Reducing Environmental Impact In Western Power Linear Infrastructure Projects

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Abstract
This paper examines methods used by a Western Australian (WA) electricity corporation, Western Power, to minimise environmental impacts associated with new transmission and distribution projects line projects to achieve positive regulatory and environmental outcomes.

Introduction
Western Power (WP) is a wholly WA government owned trading corporation responsible for the operation and expansion of the electricity transmission and distribution network to supply electricity to customers throughout the South West of Western Australia.

This network coincides with the Southwest Australia Biodiversity Hotspot, which occupies some 356,717 km2 on the southwestern tip of Australia. This hotspot is one of five Mediterranean-type ecosystems in the world, has a high level of biological diversity and endemism with 80% of plant species recorded in the Southwest of WA only occuring there (Conservation International, 2008).

Environmental impact assessment in WA is regulated by the Western Australian *Environmental Protection Act 1986* and the Commonwealth *Environment Protection and Biodiversity Conservation (EPBC) Act 1999*.

Generally WP avoids significant impacts to matters of national environmental significance; however WP has referred projects under the *EPBC Act* that potentially impact threatened species and ecological communities.

Western Power's environmental assessment process is embedded an Environmental Management System (EMS) compliant with ISO 14001. The EMS provides a structured process for identifying and managing significant environmental issues within Western Power and is designed to continually improve environmental performance. The WP Environmental Policy provides the vision for environmental performance of the company. The EMS contains operational policies and procedures that respond to the corporation's environmental aspects and impacts and an Environmentally Sensitive Area (ESA) system that records and manages on ground access to areas such as threatened ecological communities, threatened species habitat and wetlands.

Initial assessment of potential environmental impacts is essential in reducing impacts. Analysis of GIS layers in the project area guide line route selection that to reduce impact on known environmental features. Additional targeted flora, fauna, visual and aboriginal heritage surveys assess on-ground environmental features. The soil pathogen *phytophthora cinnamomi* (Jarrah dieback) has a significant effect on around 40% of vegetation in Southwest of WA. This waterborne soil pathogen can be transported through the movement of soil or vegetation so infested areas are surveyed and mapped and strict hygiene practices are adopted.

Case Studies

Busselton to Waterloo 132kV Transmission Line

The project was initiated to boost electricity supply to the Busselton region, approximately 200 kilometers south of Perth. The line route selected minimized damage to declared rare flora and ecological communities but needed to cross the Capel River containing potential habitat for the Commonwealth listed ring-tailed possum. The preferred crossing of the Capel River was an area with an intact canopy and disturbed understorey vegetation.

An engineering solution was employed to prevent clearing of riverine vegetation and loss of possum habitat. Standard 30 metre poles were used along the line route whereas across the Capel River 45 metre poles were installed with piled foundations ensuring minimal ground disturbance. Helicopters were used to string the conductors (wires) between poles eliminating further impact to possum habitat trees. Though taller poles were used visual amenity was not compromised in this setting.l

The transmission line was also routed to minimize the impact to an ironstone threatened ecological community (TEC), by siting poles within a roadside firebreak and on an adjacent road reserve allowing future line maintenance to be done without leaving the road. Prior to construction this area was designated as an ESA with appropriate signage and access procedures.

Following consultation with environmental stakeholders the project was referred to the WA Environmental Protection Authority (EPA) and the (then) Department of Environment and Heritage and was deemed to not be a controlled action under Commonwealth legislation and was not assessed under state legislation. (Western Power 2001)

Pinjar to Eneabba 132kV Transmission Line

In 2001, Western Power developed a proposal to construct and operate a 132 kilovolt (kV) transmission line between the Pinjar Gas Turbine Station and the Eneabba substation. The line was to be constructed on steel structures approximately 40-50 metres (m) in height with a typical span between the structures of 450-550m.

The transmisison line route selection process enabled the selection of a line route that minimised a range of environmental and social impacts associated with the project. The transmission line was wherever possible aligned with existing access tracks and tower structures were located in cleared areas to minimise the clearing of native remnant vegetation, avoid conservation wetlands and protected lakes, threatened ecological communities, declared rare and priority listed flora. The selected alignment also minimised effects on land used for intensive agriculture, mineralized areas, low flight zones and small holdings.

Management strategies were developed to minimise and control of the extent of clearing and control soil movement to minimise the spread of *Phytophthora* dieback. Strict project hygiene avoided the spread of environmental weeds and vehicle access was prohibited to areas of significant vegetation or declared rare flora.

Vegetation clearing was selective. Most of the vegetation within the corridor was retained. Where clearing was necessary to enable construction of towers and access to tower sites, vegetation was slashed to retain topsoil and facilitate natural regeneration from soil seed stock. In all locations the line route was designed to run parallel to existing tracks so that no new clearing was required to provide linear access along the line route. In some locations, short vehicle access spurs of up to 200 metres long were constructed from

existing tracks to tower sites. The vehicle access spurs prevented the transport of soil or plant material along the transmission line corridor.

As a result approximately only 2.9Ha of native vegetation was permanently cleared for tower sites and tower access along the 123km Pinjar – Cataby 132kV transmission line route and 38.4Ha was cleared for construction activities including conductor stringing but regenerated following project completion (EPA 2002).

One declared rare flora (DRF) population, *Anigozanthos humilis* subsp. *chrysanthus*, occured on the centreline of the proposed transmission line. A botanist was contracted by Western Power to delineate the area of this DRF. This area was fenced prior to construction activities in the presence of the botanist and no clearing was undertaken in this vicinity. The only construction activity conducted close to this population was the stringing of conductors between tower supports. This was achieved by passing a draw wire over the fenced area without impacting on the site, and was done under the supervision of a Western Power environmental officer.

The minimum conductor height above ground in areas of native vegetation was designed at 15m. That allowed vegetation to grow to a maximum height of 9m enabling a 6m safety clearance between the vegetation and the conductor. Given that the majority of the native vegetation along the proposed transmission line was Banksia woodlands which generally grows to a maximum height of 6m, there were only a few locations along the route that required selective vegetation trimming or removal.

The occurrence of *Eucalyptus camaldulensis* within the Coomaloo Nature Reserve was potentially an environmental concern as individual trees were identified by a fauna survey as potential nesting habitat for Carnaby's Black Cockatoo *Calyptorhynchus latirostris* (a Commonwealth listed threatened species). Through the use of tall towers clearing was limited to trimming of individual *Eucalyptus camaldulensis* trees so that no Commonwealth referral was required. Representatives of the Department of Conservation and Land Management witnessed trimming of vegetation necessary to allow raising of the draw-wire and conductor stringing occurred by the creation of sufficient access to allow the conductor to be taken through vegetated areas on foot. The higher conductor design utilized throughout this project also allowed the retention of tall shrubs within the transmission line corridor.

Western Power also commissioned an independent landscape study to assess transmission line visual impact and impact on wilderness quality. This study concluded that there were a range of important aesthetic values in the project area that needed to be protected and that there would be a moderate impact on natural character in the vicinity of the transmission line, however these impacts were within acceptable limits, except where the transmission line was close to key travel routes. Wherever possible, Western Power changed the alignment in key areas to reduce visual impact. Where alignment changes were not possible lower height poles were used instead of taller lattice steel towers at locations such as at crossings of significant tourist routes. (Cleary 2001)

Other Examples of Transmission and Distribution Line Impact Mitigation

Other examples of transmission and distribution line design approaches to minimize environmental impact include:

- Use of post insulators on the Muja/Bridgetown/Manjimup 132kV transmission line to reduce corridor width by 20m and avoid clearing in the Greater Preston National Park and the Hestor Conservation Area (Western Power 2003)
- Use of tall poles, hurdles and restricted stringing access to avoid "taking" declared rare flora, Caladenia Huegelii on the Southern Terminal – Cannington 330kV transmission line (Western Power 2004).
- Rebuild of an existing southwest 132kV transmission line from Shotts Terminal (near Collie) to Wells Terminal (near Boddington) at 330kV during the reduced electricity system electrical load winter period by employing onerous hygiene practices. The alternative of building adjacent to the existing transmission line would have required the clearing of several hundred hectares of Jarrah forest.
- Strategies have been devised to minimize impacts of the distribution network on the threatened Western Ringtail possum, listed under the Commonwealth Environment Protection Biodiversity Conservation Act 1999. Such strategies include conducting a cost/benefit analysis for insulation devices (Figure 1, Figure 2) , deterrent devices and undergrounding of the network in areas where there are high levels of possum related power outages, possum death-related fires and possum mortalities such as Busselton (200km south of Perth).

Figure 1 : Insulation Devices in a Sydney Substation

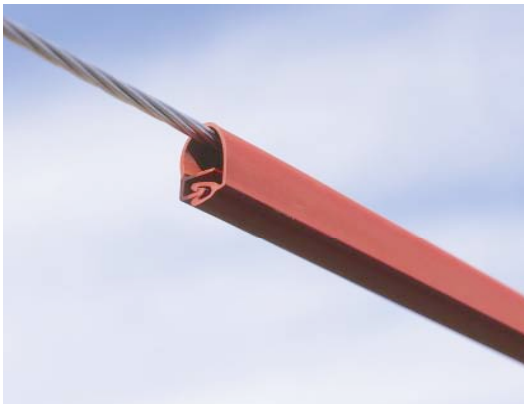

Figure 2 Line Insulation Devices

Environmental Filter and Networks Mapping System

In November 2001, Western Power ran a series of environmental workshops with operational staff from the Networks Business Unit (now Western Power) to identify and standardise environmental policies and procedures. Over 150 actions were developed from the workshops; most of which were implemented through the development of operational Policies and Procedures that were rolled out to WP staff in June 2003.

One of these actions required the development of an 'environmental checklist' for new distribution projects to assist designers incorporate environmental considerations into new distribution projects. Through consultation an electronic environmental information tool (Environmental Filter and Checklist) and a geographical information system called the Networks Mapping System (NMS) were developed incorporating environmental information layers, cadastral boundaries, aerial photography other relevant land use layers.

Three key areas of environmental concern associated with route selection, design and construction of transmission and distribution lines addressed by the Environmental Filter and NMS are impacts to native vegetation, water resources and indigenous heritage.

The system allowed personnel without an environmental background to assess impacts of new designs. Impacts are detected in response to the Environmental Filter and Checklists which prompt users to open relevant GIS layers. Designers are directed to avoid, minimize or consult on impacts. The Environmental Filter/Checklist and NMS also reduce the workload for environmental officers by allowing designers to deal with routine projects or those having only minor impacts and referring projects having more significant impacts to specialist environmental professionals. A geographic information specialist ensures environmental and landuse data is kept current and relevant. Staff, contractors and alliance partners located inside and outside the company utilize these two information systems.

Conclusion

This paper has demonstrated how threats to endangered species and ecosystems from the operation and extension linear infrastructure systems in sensitive environments such as the Southwest Western Australian global biodiversity hotspot can be minimised or avoided. Impact mitigation strategies included the use of environmental and geographic information systems in the design of electricity transmission and distribution lines, use of design techniques such as taller structures to minimize clearing, integration of specialist information on visual impact and aboriginal heritage into design and the use of insulation and deterrent devices to avoid electrocution of endangered fauna.

References

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