 metres on the northern side of the existing clearing. In moderate terrain, where mechanical clearing is not appropriate due to soil or slope constraints, trees may be cut above ground level, felled along the contour and allowed to decompose naturally. A similar technique may be applied near watercourses to provide bank protection and/or riparian habitat; however, fallen timber will be removed from streams to prevent obstruction to stream flow. Alternative clearing methods will be considered for areas where it is likely that sodic subsoils could be exposed by traditional clearing methods.

Where practicable, timber of commercial value or that suitable for other uses such as fence posts can be recovered prior to clearing operations. In other areas of vegetation, timber will be felled with the residual material normally windrowed within the easement. Disposal of cleared material is dependent upon the clearing method adopted and may include stacking, windrowing, burning, chipping, or being left in situ and will be in accordance with the relevant landholder's instructions. Where felled timber is left in situ adequate breaks will be left in vegetated windrows to ensure surface water flows are not concentrated. The clearing strategy and vegetation disposal techniques will be detailed in the Construction EMP and the work plans developed from the EMP. In all cases, appropriate clearing methods for various areas are to be selected with reference to Powerlink's Policies: *Vegetation Management for Transmission Corridors and Sites* and *Vegetation Control Standard*, as well as input from landowners and advisory bodies, such as the DERM. Vegetation works during construction will be supervised by Powerlink's Environmental Officer. Areas where a particular method of clearing is required are identified in the EMP and in associated Environmental Work Plans (EWPs).

Powerlink will provide at least three months notification to DERM of any proposed clearing within State Land so that the necessary assessment can be undertaken to determine the extent of commercial timber present.

3.2.2.3 Foundation Installation

Conventional tower foundations are grouped into three main types and broadly categorised as:

- Bored piles;
- Screw and driven piles; and
- Mass concrete.

Bored and mass concrete foundations are normally used whereas special foundations such as driven piles and screw anchors are only used where ground conditions do not permit installation of the normal types. The choice of foundation type is dependant on the specific nature of the soil and takes into account the following:

- Soil/concrete friction strength;
- Water levels;
- Soil bearing capacity;
- Construction constraints;
- Rock levels; and
- Soil properties.

Dimensions of foundations are determined by tower type, height and soil conditions at the site. Excavation of bored foundations is typically by truck mounted auger and by backhoe or track mounted excavator for mass concrete foundations. The excavation is bored at the same inclination, as the tower leg. In unstable ground conditions, the excavation may be stabilised by the insertion of a steel 'liner' in a bored foundation, shoring or timbering for a mass concrete foundation. Although dependent upon the geology of the surrounding soil, foundations may typically be excavated to approximately 8 metres. Some blasting may be required in areas where removal of rock is necessary for footing construction. Screw pile foundations are an installation that requires no pre-drilling, boring and limited pile cap excavation and are very suitable for acid sulphate soils where excavated spoil material may be an environmental concern. Driven foundation piles may also be adopted where swampy or malleable ground conditions are encountered, or where there is an environmental concern about the excavated spoil.

The simplest form of screw piles consists of a steel shaft with a helical plate welded to its bottom end. By the introduction of additional helical plates on each steel shaft the capacity can be enhanced accordingly. Pile installation is achieved with a hydraulic head attached to an excavator that rotates the pile into the ground. The tops of the piles are integrated into a mass concrete pile cap that forms the connection platform for the transmission structure. The pile cap will extend slightly above ground level and it is sized according to structural design requirements. Concrete is placed in accordance with normal construction practices and formwork removed after an appropriate curing time. Stubs are cast into the pile cap and the transmission structure erected in the normal manner.

Leg stub/base setup is the process of placing an extension of the tower leg (the "stub") in the correct position and inclination within the excavation, in preparation for concreting in place. A temporary jig or template is used to hold the stub firmly in place in the correct horizontal and vertical alignment and is removed after concrete has been poured and set. Alternatively, the lower section of the tower (the "base") may be used for the same purpose. Backfilling of mass concrete foundations is completed using the excavated material, if suitable, or imported fill. Surplus material is spread evenly about the site or removed, depending on the quantity and suitability. Throughout this process, the site is protected from soil erosion by the implementation of measures detailed in the EMP. Where sodic soils have been identified appropriate treatment methods are to be adopted.

Reinforcing steel is included in tower foundations, with the amount and specifications varying with tower and foundation type. Temporary formwork is also used for the foundation column above ground (bored foundations) and above the base (mass concrete foundations). Concrete is placed in accordance with normal construction procedures and formwork removed after an appropriate curing time.

3.2.2.4 Tower Erection

The term 'tower erection' refers to a sequence of activities from delivery of the structure to the site, pre-assembly, erection, tightening and inspection of each tower structure. Steel for lattice towers is fabricated, galvanised, sorted and bundled ready for delivery at an off-site contractor's facility. Pre-assembly of the tower is usually carried out adjacent to its final site location and involves assembly of a number of sections that will allow convenient erection at the following stage. Large or heavy towers may require the use of a small mobile crane to move members and sections around the construction site for preassembly. In most instances, a large mobile crane is used to erect the tower with a work crew installing and tightening all bolts, and checking that the structure is complete.

3.2.2.5 Conductor and Earthwire Stringing

Conductors and earthwires will be erected using the "tension stringing" method. This term is used to describe the process in which conductors and earthwires are installed under sufficient tension to be kept clear of the ground and mid-span obstacles within the easement. A draw wire pulls the conductors and earth wires through the stringing sheaves under tension. Stringing is usually carried out in sections of 5 to 10 kilometres, depending on the terrain, access and tower types. After the conductors and earthwires have been installed to the correct tensions and sags, they are "clamped in" to the insulators by removing the stringing blocks and installing permanent clamps which hold the conductor in its final position.

The stringing process requires the use of specialised equipment, which is briefly described as follows:

- A powerful winch (puller) is set up at one end of the stringing section and a braking device (tensioner) at the other;

- Specially designed pulleys (stringing sheaves) are fixed at each conductor and earth wire attachment point on each tower in the section;
- Multiple high strength, non-rotating steel winch ropes are threaded continuously through the corresponding sheave on each tower between the winch and the tensioner. This is often facilitated by threading light polypropylene ropes through the sheaves as they are installed. These ropes are used to pull the winch rope through the sheaves at each structure without the requirement for a worker to climb the tower;
- For each stringing section, eight individual winch ropes are run out –one for each phase conductor bundle on each circuit (6) and one for each earth wire (2);
- The conductors (electrical cables) are then pulled out under tension through the stringing sheaves on each tower and through to the winch. Tension of the winch ropes is continuously monitored to avoid over tensioning. Workers carry out visual checks through the stringing section to ensure that the conductor run out proceeds smoothly and wires remain clear of all obstructions (the aluminium conductor can be easily damaged if it contacts an obstruction or the ground);
- At the completion of the run out of all conductors and earth wires, they are attached to structures or temporary anchorages;
- Conductor and earth wire tensions are adjusted to give the design sag (i.e. an appropriate ground clearance);
- Conductors are clamped in final positions at the end of insulator strings at each suspension structure, and terminated on insulator strings at each tension tower;
- Earth wires are clamped or terminated as required at each structure earth wire peak; and
- Equipment is repositioned and the above process is repeated for subsequent stringing sections.

A variation of the above process employs a helicopter to undertake the stringing. It is quite similar to the process outlined above, except a small diameter, steel winch rope is run out through the stringing section by the helicopter. This winch rope is then used to pull the 'normal' heavier winch rope through the same section, and the process is continued in the same manner as conventional tension stringing. This technique is used in environmentally or visually sensitive areas to minimise vegetation clearing, and in steep and rugged terrain where direct access along the easement is limited.

3.2.2.6 Construction over road corridors

Construction of the proposed transmission line over Banana Bridge Road, the Warra Kogan Road and Wolskis Road will require road closures of short duration. These closures will allow the draw wires, conductors and earth wires to be installed across the road formation.

Appropriate consultation with the relevant agency (Western Downs Regional Council; Department of Main Roads) be undertaken and the requirements of those agencies implemented.

3.3 OPERATION AND MAINTENANCE

After the completion of construction and commissioning of the transmission line, the amount of activity on site will decrease substantially. Normal practice is for maintenance staff to carry out scheduled inspections of the line, easement and access tracks on an annual basis. These inspections are generally undertaken in a two-yearly cycle consisting of vehicle inspections in the first year followed by helicopter inspections in the second year. Additional inspections may be required if the line unexpectedly goes out of service or in the event of vandalism.

3.3.1 Structures, Conductors and Fittings

These components are inspected on a regular basis for any signs of unusual wear, corrosion or damage. Transmission lines are designed for a 50 year service life and are very reliable under most conditions. Maintenance personnel are normally expected to climb each structure to conduct a detailed visual inspection approximately once every five years. Provision may be made for the proposed structure and conductor maintenance tasks to be carried out by helicopter. These aerial inspections are completed with the line either energized or de-energized.

3.3.2 Easement

Inspection of the easement is carried out on each scheduled line patrol, with the main aim being to record the type, density and height of vegetation regrowth as well as potential erosion issues. This information is used to schedule regrowth maintenance and treatment. Additional matters of interest include new under-crossings (e.g. distribution power lines), and other activity or construction within the easement which may affect the operation or maintenance of the line.

Powerlink's policy is for the landowner to be contacted prior to any vegetation control work on a property and the owner's agreement sought regarding the treatment method to be employed. This is particularly important if chemicals are involved. Three techniques of vegetation management are employed:

- Chemical;
- Mechanical; and
- Hand clearing.

The technique adopted for each area should take into account a number of issues such as type of regrowth, terrain and the local environment. Herbicide treatment of regrowth is a cost-effective option in many situations however, this method must be carried out within the appropriate environmental and statutory constraints, and in accordance with the manufacturers label information. Herbicide application can include foliar spray, cut stump or stem injection methods – depending on the target species to be controlled. Chemical control of weeds and vegetation will not be applied in the event that an organic farming enterprise is identified.

Mechanical clearing is usually performed by tractor driven slasher and is suitable for shrubs and smaller trees. This method is limited to relatively flat and accessible terrain and the type of vehicle or machinery used. This technique is also be used for access track maintenance, particularly where grasses or low-growing vegetation is the predominant form. Hand clearing is labour intensive but allows for target-specific vegetation clearing, which minimises disturbance to non-target species. It can be employed in areas where vehicle access is not available or where sensitive vegetation occurs (e.g. riparian or watercourse vegetation). Selective lopping of larger trees is an option that is often adopted for urban, visually sensitive or environmentally sensitive areas.

3.3.3 Weed Management

Weed infestation is largely managed under the provisions of a weed management plan, and includes vehicle and machinery washdown, and weed monitoring and control. Restricted access by the public and other parties reduces the potential for vehicle-assisted weed dispersal. Maintenance of vigorous groundcover vegetation along the corridor also reduces the capacity of weeds to colonize an area. Weed control is normally undertaken concurrently with regrowth control, or where required. Powerlink has a policy of cleaning all vehicles and plant/machinery prior to entry to new areas and on exit of suspected weed contamination areas. This assists in the control and prevention of weed dispersal. Construction and maintenance vehicles will be cleaned in accordance with approved protocols upon establishment of the transmission line and after leaving areas of suspected weed contamination. In areas known to contain declared weed infestations, Powerlink will coordinate weed control activities in accordance with local pest management plans and in consultation with landowners and managers.

3.3.4 Access Tracks

Access track maintenance is required to ensure unhindered entry to tower sites for inspections and maintenance. Techniques employed should be appropriate for the area. For example, a grader may be required in hilly terrain where some re-shaping or drainage is necessary, but a slasher would be preferred in open grasslands and on existing grassed tracks. Access track construction work should minimise disturbance to natural ground cover, thus reducing erosion potential and subsequent maintenance requirements. Planting the access with grass species in some areas with erodible soils (notably on slopes) may be required to minimise potential for gully or rill erosion. Maintenance of access tracks should include erosion and sediment control measures such as diversion drains, whoa boys and level spreaders. Any temporary diversion structures shall be designed in accordance with the manual: Best Practice Erosion and Sediment Control (Australasian Chapter of International Erosion and Sediment Control Association, 2008). Erosion prone areas are discussed in Section 5.3, and additional erosion control measures are outlined in the Environmental Management Plan (EMP). Access track maintenance is in accordance with Powerlink's Transmission Line Access Track Standards included in Appendix D.

3.4 DECOMMISSIONING DETAILS

The design lifespan of a transmission line is expected to be 50 years. The process of dismantling and removal of the transmission line is a staged process, which includes:

- Lowering the overhead conductors and earth wires to the ground and cutting them into manageable lengths to roll onto drums or reels. These are removed from the site and sold as scrap. Some minor damage to vegetation results, but other clearing is not normally required for this operation;
- Removing insulators and line hardware from structures at the site and recycling as appropriate or disposal at an approved local authority dump;
- Dismantling of towers and recycling of steel;
- Removal of foundation to 0.5m below ground level; and
- Rehabilitation of tower sites, access tracks and the easement through the promotion of natural revegetation.