Before the Proposed Central Hawke's Bay District Plan Hearings Panel

Under	the Resource Management Act 1991 (the Act)
In the matter of	the Proposed Central Hawke's Bay District Plan – Hearing Stream 5: **Hazards & Risks, and Subdivision:** **Contaminated Land, Hazardous Substances, Natural Hazards, Earthworks, Mining & Quarrying, and General Subdivision**
Between	**Central Hawke's Bay District Council** Local authority
And	**Transpower New Zealand Limited** Submitter 79 and Further Submitter FS18

Statement of evidence of Benjamin Roy Cartwright for Transpower New Zealand Limited

Dated 17 August 2022

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1 Summary of evidence

1.1 In my Hearing Stream 3 evidence[1] I detail the specific components, functions, and use of the National Grid ("Grid"), including the necessary work undertaken to maintain, upgrade and restore the Grid. This evidence will cover the specific components of Hearing Stream 5, reiterating sections of evidence from Hearing Stream 3 where they relate specifically to the topics covered in Hearing Stream 5. Unless otherwise stated, my evidence to Hearing Stream 3 stands.

1.2 Physical access to transmission lines is required for all maintenance and project work, including for staff, vehicles, helicopters and large construction equipment. A regulated transmission corridor is essential for providing adequate access and working space at the poles, towers and mid-span.

1.3 Earthworks need to be managed to take the lines into account, in all areas. Earthworks can prevent physical access to transmission lines and undermine the structural integrity of support structures or reduce conductor to ground clearances to unsafe levels.

1.4 The 10m to 12m National Grid Yard (either side of the centerline) is the area (measured horizontally) beneath the conductors in "everyday" wind conditions, being the conditions when line maintenance can be carried out. A 12m setback around National Grid support structures is also required for access, maintenance, and safety purposes. The wider National Grid Subdivision Corridor is the area sought for subdivision which extends to the width defined by the swing of the conductors in high wind conditions. These areas are the bare minimum to ensure that Transpower's maintenance, repair, upgrade, and operation activities are not compromised.

1.5 While the New Zealand Electrical Code of Practice for Electrical Safe Distances (NZECP 34:2001) prescribes minimum safe distances, it does not provide a comprehensive system for the management of these distances. This is to say, it does not prevent under build and does not ensure the operation, maintenance, upgrade and development of the National Grid is not compromised.

[1] Statement of evidence of Benjamin Roy Cartwright for Transpower New Zealand Limited Dated 31 May 2022

2 Qualifications and experience

2.1 My full name is Benjamin Roy Cartwright.

2.2 I am employed by Transpower as an Engineer – Lines within the Tactical Engineering Team.

2.3 I have a Bachelor of Engineering in Mechanical Engineering from the University of Canterbury. I am a member of Engineering New Zealand.

2.4 I have four and a half years' experience in transmission line engineering work. I currently work in the Grid Development Division of Transpower. My role involves providing transmission line engineering advice and support, writing, and reviewing standards and specifications for design, construction and procurement, supporting projects, reviewing design deliverables and ensuring construction quality.

2.5 I am familiar with the National Grid assets within the Central Hawke's Bay District Council's jurisdiction.

2.6 I have read the statements of evidence of **Ms Pauline Whitney** and **Mr Daniel Hamilton** for this hearing and have taken these statements into account in preparing this statement of evidence. I support the planning solutions which the evidence of Ms Whitney recommends.

3 Code of conduct

3.1 I confirm I have read the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2014.

3.2 As I am employed by Transpower, I acknowledge that I am not independent, however I have sought to comply with the Code of Conduct when preparing this evidence. In particular, unless I state otherwise, this evidence is within my sphere of expertise, and I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

4 Operation, maintenance, and upgrade of transmission lines

Accessing and Clearing Work Areas

4.1 A clear working space and good access is required, particularly around the base of support structures and in some cases under conductors, to move the plant and equipment in and set it up correctly. Cordons must be installed around the work site to minimise hazards and restrict access to everyone other than the trained work party. When work is carried out on a support structure, the effective work area for health and safety purposes includes the spans of conductor either side of that structure.

4.2 For some projects, such as wiring or where alterations are being made to structures, temporary hurdles or bypass lines may be required, or properties may need to be evacuated to protect against potential conductor drop hazards. Replacing a conductor is the time when the risk of conductor drop is greatest.

4.3 Figure 1 and Figure 2 below show hurdles established at a work site, including the space required, and their mid-span location. Hurdles are installed to protect traffic on access roads, state highways and local roads from risks associated with dropped conductors (mainly during re-stringing). Similar projects in urban and industrial developments have required the evacuation of residents or workers for periods of up to a week (refer Figure 3).

Figure 1. Typical hurdles installed to mitigate potential conductor drop during wiring

Figure 2. More substantial hurdles installed to mitigate potential conductor drop during wiring

Figure 3. Reconductoring in an urban setting

Access for Planned Works

4.4 Transpower has:

a statutory rights to access its assets on private land under the Electricity Act 1992 (**Electricity Act**). The Electricity Act provides for access to maintain, inspect and operate the National Grid; and

b in some cases, contractual or property rights to access new assets that are located on private land.

4.5 In an ideal situation, Transpower would have unimpeded physical access to all transmission line structures. In practice, this is not always possible.

4.6 Physical barriers and natural obstacles, such as waterways, valleys, and undulating ground and including through earthworks, require Transpower to use alternative access options, for example helicopters and/or walking in are sometimes required.

4.7 Intensive or sensitive development constitute additional physical barriers to accessing transmission line support structures, increasing the costs and difficulties associated with gaining access.

4.8 The quality of access is important as some construction plant, for example cranes and concrete trucks, require wider and lower gradient tracks than what are traversable by smaller vehicles. The existing access is usually the most suitable as it was generally used to construct the line and for ongoing maintenance. If the landowner decides that they wish to change the access Transpower should be consulted to ensure that the new route will not impede future works on the Grid.

4.9 If the planning regime ensures continuation of existing access, this will avoid the need (and associated costs and delays) to dismantle fences and other structures, temporarily bridge waterways, carry out excavation or vegetation removal, just to access the National Grid.

Figure 4. Example crane access required for cross arm and insulator works

Access for Emergency Works

4.10 In the event of a fault, Transpower must always be able to quickly access its lines in order to find and fix the fault. Businesses and communities are heavily reliant on electricity, so it is crucial that faults are identified and fixed as soon as possible.

4.11 While Transpower's assets perform well in storm events or natural disasters, excessive winds and rivers changing course do at times break or collapse National Grid infrastructure and emergency repairs need to be carried out to get these back into operation. During these times there is often a heightened requirement for electricity. The National Grid is a lifeline utility[2].

4.12 Suitable, known and agreed access routes are important so as to not delay the restoration of services.

[2] Under the Civil Defence Emergency Management Act 2002.

5 Risks arising from third party activities undertaken in close proximity to National Grid assets

Earthworks

5.1 Transpower seeks controls on earthworks near the National Grid.

5.2 Earthworks adjacent to towers or poles can undermine the stability of the structure foundations, causing the structure to lean or, worse, collapse.

5.3 Excavations or mounding mid-span can also increase risks by reducing the clearance between the ground and conductors. **Appendix A** includes some examples of earthworks activities that have created unstable batters or resulted in ground to conductor clearance violations, causing significant safety risks, as well as risks to security of supply.

5.4 One of the reasons Transpower seeks to manage earthworks undertaken by third parties (which includes quarry and landfill operators) is to avoid, or at least significantly reduce, the safety risks described above. Physical separation from transmission infrastructure greatly reduces the likelihood of harm or damage occurring to people or property. However, Transpower is comfortable with provisions that align in part with NZECP34:2001 (albeit that the physical separation standards are sought in the plan for broader reasons than safe electrical separation distances, as detailed below).

5.5 Earthworks can cause dust which results in the build-up of material on the National Grid lines and contributes towards the degradation of the equipment thus reducing its useable lifespan.

5.6 Excavated areas or piles of earthworks soil can also restrict Transpower's ability to access and locate the heavy machinery required to maintain and upgrade support structures. This can lead to potential line component failure and significant constraints on the operation of the lines, such as increased power outages. Earthworks can also undermine the stability of support structures.

5.7 For these reasons, Transpower seeks controls on earthworks near the National Grid.

5.8 In determining appropriate setback distances for earthworks from National Grid support structures, a common assumption is the National Grid is not compromised if the earthworks comply with NZECP 34:2001. This is not the case. The example below (see Figure 5) illustrates that NZECP 34:2001, on

its own, does not adequately ensure that the National Grid is not compromised.

Figure 5. NZECP34 compliant earthworks around a pole on the ARI-HAM-A line

5.9 Figure 5 shows earthworks near a transmission line pole that are technically compliant with NZECP 34:2001. As a result of the earthworks near the pole structure, Transpower's ability to operate and maintain the line and structure at that location has been compromised. The batter slope may become unstable as a result of erosion and slipping. Access to the site is now severely restricted and there is no ability for Transpower to operate heavy plant on the elevated platform. Ongoing engineering checks are required to monitor the effects of erosion and to ensure the stability of the foundations.

5.10 **Specific to Rule EW-R5:** I support Transpower's amendment of EW-R5 to align with Section 2.2.3 of NZECP:34 as this provision provides the distances necessary to reduce the risk of both an earth potential rise (EPR) event and a future stability issue. Transpower, as part of its regular maintenance programme, has had several major incidents of soil movement compromising the structures strength. This has resulted in costly relocations and remedial strengthening. Section 8 of my evidence deals further with the limitations of NZECP:34.

6 The potential impacts of other activities on transmission lines

6.1 In addition to potentially exposing people and property to the risks outlined above, third party development and activities in close proximity to overhead transmission lines can impact Transpower's ability to operate, maintain, upgrade and develop its infrastructure. Such activities can also give rise to reverse sensitivity effects.

6.2 Despite the National Policy Statement on Electricity Transmission ('**NPSET**') being gazetted over 12 years ago, under-build and inappropriate development continues to occur under and around National Grid assets and overhead transmission lines in particular (see **Appendix B** for examples).

Activities sensitive to National Grid assets

6.3 There are a range of activities that have sensitivities to Transpower's assets. These sensitivities include:

a electrical interference could have serious implications for places such as hospitals or rest homes which rely on the proper functioning of electrical equipment 24 hours a day;

b radio controlled systems and global positioning systems are also known to be affected by the close proximity of transmission lines. These systems are being used more commonly for communications and automated control systems in industrial processes;

c also, of concern is any residential development or intensification of other activities under transmission lines or close to support structures. As outlined in the evidence of **Ms Whitney**, the NPSET provides specific reference to sensitive activities (which include residential activities). The main hazard associated with high voltage transmission lines is receiving an electric shock. This is a risk which cannot be mitigated from an engineering perspective; it can only be avoided.

6.4 As noted earlier, people living or working in buildings under transmission lines create significant difficulties when Transpower needs to do maintenance, upgrade and development work.

Preventing Transpower's access

6.5 Both land use and subdivision can prevent physical access to structures and the area of mid-span. Figure 9 in **Appendix A** shows a dwelling constructed in Auckland that prevented Transpower accessing the tower for grillage refurbishment work.

Residential activities

6.6 Reverse sensitivity effects are caused by activities which are located near lines. They often relate to noise, visual, electrical interference, and perceived health and safety effects (humans and animals), as well as the limitations placed on land use in close proximity to the lines.

6.7 Physical separation of third-party activities from transmission lines can reduce the incidence of people who live and work nearby complaining about the line and requesting changes (i.e., limits or restrictions) to its operation.

6.8 The area or distance from the lines within which reverse sensitivity effects can arise may vary according to the type of issue raised, but they are most noticeable in the area to where the conductor swings out. Depending on asset type, this area can be out to 39m either side of the centreline.

Types of concerns raised about transmission lines

6.9 The presence of a transmission line can give rise to perceived health concerns and visual amenity issues, even some distance from the line.

6.10 In addition to general complaints arising from the presence of transmission infrastructure, Transpower also receives requests from landowners to underground existing overhead lines, raise conductors, or restrict future Grid works, particularly if they involve changes in visual appearance.

6.11 At the North Island Grid Upgrade Project ('**NIGUP**') Board of Inquiry into the then proposed 400kV capable Brownhill Road – Whakamaru North A line, a number of submitters raised concerns about both potential mechanical and electrical noise, and the potential effect on milking dairy herds in close proximity to the lines, as well as on the operation of sensitive electronic equipment such as radio-controlled systems. In most cases, these concerns were addressed by Transpower moving existing buildings away from the proposed line. It is noted that in general, Transpower seeks to avoid these existing activities where practical.

6.12 These complaints are much more difficult to address where new activities locate close to an existing transmission line, perhaps without understanding the effects that lines can have.

6.13 Noise can also give rise to complaints. Noise from a transmission line usually comes in two forms: mechanical noise and electrical noise:

a Mechanical noise can come from vibration which causes a rattle of the line hardware (insulator attachments, steel members) or from environmental events such as high winds (wind whistling through conductors or over steel works).

b Electrical noise usually comes from some form of electrical discharge, or leakage. This generally can be heard discharging down insulators when it starts raining after a long spell of fine weather. In some cases this corona discharge may be seen at night when insulators are polluted and electricity is seen discharging down from the conductor to the tower steel.

6.14 In some areas of New Zealand, landowners/occupiers have also raised concerns about electric and magnetic fields ('**EMF'**) from transmission lines. I note that Transpower's assets operate well within the limits in the International Commission on Non-ionising Radiation Protection Guidelines for limiting exposure to time varying electric magnetic fields (1Hz – 100kHz)[3] (known as the ICNIRP Guidelines). These Guidelines are recognised by the Ministry of Health and the World Health Organisation. However, that fact does not prevent people from making complaints and lobbying in opposition to Transpower's activities.

6.15 Transpower's telecommunication assets comply with NZS2772.1:1999 Radiofrequency fields - Maximum exposure levels - 3kHz to 300 GHz. Other users of Transpower sites are also required to comply with this standard.

7 National Grid Corridors

7.1 The importance of transmission corridors has been recognised by Government policy makers. The NPSET, introduced in 2008, requires councils to give effect to its provisions in the plans they adopt under the RMA.

[3] Health Physics, 99(6): 818-836, 2010.

7.2 Transpower seeks to manage the network through a National Grid Corridor approach which is comprised of a National Grid Yard, and a wider National Grid Subdivision Corridor.

7.3 As explained by **Ms Whitney** Transpower is seeking a National Grid Corridor within Central Hawke's Bay for undesignated overhead transmission lines, to provide for:

a A 10-12m corridor either side of the centreline, where specified activities are restricted (**National Grid Yard**);

b A 12m setback around National Grid support structures (**National Grid Yard**); and

c A wider corridor (out to 14, or 32m either side of the centreline depending on the line voltage and the nature of the line's support structures) where subdivision is managed (**National Grid Subdivision Corridor**)

7.4 The 10m or 12m National Grid Yard is the general area beneath the conductors in "everyday" wind conditions, being the conditions when line maintenance can be carried out. A 12m setback around each support structure is also sought for access, maintenance and safety purposes.

7.5 The distance a transmission conductor swings in the wind is dependent on the ambient temperature, the power being carried, the wind speed, the type and size of conductor, the tension the conductor is strung at, the supporting structure configuration (cross arm length) and the length of the span (distance between two towers or poles).

7.6 To calculate appropriate corridor widths, a set of standard line types, based on voltage and structural configuration have been developed by Transpower. Following analysis, it was determined that the swing is most sensitive to the wind speed and span length.

7.7 An ambient temperature of 10ºC, a wind pressure of 100Pa (46km/hr), full electrical load and the conductor type applicable for the line type were assumed for each transmission corridor. A range of swings was then determined for each line type.

7.8 The width of transmission corridors was then determined by the swing of the 95th percentile span across the country and access requirements for maintenance purposes.

7.9 Specific to the National Grid Subdivision Corridor, the width of the subdivision corridor is based on the extent of the swing of the conductors in high winds. The distance a transmission conductor swings in the wind is dependent on the ambient temperature, the power being carried, the wind speed, the type and size of conductor, the tension the conductor is strung at, the supporting structure configuration (cross arm length) and the length of the span (distance between two towers or poles). As such the subdivision corridor width increases for higher voltage lines and towers as generally the span (distance between support structures) is greater for towers and combined with a higher voltage which makes the transmission lines heavier, means the conductor swing in high winds increases. The derived National Grid Subdivision Corridor widths are based on a 95th percentile span across the country.

7.10 The National Grid Corridor approach has several important purposes:

a To enable uncompromised access and maintenance;

b To avoid reverse sensitivity effects;

c To provide a consistent approach to managing the potential for adverse effects on the National Grid;

d To reduce risks of damage to structures and their foundations as a result of adjacent structures and land disturbance; and

e To avoid safety hazards.

7.11 The National Grid Corridor is also important for the following reasons:

a To protect the infrastructure corridor itself. As land uses become more intensive, it is increasingly difficult to identify routes for new assets. If a transmission line is compromised by encroaching land uses, it can sometimes be impossible to optimise the capability of the existing line (which defers the need to build new lines). If new lines are required, it can be difficult to identify an alternative route which would disrupt landowners less.

b To alert landowners to the constraints the National Grid lines impose on land use. It also clearly indicates how they can manage their own activities.

7.12 The corridors Transpower seeks reflect the minimum areas considered necessary for the protection and operation/maintenance of the National Grid.

The corridors have not been sized to provide for major rebuilds or new lines. The proposed areas do not *fully* address such matters as amenity and reverse sensitivity. As such, the corridors Transpower seeks are very much a compromise.

8 NZECP 34:2001 - PURPOSE AND LIMITATIONS

8.1 In this part of my evidence, I briefly comment on whether NZECP34:2001 is sufficient to address corridor management issues for the National Grid.

8.2 NZECP34:2001 serves an important purpose in prescribing minimum safe distances for the construction of buildings and structures, for the use of mobile plant, and for excavation and deposition near transmission line support structures and overhead lines. It does not address the wider third-party effects that compromise the National Grid, which are managed by the NPSET (discussed in detail above). As such while NZECP34 sets a baseline of standards, it does not address other issues in respect of the National Grid and therefore does not form the baseline for the district plan to give effect to the NPSET.

8.3 Compliance with NZECP34:2001 is mandatory. Regulation 17(1)(a) of the Electricity (Safety) Regulations 2010 provide that:

A person who carries out any construction, building, excavation or other work on or near an electric line must maintain safe distances … in accordance with ECP34.

8.4 Clause 2.4.1 of NZECP34:2001 states that:

Except with the prior written consent of the overhead electric line owner, no building or similar structure shall be erected closer to a high voltage overhead electric line support structure than the distances specified in Table 1"

8.5 NZECP34:2001 Table 1 states:

Minimum safe distances between buildings and overhead electric line support structures

Circuit Voltage	Pole	Tower (Pylon)
11kV to 33kV	2m	6m
Exceeding 33kV to 66kV	6m	9m
Exceeding 66kV	8m	12m

8.6 Therefore, in respect of circuits exceeding 66kV (i.e. Transpower's 110kV and 220kV lines), NZECP34:2001 requires that buildings must be at least 8m from a pole and 12m from a tower.

8.7 NZECP34:2001 also specifies minimum safe distances for excavation and construction near support structures, and between conductors and buildings and other structures. These distances differ depending on the voltage of the line, and the length of the span between support structures. The tables within NZECP34:2001 are firstly based on generic and conservative span length envelopes. More detailed calculations can be undertaken to remove the conservatism. These detailed calculations require specialist engineering expertise. For spans longer than 350m, NZECP34:2001 would generally prevent the construction of buildings inside of the 12m Yard we propose.

8.8 It is important to note that the minimum safety requirements in NZECP34:2001 neither seek to protect the integrity of the National Grid from the effects of third parties, nor prevent development (including sensitive and intensive development) from occurring directly underneath transmission lines. As discussed above, such development can constrain operational and maintenance activities on lines.

8.9 Further, NZECP34:2001 does not adequately account for EPR hazard contours. Clause 5 of NZECP34 specifies four metres as the minimum distance that must be kept between live overhead lines and any part of any mobile plant or load carried by that plant (without Transpower's prior written approval). In my experience, the four-metre distance is very difficult for people carrying out activities in proximity to transmission lines' to measure, monitor and enforce. Mobile plant operators such as forklift or crane drivers, concentrating on the load they are carrying, may not look up and be aware of live conductors as low as 7 metres above the ground.

8.10 While NZECP34:2001 is a good base document for the determination of safe clearances, experience has found that the document is not well understood by the public. Even relatively sophisticated commercial entities often do not understand compliance requirements.

8.11 Specific to earthworks, Section 2.2 of NZECP sets minimum safe distances for excavation (or other interference) near support structures. Section 2.2.1 is specific to poles and section 2.2.3 is specific to towers. The relief sought by Federated Farmers in its submission to reflect section 2.2.1 of NZECP within

Rule EW-R5 would allow earthworks up to 300mm in depth 2.2 metres from a pole support structure, and up to 750mm depth between 2.5 metres and 5 metres of the pole support structure. There would be no depth standard (i.e., control) between 5 metres and 12 metres of the pole support structure. The main area of concern is the potential impacts on the support structures and lines of allowing earthworks to go to 750mm in depth within 2.2 metres and 5 metres of a pole support structure, with no depth standard between 5 and 12 metres, and the standards sought by the submitter do not take into account the effects on the support structure, any earth potential rise issues or how access would be maintained. Rather it only addresses safety effects. As outlined in my evidence, the ongoing operation and maintenance of the National Grid is not only dependent on safety issues but also ensuring the Grid itself is not compromised. To ensure stability of, and access to, support structures is not compromised, I support the reference to the setbacks and depths as provided in NZECP34 section 2.2.3, as recommended in the evidence of Ms Whitney.

8.12 Usually, Transpower's contractors will patrol every line and structure once a year. If an NZECP34:2001 violation is discovered, then the Transpower contractor will discuss this with the landowner and come back to check the problem has been rectified. If a regular patrol does not discover any minimum distance violations, a breach could occur the following week but may not be picked up until the next patrol (which could be a year later) This means that it can be very difficult to enforce the minimum distances in NZECP34:2001.

9 Conclusion

9.1 The National Grid is enduring critical infrastructure, both locally and nationally. It is critical that there is a planning framework in place that will enable development and other asset maintenance to occur safely and efficiently.

9.2 Preventing sensitive and incompatible activities (including earthworks) from being undertaken beneath the transmission lines, along with controls on activities that will occur near lines, will assist the National Grid to be reliable, and to have a managed environmental footprint while serving future generations.

9.3 It is critical that a preventative approach is taken to the management of the transmission corridors and a proactive approach is taken to ensure safety for high-risk activities regularly occurring under National Grid assets.

Ben Cartwright

24th August 2022

APPENDIX A: EXAMPLES OF THIRD-PARTY ACTIVITIES AFFECTING TRANSMISSION LINES

Earthworks

10 Uncontrolled earthworks can undermine the support structures or generate dust. The dust can result in the build-up of material on the National Grid lines and increase the wear on the equipment reducing its useable lifespan. Excavations or mounding mid-span can increase risks by reducing the clearance between the ground and conductors.

Example 1: Subdivision earthworks compromising National Grid support structure

11 **Figure 6** shows earthworks that occurred around a tower as part of development for an urban subdivision in Whitby, Porirua. The earthworks were well within 12m of the support structure.

Figure 6. Earthworks in Porirua

12 As well as possibly undermining the stability of the tower structure, the earthworks in the photograph have also restricted vehicular access to the tower and the area where Transpower can place machinery required to maintain the tower. This compromises Transpower's ability to maintain the existing transmission line.

13 In this instance, Transpower worked with the developer retrospectively to ensure that the constraints on the line introduced by the developer were mitigated and the long-term stability of the towers would be retained. This required the installation of a shotcrete surface on the cut batter. Such works are an example of how earthworks conducted close to the Grid can undermine Transpower's ability to operate and maintain

the network effectively and efficiently. Ultimately, the manner in which Transpower carries out maintenance at this tower will need to change to address the effects.

Example 2: Hastings District earthworks – ground clearance violations

14 Another example of earthworks adversely impacting on the operation of existing National Grid assets is earthworks undertaken in Hastings (Figures 7 and 8). Transpower investigated the clearances from the conductor to ground for two Hastings properties and found the minimum clearance was only 5.3m from the ground to conductor at everyday conditions (instead of 6.5m required under NZECP34). This violation occurred as a result of earthworks – that is due to a build-up of soil under the conductors. The soil had been excavated onsite, spread under the line and reduced the required ground clearance to an unacceptable distance. As a result of the earthworks people and property were at risk.

15 Transpower needed to arrange temporary fencing of the two earthworks sites to prevent any further access under the conductors until rectification works were completed. Mitigation included installing a new set of cross arms on the poles. The top and bottom crossarms were changed to shorter steel crossarms with new Horizontal Line Posts (HLPs) attached. This lifts the conductor into a clamp on the end of the HLPs on the same pole by approximately 1200mm and prevented the need to replace the poles. Transpower then carried out ground works to cut the edge of the bench/track back to ensure the regulation 6.5m ground clearance at maximum operating temperature was complied with i.e. remediating the site back to original ground level and achieving compliance with NZECP34:2001.

Figure 7. Hastings ground clearance violations

Figure 8. Hastings ground clearance violations

Example 3: Buildings and Structures Preventing Access to the National Grid

16 In 2014 a grillage refurbishment crew was carrying out a pre-works inspection at Tower 48 on the Henderson to Roskill 110kV transmission line. The crew discovered a dwelling was under construction directly below the line and Transpower had not been consulted on the proposal. This dwelling blocked access to the tower

site, meaning that Transpower had to secure alternative access across four separate properties. This required the removal of fencing and vegetation. Figure 9 clearly illustrates the difficulties now arising at the site.

Figure 9. Dwelling blocking access to tower