TRANSPOWER

Keeping the energy flowing

FILE NOTE

Date	14/01/2020
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Asset	ROX-ISL-A & ROX-TWZ-A Lines
Project	Clutha-Upper Waitaki Lines Project (CUWLP)
Subject	Works Methodology

The following file note outlines the types of work required as part of the CUWLP that will require an environmental assessment.

ROX-ISL-A Duplexing (Roxburgh to Naseby and Naseby to Livingston sections)

Duplexing

Duplexing means adding an additional conductor to an existing circuit, which enables more current to be carried down that circuit, and thus more power to be delivered.

A 'simplex' transmission circuit is a circuit with only one conductor per phase (there are three phases in a circuit). For example, a single circuit with simplex conductor would have a total of three conductors (wires) on the transmission line.

Duplex means that there are two conductors per phase, so a single-circuit transmission line with duplex conductors would have a total of six conductors on the line, but all six conductors would be associated with one circuit.

Left – Simplex conductor, Right – duplex conductor

The conductor is added by establishing pulling/tensioning sites (often referred to as wiring sites) at intervals approximately 4km – 6km apart with the new conductor on large drums at the tensioner end and empty drums to receive the old conductor at the puller end.

The new conductor is attached to the existing conductor and pulled through the puller machine. Once the new conductor is in place, it is then tensioned (pulled to the correct strain) and clamped in place at each tower.

In order to allow the addition of a conductor, a range of enabling works are required. These are detailed below.

Wiring Site Establishment

Wiring sites (or pulling/tensioning sites) will be established at intervals of 4km-6km apart. These sites will hold the conductor drums, running blocks and the pulling and tensioning equipment. The formation of these sites includes establishing a relatively flat working area of roughly three areas of 8m x 5m with 150mm of compacted base course. Earth mats will be installed to earth equipment in the event of a line fault. Wiring sites are only used during wiring (up to 6 months) and are removed at the completion of works and reinstated.

Examples of wiring sites

Wiring site with earth mat in the foreground

Foundation strengthening/refurbishment

Additional conductor increases the loading on each tower's foundations. As such, strengthening and refurbishment of tower foundations is required to support the additional load.

Excavation

Generally, soil around the foundation steelwork is excavated to the required level. In some cases the entire "grillage" requires exposure. Earthworks are undertaken around each tower footing to expose all leg bracing and grillage steel. Excavation is undertaken by both a digger and by hand, depending on the location and ground conditions.

Clearance of vegetation around the base of the foundations (usually grasses and scrub) may be required to expose the foundations.

Surplus excavated material is removed from the tower site and disposed of either off site or in a location agreed with the landowner. Top soil and sufficient soil to reinstate the excavation is stockpiled adjacent to the tower.

Abrasive Blasting

If there is corrosion on the existing steel, abrasive blasting may be required.

Screens will be erected around each leg where conditions require to help contain the particulate matter/dust generated through the abrasive blasting process in situations where there may be a perceived nuisance. The tower leg steel will be abrasive blasted using dry garnet from approximately 300 mm above the ground surface to 800 to 1000 mm below the ground surface.

The blasting process will generally result in the release of the galvanized coating as an innert particulate form, mixed up with the garnet abrasive being used to abrasive blast the tower foundations. The garnet used to abrasively blast the tower foundation will fall to the ground within the work area.

Blast detritus would comprise mainly of spent abrasive material (garnet), rust and some residual zinc. A sealant is then applied to the steel. The sealant commonly used is a product called Flintkote and is applied by brush. If required, some of the steel members will be replaced.

Concrete encasement/Reinstatement

Each leg is then encased by concrete in a "L" shape. Framework is installed around each tower leg and concrete is poured into the framework. Once concrete is cured, the excavated area will be backfilled and any spoil removed. The ground line refurbishment at each tower will generally be completed within 1 day. No tower leg excavations will be left open overnight.

Left – Concrete encasement into wooden framework, Right – Completed works

Tower Replacement

In some instances, a full replacement of the tower may be required. This almost always requires an outage on the line. Temporary structures are usually required to enable the replacement of a tower. The conductors are transferred to temporary structures while the works are completed on the tower, to allow electricity to continue be transmitted and long outages prevented.

In some cases where the tower is being replaced in a new location, temporary structures are not required.

A combination of cranes, excavators and hiabs are used to install the new tower. If vehicle access is difficult, the use of helicopters may be required.

The foundations are established first, and then the new tower is installed in sections onto the new foundations. Linemen install the tower hardware (e.g. insulators) and, when ready, the new conductor is transferred from either the temporary structures or the old tower onto the new tower.

The old tower is then dismantled and removed from the site.

Insulator installation onto a newly constructed tower, using temporary structures.

Access Maintenance/Upgrades

Access to works sites will generally be from local roads and existing access tracks. Most structures have at least 4WD access or better. In some instances, access track maintenance and vegetation trimming may be required to ensure safe access for equipment associated with the required work. Generally, clearance of approximately 1.5 metres is required from either side of the access track to enable vehicle and equipment access.

In some cases, upgrades of existing tracks may be required to enable access to the site with a concrete truck or crane/hiab. Occasionally a new track (either temporary or permanent) may be required.

Access track maintenance works will generally consist of grading, local widening of existing access tracks to a 4.0 m width, clearing of water tables and culverts, installation or repair of culverts, clearing slips, repairing wash outs or scouring of tracks on roads, forming and repairing batters, restoring track width, removal of rock falls and rock outcrops, alignment and realignment. Gravel may also be placed on the access tracks to ensure safe access.

Some vegetation trimming/clearance will be required along the access tracks to enable access to the tower sites. This work is carried out on growth that is large enough to prevent vehicle access and is usually in areas previously disturbed, such as the edges of the access tracks.

Examples of typical access tracks

ROX-TWZ-A Thermal Uprating (Cromwell to Twizel section)

Thermal Uprating

Thermal uprating involves increasing the maximum operating temperature of a transmission line in order to increase the amount of power that can be delivered by that line. In the case of the CUWLP Project, the Cromwel to Twizel section of the ROX-TWZ-A line will have the maximum operating temperature increased from 50°C to 75°C.

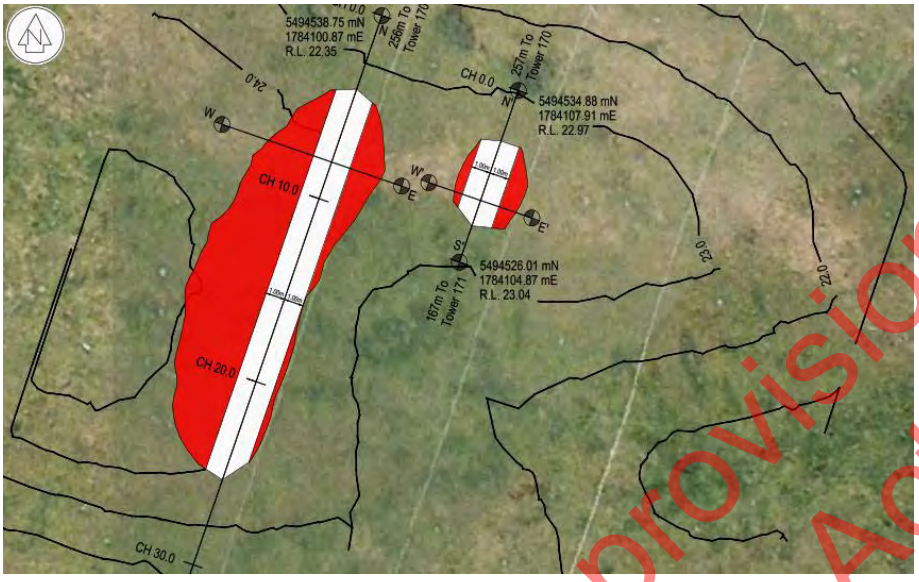
Physical works required to thermally uprate a line are relatively minor. However, when the maximum operating temperature of a line is increased, the conductor sag can be greater. All transmission lines must comply with the New Zealand Electrical Code of Practice 34 (NZECP 34) which specifies minimum clearance distances from conductors to ground/structures at various operating temperatures.

Once the line has been thermally uprated, there may be instances where spans do not meet the minimum separation requirements of NZECP 34. There are various ways to rectify these clearance violations which are detailed below.

Mid Span Earthworks

In many instances the simplest way to rectify a clearance violation is to physically remove it with earthworks. The violation area is identified and an earthworks plan is established to remove it. The excavated spoil is either removed from site or redistributed elsewhere with agreement from the landowner.

In some cases earthworks may not be appropriate, such as in areas of high environmental or archaeological value.



Example of an earthworks plan to clear a mid-span violation

Other rectifications

If earthworks are not appropriate, other rectification methods can include:

- Increasing the height of the adjacent towers, either through a body extension or a full tower replacement
- Removal of hanger brackets or alterations to insulators to reduce the distance between the tower's crossarms and the conductor
- Retensioning (or tightening) the conductor, or shortening the conductor by removing small sections and re-joining the remaining conductor (known as a Nip Tuck)
- Adding a tower/structure mid span

Example of a body extension in progress

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Date: 27 May 2020

To: Janine Smith and Anne Haira

From: Raewyn Moss and Jo Mooar

Subject: Confidential Briefing Note: Clutha Upper Waitaki Lines Project (CUWLP)

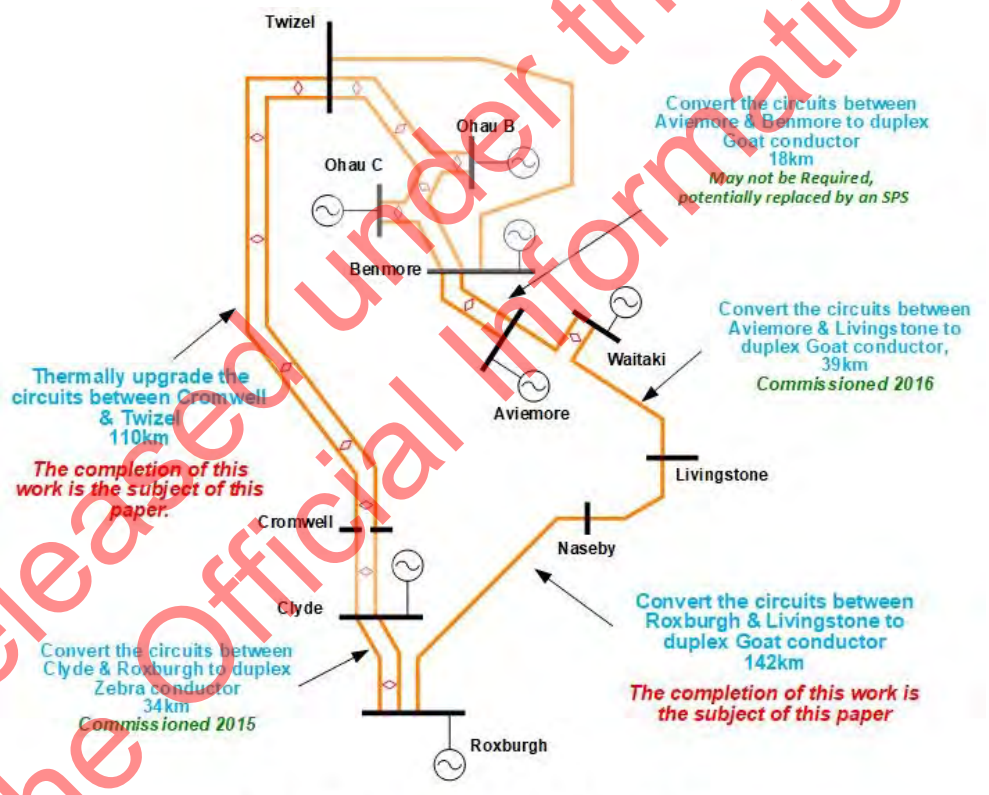
Summary

The Clutha Upper Waitaki Lines Project (CUWLP) was approved by the Electricity Commission in 2010. It comprises five sections, two of which have already been completed because they were required for lower South Island security.

Two of the remaining sections[1] are required if more power is required to be transferred north as a result of, for example:

- new generation in the region, or
- retirement or downsizing of the Tiwai aluminium smelter.

Figure 1 below shows the circuits between Roxburgh and Twizel that are the subject of the CUWLP, identifying those that have already been completed, and those that remain to be completed.



Clutha – Upper Waitaki Lines Project (CUWLP)
Status: February 2020

[1] The last remaining section of the five approved CUWLP sections may be able to be addressed by a special protection scheme (SPS), which would require less investment, rather than the upgrade earlier contemplated in the Electricity Commission's approval in 2010. This will be determined once the other CUWLP sections are completed.

Background

The completion of the CUWLP is important as it removes a constraint in the lower South Island, which limits the northward transfer of electricity. Removal of the constraint will be necessary when there is excess electricity in the lower South Island. An excess of electricity is expected if there is growth in renewable generation in the region, or if the Tiwai Point aluminium smelter reduces its supply significantly.

In December 2019, speculation and uncertainty regarding the future of the Tiwai Point aluminium smelter resulted in Transpower entering into separate agreements with Contact Energy and Meridian Energy to commence enabling work on two of the remaining three CUWLP projects. The agreements provided Contact and Meridian would each contribute $5m to fund the immediate commencement of enabling works to address the transmission constraints that would arise if the smelter load was removed or substantially reduced. The enabling works were commenced in December 2019 (see below).

Both Contact Energy and Meridian Energy confirmed on 4 May 2020 they will not be making any further financial commitment to advance or complete the remainder of work required to conclude and commission the CUWLP.

A decision from the owners of the Tiwai aluminium smelter about the smelter's future was expected in March 2020. No announcement from the owners has been made and recent communications suggest a decision may be some time off.

Costs and readiness

Under the agreements with Contact and Meridian, Transpower commenced enabling activities in December 2019. These activities have included design updating, commencing acquisition of landowner and environmental approvals, undertaking foundation and tower strengthening works, dealing with undercrossing low voltage lines and purchasing of long lead-time materials such as conductor core.

Those activities are continuing today, albeit they were suspended during the Level 4 lockdown. Crews have been mobilised to the work sites in Level 3 and work is continuing.

We estimate it will cost a further $92m to complete the two remaining CUWLP sections in order to complete commissioning in 2023. Indicative phasing of the expenditure is set out below.

Financial year (ending 30 June)	**$m**
2020/21 (from 1 Aug 2021)	26
2021/22	38
2022/23	28
Total	**92**

Of the above $92m, over $80m is projected to be spent in New Zealand. This includes labour, concrete, accommodation, management and design.[2]

[2] The only overseas costs are for material for the conductor (line) manufacture, some tower steel, insulators, and some specialist substation equipment.

The scale of the most significant remaining section of the CUWLP, the ROX-LIV duplexing, is illustrated in the table below. In addition to the works set out, included in the above $92m is $2m expenditure on the CML--TWZ section of the Roxburgh-Twizel A transmission line.[3]

The ROX-LIV Duplexing Project This section of the CUWLP replaces the existing simplex conductor with duplex Goat conductor on this section of the Roxburgh to Islington 220kV line. The line section runs from Roxburgh on the Clutha River to Livingstone in North Otago. It passes through Alexandra, the Ida Valley, Naseby, and over Danseys Pass.	
Line Length	142 km
Towers	436
Km of conductor to be installed	850 km
Goat ACSR Dia	26mm
Line capacity increase	From 246MVA to 646MVA (winter)
Linesmen on site during wiring (2 crews)	60 linesmen
Number of weeks wiring for 2 crews	34
Wiring runs	28
New towers required	7
Tower foundations to be strengthened Total concrete for project	327 5,200 m^3
Foundation Crews	4 x three-man crews for 70 weeks
Towers requiring steel strengthening	80
Number of LV Undergrounding sites	Estimated 50 sites
Length of access track upgrade	Estimated 30km
Total accommodation nights required	15,000
Number of Landowners impacted	230
Easements required	Estimated 22
Districts and regions affected	Waitaki & Central Otago Districts Otago & Canterbury Regions
Line elevation range between Roxburgh and the top of Danseys Pass	160 m to 900 m

We estimate that additional benefits in the order of $3.5m will flow to local network operators and service providers and sub-contractors where the CUWLP works require the relocation or undergrounding of local distribution lines and associated works.

Regulatory requirements

As indicated above, the CUWLP was approved by the Electricity Commission in 2010. While the Electricity Commission's approval remains valid (because no expiry date was specified for the Commission's approval), Transpower has previously indicated it would wait until there was sufficient certainty about the need for the investment in the remaining two sections (e.g. an announcement of significant reduction or closure of the Tiwai smelter or investment in new generation in the region) before committing to the remaining aspects of the CUWLP.

[3] The CML-TWZ section of the CUWLP project is mainly aerial solutions, re-tensioning conductors (lines), hardware changes etc. The costs to Transpower largely sit with service providers and contractors in the region.

Transpower is planning a short industry consultation period on whether to commence the remaining investment now. While it is expected some industry participants will support investment now (e.g. major generators in the lower South Island), it is equally possible that other participants will object (e.g. the Major Electricity Users Group, because the investment will predominantly benefit South Island generators, but will be paid for by other customers through increased transmission charges).

However, we expect the industry consultation to disclose further benefits that may be applied to the CUWLP, such as the value of avoiding additional periods of spilled energy when there is excess electricity in the lower South Island that cannot be moved north. Investing in the CUWLP now to remove the lower South Island constraint also makes investment in renewable energy in the region more attractive, which advances the country's climate change goals. Further, there may be collateral benefits to advancing a major project in a region of the country badly affected by the Covid lockdown such as the employment of individuals and firms, heavy use of accommodation and hospitality providers, and the procurement and manufacture of materials and other inputs into the project.

Regulatory requirements (environment and property)

Transpower has the bulk of the environmental approvals necessary for the CUWLP, and properties can be accessed relying on Transpower's statutory rights under the Electricity Act (EAct). However, additional environmental approvals and property rights (easements) will be required at some properties/locations.

Some consents will be required under the Resource Management (National Environmental Standards for Electricity Transmission Activities) Regulations 2009 (NESETA), and earthworks on contaminated land and/or aquifers may require regional consents. Some archaeological authorities under the Heritage New Zealand Pohere Taonga Act 2014 (Heritage Act) are likely to be required, particularly in the Danseys Pass area. Obtaining the necessary resource consents and archaeological authorities is unlikely to be contentious but will take time and may be resource intensive.

Transpower has identified ~22 residential or lifestyle properties where our statutory rights under the EAct may be exceeded, and an easement may be required. If any necessary property rights cannot be reached by agreement, recourse would be needed to the Public Works Act (PWA).

Any fast-track process under the RMA and Heritage Act could potentially reduce time to obtain the approvals. Changes to the Heritage Act to avoid the need for landowner approval before exercising an authority could also be beneficial.

Recourse to the PWA process is unlikely to be needed. However, the EAct process of obtaining easements will take time and tie up valuable resources. This process could be made more efficient if the EAct test was amended to provide for compensation discussions to occur at the same time or after the work occurred, rather than as an authorisation prior to work occurring.