# Appendix 1 – Commerce Commission request for additional information

**1. Outage duration:**

**a) Please provide further details on the need for a 4-day outage to reconnect the line to the permanent structures. For example, advise what works had to be carried out during the outage and which of the works had to be done sequentially (ie the package of work could not start until another package of work was completed).**

Three days were required for trans-positioning the three phases of sub-conductors. This was completed as planned, targeting one phase per day due to the shorter daylight hours in August. Each phase had two sub-conductors.

The diagram on the next page provides further detail. The two wiring spans (Tower 765A-766 and Tower 774A-775) for connecting the 3km section of new line were simultaneously worked with two separate crews. Each crew had to maintain the existing conductor tensions from Tower 765A-775, while also maintaining the new conductor tensions from Tower 766-774A. This required engineered controls to sequentially manage loads to the temporary poles and permanent tower structures. These controls included step processes and hold points for construction activities.

The trans-positioning necessitated each sub-conductors' tension to be held and lowered for new sub-conductors to be raised, brought up to pre-tension, sagged and terminated. This occurred for each phase.

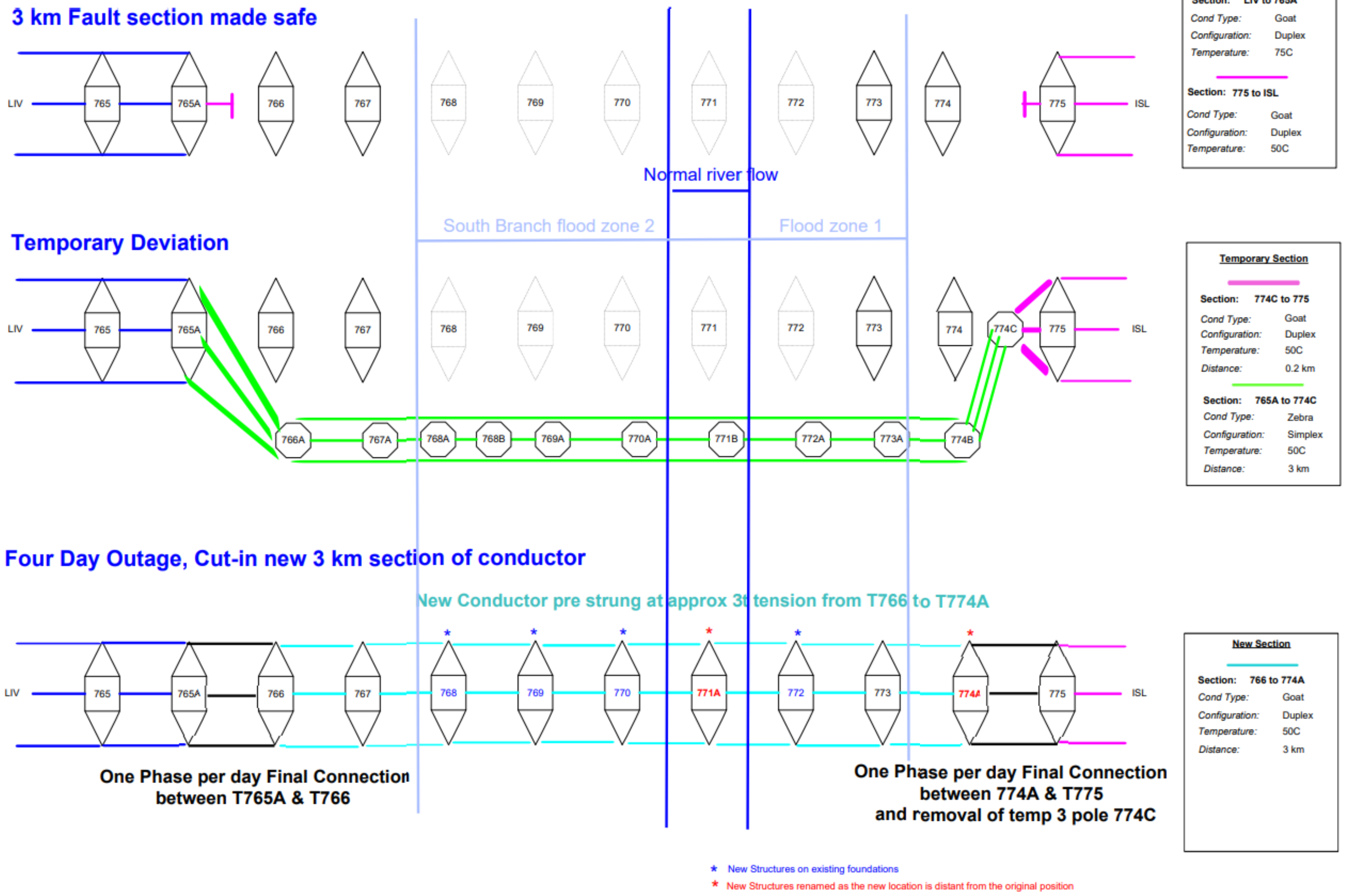
The fourth and final day involved installing spacers, removing temporary earths, completing pre-commissioning inspection and function checks before carrying out the commissioning of the ISL-LIV-1 circuit.

**b. To the extent possible, advise how the durations for the works compare with the durations of similar works on other recent transmission line projects.**

It is difficult to provide a comparable example of similar works that have been undertaken in other transmission line projects. This is due to the nature and extent of the damage caused to the ROX-ISL A Line, and the need to plan remediation works around a braided river – including managing weather related risks, the terrain, and access issues.

The diagram on the next page shows the complexity involved in returning the permanent line to service. The need to maintain mechanical tensions to either side of the temporary pole structures is unique in nature.

# ROX-ISL A Line
# 3 km Rangitata River Fault Section of ISL_LIV_1 Cricuit



**2. Tower 771A re-erected in the riverbed:**

**a. We note that you did not consider the option of not having a tower in the riverbed, for example by installing larger towers on either side of the river bank.**

The option of not having towers in the riverbed (or braided river) was a preliminary consideration. However, from an engineering perspective, and given the north branch of the river is approximately 1.8km wide, this option was not feasible and not short-listed in our delivery business case. It would have required structures approximately 200m tall on each side of the river. Even if this was technically sensible and feasible, a tower of this height would not be covered by emergency works and would have significant property and consenting challenges. Currently, our highest tower stands at approximately 70m high.

We did include the option of introducing a new single tower to replace towers 771 and 772, but this was not the preferred option.

We would also like to note that there is no guarantee how the flow of the braided river and location of riverbed will change over time. What looks like a river bank now may not be so in the future. Towers 768 to 773 have river pile foundations due to the increased risk of flooding in that 2.7km section.

**b. The reason for this seems to be that Transpower sought the least cost solution. Please provide any details on the technical considerations of erecting tower 771A in the riverbed.**

While cost is a key consideration in any delivery business case, there were many other determining factors that lead to the location of Tower 771A:

- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]

Please also note that Tower 771A is not in a riverbed where flow is constantly around the foundation piles. Rather it is within a section of the braided river that can be morphologically active in high flows but is surrounded by material. Construction of the tower and its foundation occurred on dry land.

**c. Include in your response the extent that towers in riverbeds reflect Good Electricity Industry Practice?**

Our design standards meet Good Electricity Industry Practice (GEIP). Following GEIP should involve looking at all options and determining which one provides the best value for our customers. Having a structure in a riverbed may be the best option if the risk of damage is deemed acceptable, which it was in this case.

**d. If Transpower were to build a new backbone transmission line today, would it erect any towers in riverbeds?**

The location of a new backbone transmission line will be largely determined by the location of supply (generation) and demand for electricity. The question of whether we would erect towers in riverbeds would form part of a specific design and delivery business case that considers a number of variables.

Our view is that if the tower location meets our design standards [redacted] and is cost effective to manage this risk, then it is reasonable to expect that a tower be erected similar to Tower 771A. That is within a section of a braided river that can be morphologically active in high flows but is surrounded by material.

Structures in riverbeds should be avoided if possible, but not when the cost of avoidance has a larger financial or visual impact. Structures can be designed and maintained to withstand the forces of being in a river. This approach is not dissimilar to a road or rail bridge that crosses a river – it does not usually span the whole river in one go – there are often piers in the main flow.

## 3. Maintenance and inspection

**a. In 2017, Transpower assessed the condition of the foundation of tower 771 as high. Please advise the level of accuracy of the condition assessments of tower foundations erected in riverbeds.**

As noted above, the tower foundations were within a section of a braided river that can be morphologically active in high flows but were surrounded by material. Therefore, we believe the accuracy of the condition assessments reflected the accessibility to and visibility of each leg of the tower and its foundation.

In terms of our maintenance policies and procedures, our Condition Assessment (CA) activities and Standard Maintenance Procedures are set out in our Service Specifications.[1] This confirms our maintenance interval requirements and a required accuracy of +/- 10%.

In 2017, the foundation leg condition codes for Tower 771 were CA 90, and the foundation connection condition codes varied with one leg coded CA 50, and three legs coded CA 80 – with a comment that there was "rust on base plates". On the basis of the condition codes, the physical foundation was in a good condition with no issues at the time of assessment. We are comfortable that the condition codes were accurate at the time of assessment and will have correctly represented the condition of the foundation.

Additionally, any defects supplementary to the CA codes would be identified by one of our service providers through routine patrols that are recorded in our Maximo system. Any defects would prompt an intervention under our Predictive Maintenance workstream.

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1 [redacted]

**b. Is the method of assessing tower foundations in riverbeds the same as that for assessing tower foundations on dry land?**

Yes. Our Service Specifications and Maintenance Companion Guide confirm that as part of the CA process, assessment of the physical foundation is the same for any tower foundation. Visual assessment guidelines are used to identify any degradation or damage.

There is also a requirement to record any defect that may impact on the tower foundation to perform as designed (i.e. whether it is fit for purpose).

Further to this, every tower visited under the annual routine patrols programme assesses the tower and foundation to ascertain if there are any defects that pose, or could pose, a threat to the safe operational status of the asset. After weather or seismic events, a Special Purpose Patrol is undertaken on the transmission line as well which checks for earth movement or scouring/erosion.

**c. Has Transpower managed to find the root cause of failure of tower 771? The application refers to scouring? Is this considered the root cause?**

The root cause failure of Tower 771 is scheduled to be investigated in June 2021.

While the root cause is currently inconclusive, we suspect one of the piles for the foundation was scoured due to damage from the flooding event.

**d. How confident is Transpower that the design features of the new foundation is appropriate given the likelihood of similar or worse flooding in the future?**

Transpower is confident that the scenarios used in the design process ensured that the foundation will have appropriate capacity to resist future flooding events. The following load cases were analysed:

Co-incident with 300-year return period wind loads:

- 1 in 20-year flood (AS5100.2 debris accumulation included)
- 1 in 20-year flood (2000kg log impact)
- 1 in 20-year flood (floating debris mat 5-6$m^2$ per pile)

Co-incident with 4-year return period wind loads:

- 1 in 100-year flood with 3m scour (governing loading case, AS5100.2 debris accumulation included)
- 1 in 100-year flood with 3m scour (2000kg log impact)
- 1 in 100-year flood with 3m scour (floating debris mat 5-6$m^2$ per pile)