GHD Advisory

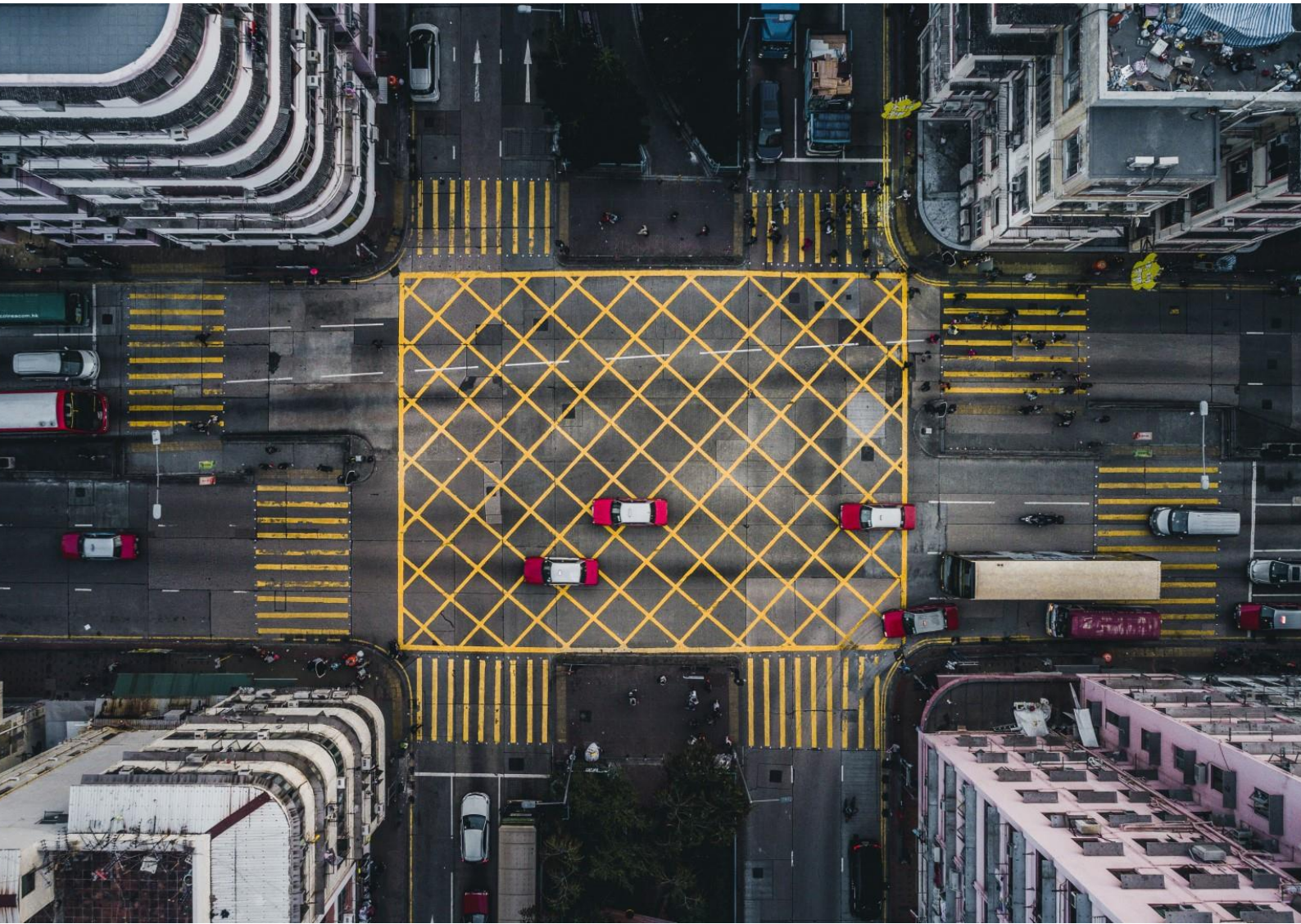
CPPAL AFAP Validation

As Far As Practicable (AFAP) Validation Assessment

Powercor Australia Ltd

05 December 2024

→ **The Power of Commitment**



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Executive Summary

GHD Pty. Ltd. (GHD) undertook an independent validation assessment of CitiPower and Powercor's (CPPAL) As Far As Practicable (AFAP) process which is used to assess and minimise the bushfire and network safety risks arising from their electricity networks, in accordance with Section 98 of the Electricity Safety Act 1998 (ESA).

The scope of this assessment was divided into three key parts, as described below:

1. Part one: Cross-validation of CPPAL's methodology to undertake bushfire and network safety risks AFAP assessments against:
    - The AFAP Investment Procedure (PR-2914)
    - Section 98 of ESA 1998 to determine if it meets the regulatory objectives of minimising these risks AFAP.
2. Part two: Validation of the control effectiveness criteria used by CPPAL to rate and evaluate the identified options.
3. Part three: Validation of the evaluated recommendations (categorised as AFAP options as opposed to other ideas) identified from the CPPAL AFAP assessments to minimising bushfire and network safety risks to AFAP. Further, the effectiveness ratings assigned per AFAP option were reviewed as part of the validation.

The report has four distinct sections, with Sections 2 and 3 detailing the methodology and findings associated with the parts described above:

– Section 1: Introduction
– Section 2: Validation methodology
– Section 3: Validation findings
– Section 4. Additional recommendations and conclusions

The report follows a structured approach to present the validation findings, using three key criteria to identify (1) critical discrepancies or gaps, (2) non-critical discrepancies or gaps, and (3) observations or improvement opportunities. A critical discrepancy or gap identified during documentation review is define as those that could materially impact the outcomes of the AFAP assessments. It is proposed that actions associated with these items are assigned a higher priority and are actioned as soon as practicable. Further definitions are provided in Section 2.1

Each point was colour coded throughout the report to visually convey their criticality to the reader. Refer to Section 2.1 for the colour scheme applied.

The key findings from this validation assessment are summarised in Table 1, with the high-level validation assessment outcome shown.

Table 1 Summary of independent validation assessment, detailing validation outcomes

Scope	Finding		Validation outcome
Part one	The AFAP assessment methodology used by CPPAL is consistent with the requirements of Section 98 of the ESA and the AFAP Investment Procedure, with no critical discrepancies or gaps found	– No critical discrepancies or gaps identified. – One (1) non-critical discrepancies or gaps identified. Point 1 in the report. – In addition to this, GHD suggests three (3) additional recommendations that relate to the material reviewed as part of this scope. These are labelled as 'observations or improvement opportunities' but are beyond the scope of the AFAP cross-validation assessment.	Cross-validation complete. No critical discrepancies or gaps identified.
Part two	The control effectiveness criteria used by CPPALUE are based on a reference from the iron ore pelletizing industry but lack further	– No critical discrepancies or gaps identified. – Two (2) non-critical discrepancies or gaps identified. Points 5 and 6 in the report.	Validation complete. No critical

Scope	Finding		Validation outcome
	justification and documentation to support their validity and applicability.	– One (1) improvement opportunity identified.	discrepancies or gaps identified.
Part three	The disproportionality factors (DFs) applied by CPPALUE are consistent with those used by other major electricity companies and sectors but may need to be reviewed and updated to account for changing risk profiles and uncertainties	– No critical discrepancies or gaps identified. – One (1) non-critical discrepancies or gaps identified. Point 9 in the report. – Four (4) improvement opportunities and observations identified. Points 8, 10, 11 and 12 in the report.	Validation complete. No critical discrepancies and gaps identified.

This report is subject to, and must be read in conjunction with, the limitations set out in section 1.2 and the assumptions and qualifications contained throughout the Report.

Contents

Table index

Figure index

Appendices

1. Introduction

CitiPower and Powercor (CPPAL) and United Energy (UE) are prominent Distribution Network Service Providers (DNSP). each serving distinct geographical areas with a comprehensive range of services focused on delivering reliable and safe electricity supply to their customers.

Within Victoria:

– CPPAL operates in both rural and urban areas
– Powercor's network provides electricity in both central and western Melbourne suburbs, as well as regional Western Victoria
– CitiPower operates primarily in the Melbourne metropolitan area, providing electricity to the central business district and nearby inner suburbs
– UE operates in the eastern suburbs of Melbourne and the Mornington Peninsula, servicing a mixture of urban, semi-rural and industrial areas.

Figure 1 illustrates the coverage and boundaries between various DNSPs in Victoria.

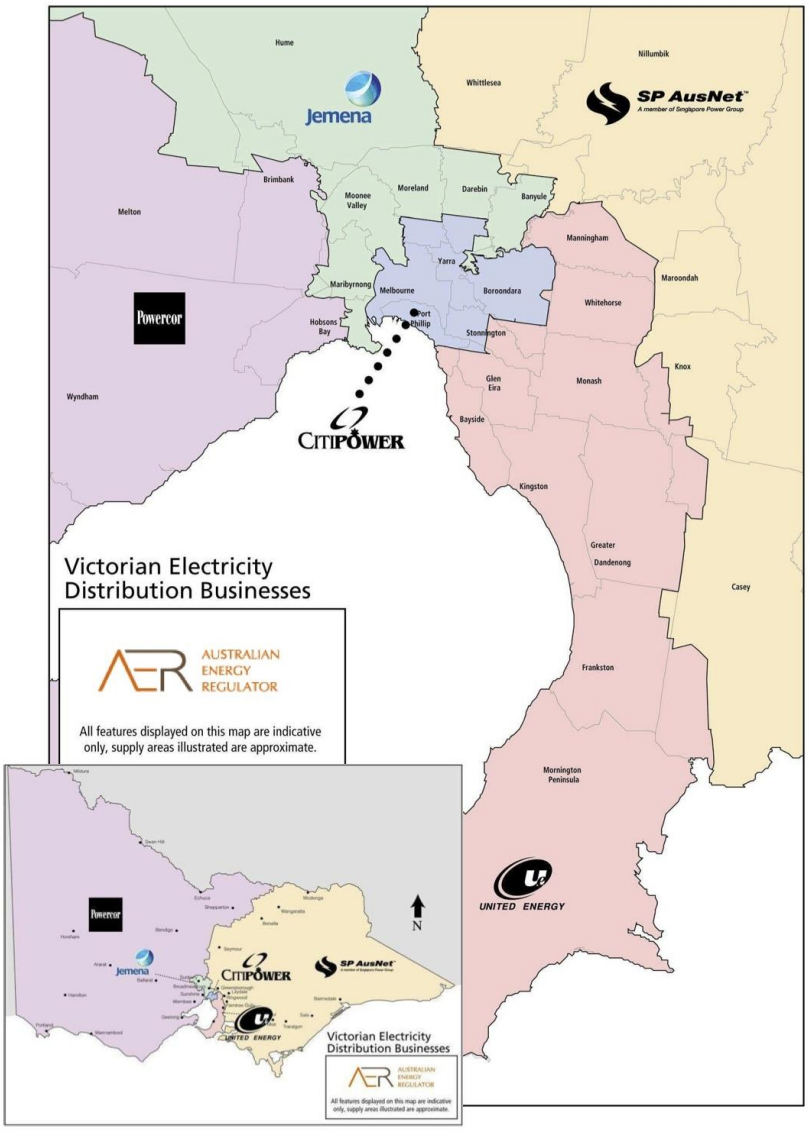

Figure 1 ***Supply areas of Victorian electricity distribution business. CitiPower and Powercor are highlighted in purpose and blue respectively [1].***

CPPAL and UE (collectively referred to as CPPALUE) are responsible for providing reliable and safe power across their respective operational areas, and have statutory obligations to minimise *As Far As Practicable* (AFAP):

– Hazards and risks to "the health and safety of people and the environment"
– Hazards and risks to "property damage" arising from their electricity networks
– Bushfire danger arising from their respective electricity networks

Specifically, under Section 98 of the Electricity Safety Act (ESA) (1998) [2], CPPALUE are required to "design, construct, operate, maintain and decommission its supply network to minimise as far as practicable":

– the hazards and risks to the safety of any person arising from the supply network
– the hazards and risks of damage to the property of any person arising from the supply network
– the bushfire danger arising from the supply network.

This is reinforced in CPPALUE's risk appetite statements [3] for safety and bushfire danger as well as compliance to legislative obligations:

– "We will seek to prevent the risk of fatality or serious injury of our network employees and members of the general public to *as far as practicable*;
– We week to minimise network safety risk arising from the supply network *as far as practicable*
– We seek to minimise the bushfire danger arising from our supply network *as far as practicable*
– We have no risk appetite for material non-compliance with our regulatory and legal obligations"

As described in Section 4 CPPALUE AFAP Investment Assessment Process [3], CPPAL and UE have adopted AFAP as the common term when evaluating safety or harm risk reduction, consistent with advice provided by Energy Safe Victoria (ESV) as the energy safety regulator in Victoria.

The challenge of maintaining network safety and mitigating bushfire and environmental risks is increasingly critical given the changing climate and expansion of urban areas into regions susceptible to fires. Determining if the risk has been reduced AFAP involves a semi-quantitative assessment of the effectiveness of the controls and the cost involved in minimising the risk further. AFAP is considered to have been achieved when the cost of reducing the risk further is "grossly disproportionate" to the risk reduction gained. An overview of the AFAP methodology is provided in Figure 2.

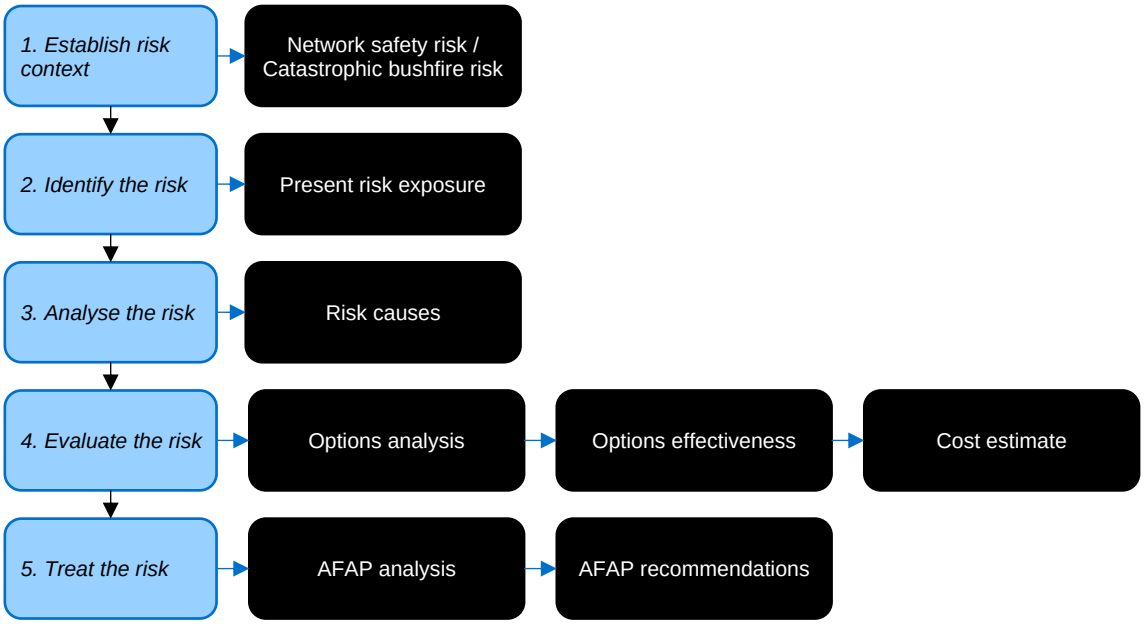

Figure 2 ***As Far As Practicable stage overview (adapted from Figure 1 in ref [4] and ref [5])***

CPPALUE appreciate that, in most instances, assessing the cost for implementing suggested risk reductions measures is relatively straightforward in comparison with determining and quantifying the gained benefits. CPPAL

and UE have developed a process to assess and quantify the benefit of different risk reduction measures, including how the organisations value the benefit of risk reduction for different types of risks. This is used to support disproportionality assessments.

The notion of gross disproportion requires duty-holders to assess the costs of a proposed control measure against its risk reduction benefits. Specifically, it is that a proposed control measure ought to be implemented if the cost to do so, is not grossly disproportionate to the benefits achieved by the measure.

Safety legislation requires risks to be reduced 'AFAP" – that is, invest until the costs are disproportionate to the benefits expected. In these processes the duty-holder needs to take account of both the level of individual risk and the extent and severity of the consequences of major accidents. This concept is consistent with the use of Present Value Ratios (PVR) discussed further in the body of this report.

In other states that fall under the Australian Energy Regulator (AER), the AER also applies the concept of disproportionality when assessing safety. To support the quality of asset replacement planning the AER released an industry practice application note in 2019. This includes guidance upon the modelling required to support disproportionality assessments. This includes the use of Disproportionality Factors (DFs).

DFs are intended to account for the inherent uncertainty in the variables involved in the risk analysis and taken into consideration what the community, government and law would regard as risk reduction expenditure to be grossly disproportionate. Within the guidance the AER specifies DF to be used for different exposures.

In assessing electrical safety, the industry typically benchmarks against AS5577 - Electricity Network Safety Management Systems, use Formal Safety Assessments and benchmark against controls that would represent Good Electrical Industry Practice (GEIP). All controls are typically assessed for effectiveness with any gaps progressed through to capital planning for funding consideration if they pass a disproportionality assessment. Bushfire risk assessments also benchmark against GEIP and consider alignment with clearance requirements and other state based regulatory requirements.

1.1 Purpose of this report

CPPAL and UE have both undertaken network wide AFAP assessments to establish further work needed to minimise (1) bushfire and (2) network safety risks AFAP. These assessments have involved the development and establishment of AFAP risk treatment plans in alignment with the requirements within Section 98 of the ESA and internal CPPALUE documentation.

The purpose of this engagement is to complete an independent validation assessment of CPPAL's AFAP process, detailing the following:

1. Part one: Cross-validation of CPPAL's methodology to undertake bushfire and network safety risks AFAP assessments against:
    - The AFAP Investment Procedure (PR-2914)
    - Section 98 of ESA 1998 to determine if it meets the regulatory objectives of minimising these risks AFAP.
2. Part two: Validation of the control effectiveness criteria used by CPPAL to rate and evaluate the identified options.
3. Part three: Validation of the evaluated recommendations (categorised as AFAP options as opposed to other ideas) identified from the CPPAL AFAP assessments to minimising bushfire and network safety risks to AFAP.

The report has three distinct sections, in addition to the introduction, that are further divided to address the Parts described above:

– Section 2: Validation methodology
– Section 3: Validation findings
– Section 4. Additional recommendations and conclusions

Section 2 outlines the validation assessment methodology applied to each Part, providing a summary of the criteria applied to identify critical and non-critical discrepancies (specifically for Part one of the scope) and gaps as well as other observations. Section 3 details the validation assessment findings, providing a summary of the gaps and opportunities identified during the assessment. Finally, Section 4 aims to provide a holistic review of the CPPAL AFAP validation process, with articulating additional thoughts and recommendations that are beyond scopes for each Part but form part of the broader assessment.

1.2 Scope and limitations

The scope of this validation assessment is summarised in Table 2, divided to three distinct Parts as detailed in Section 1.1. The relevant documentation reviewed as part of these scope elements is also provided, noting that the document revision and dates are provided in Appendix A and further descriptions of their relevancy to each scope element is detailed in Sections 2.2.1, 2.2.2 and 2.2.3.

Table 2 Scope of the validation assessment

Scope element	Description	Provided documentation
Part one: Cross validation of AFAP assessment methodology	Cross-validation of CPPAL methodology used to undertake bushfire and network safety risks AFAP assessments with Section 98 of the ESA (1998) and PR-2914	– PL-0014 Network Bushfire Mitigation Risk Treatment – PL-0013 Network Safety Risk Treatment – AFAP Investment Procedure PR-2914 – STR-0003 Network Safety Strategy – STR-0005 Bushfire Mitigation Strategy – PR-0003 Network Investment Procedure – 13-10-CPPCUE0005 Enterprise Risk Management Framework – Section 98 of the ESA (1998)
Part two: Validation of control effectiveness criteria	Validation of the control effectiveness criteria used by	– Section 5.1.4 of PL-0014 Network Bushfire Mitigation Risk Treatment – Section 5.1.4 of PL-0013 Network Safety Risk Treatment

Scope element	Description	Provided documentation
	CPPAL to rate and evaluate the identified options	– Record of control effectiveness values for CPPAL AFAP assessments.docx. – Two additional references embedded within this document that formed part of the validation assessment include: • RE:AFAP initiative assessment template – (New Controls / Improved Controls assessment register) email thread provided by CPPAL • Determining the effectiveness of controls; Catastrophic bushfire risk presentation for CPPALUE – Record of control effectiveness values for CPPAL AFAP assessments_V2.docx – An updated version of Record of control effectiveness values for CPPAL AFAP assessments.docx.
Part three: Validation of AFAP recommendations	Validation of the evaluated recommendations identified from the CPPAL AFAP assessments to minimising bushfire and network safety risks to AFAP.	– Section 5 PL-0014 Network Bushfire Mitigation Risk Treatment – Section 5 PL-0013 Network Safety Risk Treatment – STR-0006 Framework Value – CPPAL-RP-0003 Bushfire Risk AFAP Options Analysis Report_Confidential.xlsx – CPPAL-RP-0007 Network Safety AFAP Options Analysis Report_Confidential.xlsx – REFCL exposures & benefits.docx – SWER EFD Benefits estimation.docx – Bushfire Risk_AFAP Options_Passed and Marginal not progressed_NRA 20Feb24 – Screenshots of the Bushfire Risk Tool (BRT) – refer to Appendix B of this report. – VPN105024 Minimise bushfire risk of bare SWER lines with CC – Cost_benefit_20240215_VR0.76.xlsx – VPN105024 Minimise bushfire risk of bare 22kV lines with CC – Cost_benefit_20240215_VR0.87.xlsx – SWER EFD Benefits estimate.docx (revised version) – SWER EFD Benefits estimations_V2.docx (revised version with updated bushfire risk model life loss per annum values) – SWER DF & CC effectiveness.docx – REFCL exposures & benefits.docx – 22kV DF & CC effectiveness.docx

For Part three of the scope, it was necessary to undertake precursor steps in order to validate the evaluated recommendations. Further details are provided within the methodology (refer to Section 2.2.3), however the scope involved:

– Validating the AFAP process by reviewing if CPPAL's methodology broadly aligns with what other DNSPs are doing.
– Verification that the AFAP assessments completed by CPPAL (as per the AFAP Options Analysis Reports) reflect of the process detailed in PR-2914.
– From these steps, then determine if the proposed AFAP recommendations are valid. The scope is limited to reviewing the 69 AFAP recommendations for bushfire risk and 39 AFAP recommendations for network safety risk.

The following were excluded from the scope of works:

– To complete a validation assessment for United Energy's AFAP process. It is understood from conversations with the CPPAL representatives involved in this engagement that UE will adopt CPPAL's AFAP process in the next financial year. Assuming that the AFAP process will follow the exact same process and format as this

review, the discrepancies, gaps, observations, and opportunities identified will then likely be applicable to UE. However, this is beyond the scope of this assessment and no comments or suggestions have been proposed by GHD within this report.

– Validation that no further opportunities for investment are required by CPPAL to demonstrate that AFAP has been achieved for its bushfire and network safety risks. GHD's scope was limited to validating 69 AFAP recommendations for bushfire risk and 39 AFAP recommendations for network safety risk.
– Assistance with developing CPPAL's upcoming revenue proposal.
– Site visits to support the validation assessment, including but not limited to, AFAP recommendations that were labelled as area or site specific within the Options Analysis Reports.
– Close out of recommendations and follow-up actions generated and reported in the AFAP validation study.
– Any liaison with third parties, such as regulatory or statutory authorities.

1.3 Assumptions

The following assumptions were for this engagement:

– The documentation and embedded data provided will not be independently verified by GHD. It was assumed that the most up-to-date revisions of documents were provided for this assessment. It was noted by CPPAL in an email received on 21 February 2024 that there have been some changes in the annualised risk reduction per annum values provided in Table 3 of PL-0014. This was noted within the discussion in Section 2.2.3.
– It was assumed that as part of the AFAP recommendation development process that the necessary CPPAL stakeholders (including relevant subject matter specialists) were present. However, for visibility, GHD have proposed recommendations in Section 3.3 to include this in records of future assessments.
– For some recommendations, it was noted within the Options Analysis Reports provided that AFAP assessments were complete outside of the spreadsheet. This was confirmed by CPPAL in an email received on 21 February 2024 and during a Microsoft Teams meeting held on 9 April 2024. Where needed for validation purposes, additional calculations for Net Present Value (NPV) were provided for GHD's review. These included:
    - VPN105024 Minimise bushfire risk of bare 22kV lines with CC - Cost_benefit_20231110_VR0.87
    - VPN105024 Minimise bushfire risk of bare SWER lines with CC - Cost_benefit_20240215_VR0.76
– Based on GHD's experience with other MECs, calculation of the annualised risk benefit for works associated with transformers can be a complex exercise, with specific spreadsheets utilised in industry to assist with these calculations as the assets age. It was therefore assumed that transformer related AFAP recommendations do not require this complex assessment and are standalone within the AFAP Options Analysis reports provided.
– It is assumed that the AFAP analysis undertaken by CPPAL is separate from the Regulatory Investment Test for Distribution (RIT-D).

2. Validation methodology

This section details the validation assessment methodology and criteria process.

2.1 Categorisation of validation findings

GHD developed three key criteria during the documentation review process to provide a structured validation assessment for each scope element.

- Critical discrepancy or gap identified: A discrepancy or gap identified during documentation review that could materially impact the outcomes of the AFAP assessments. It is proposed that actions associated with these items are assigned a higher priority and are actioned as soon as practicable.
- Non-critical discrepancy or gap identified: Unlike critical discrepancies or gaps, non-critical discrepancies or gaps are unlikely to alter the outcomes of the AFAP assessment. However, they represent improvement opportunities to, for example, assist with clarification or further development of the AFAP process. It is proposed that actions associated with these items are assigned a low to moderate priority, with CPPAL responsible for assigning an actionable timeframe.
- Observations or improvement opportunities: Based on GHD's experience working with transmission and distribution network operators, the validation process also provides commentary on commonalities on other known industry practices. Where possible, GHD provide references to publicly available documents for CPPAL's reference. Where applicable, observations noted in this validation exercise provide insights into risk assessment and practicability assessments undertaken in different sectors. Completing actions arising from this observational category is optional, with CPPAL to review the observations provided and determine if the proposed actions will strengthen their AFAP assessments.

2.2 Validation methodology

2.2.1 Part one: Cross-validation of AFAP assessment methodology

For scope element one, GHD undertook a cross-validation of CPPAL's methodology to undertake (1) bushfire risk and (2) network safety risk AFAP assessments against the CPPAL's PR-2914 AFAP Investment Procedure and Section 98 of the ESA 1998. The relevant documentation (and associated sections) for this cross-validation exercise is summarised in Table 1. Supporting documentation which either formed the contextual basis for PR-2914 or was referred to as part of the broader CPPAL Strategy are also highlighted in Table 1. A summary of the documents reviewed as part of this engagement is provided in Appendix A.

Table 3 Document list for Part one cross-validation assessment

Document	Applicable sections	Relevancy to methodology cross-validation
(PL-0014) Bushfire Risk Treatment Plan	Section 5.1	Methodology to undertake bushfire risk AFAP assessments is detailed within this report. Outcomes are discussed within each sub-section of the methodology.
(PL-0013) Network Safety Risk Treatment Plan	Section 5.1	Methodology to undertake network safety risk AFAP assessments is detailed within this report. Outcomes are discussed within each sub-section of the methodology.
(PR-2914) AFAP Investment Procedure	All sections	The document outlines the AFAP process used by CPPALUE to evaluate the potential network investments based on their statutory obligations to minimise hazards and risks to health, safety, and the environment. The methodologies within PL-0013 and PL-0014 will be validated against this procedure.
(STR-0003) Network Safety Strategy	-	For reference only. Used as contextual material as it informs the network safety risk AFAP assessment.

Document	Applicable sections	Relevancy to methodology cross-validation
(STR-0005) Bushfire Mitigation Strategy	-	For reference only. Used as contextual material as it informs the bushfire risk AFAP assessment.
(PR-0003) Network Investment Procedure	-	This procedure summarises the treatment of mandatory harm reduction AFAP projects in Section 5.2, highlighting the use of Value of Statistical Life (VoSL) and DFs
(13-10-CPPCUE0005) Enterprise Risk Management Framework	-	Overview of the overarching risk management framework
Electricity Safety Act 1998	Section 98	The methodologies within PL-0013 and PL-0014 will be validated against this section of the Act.

As this is a cross-validation of the AFAP assessment with PR-2914 and Section 98 of the ESA 1998, this part of the scope does not aim to validate the AFAP methodology itself. Refer to Section 2.2.3, where GHD reviewed the resulted AFAP recommendations, for further discussion of the AFAP methodology.

2.2.2 Part two: Validation of control effectiveness criteria

Assigning control effectiveness during the AFAP options analysis forms a key part in determining which options transition into recommendations. Once control options have been identified, their effectiveness is established in accordance with the Enterprise Risk Management Framework (ERMF). To assist with quantification of control effectiveness across multiple causes, effectiveness ranges for control mitigation and overall effectiveness rates were established by CPPAL, as shown in Table 2.

Table 4 AFAP assessment control effectiveness range and ratings (table 4 of ref [5] and table 2 of ref [4])

Qualitative control effectiveness rating	Effectiveness range (%)	Effectiveness rating (%)
Ineffective	0 – 20	1
Partially effective	20 – 50	36
Mostly effective	50 – 80	66
Fully effective	> 80	98

CPPAL utilised the following sources as a basis for control effectiveness quantification:

– Hazard Identification, Risk Assessment, and Control Measures as an Effective Tool of Occupational Health Assessment of Hazardous Process in an Iron Ore Pelletizing Industry [6]
– Broadleaf resource material on control Effectiveness [7]
– Developing MITRA Learning Model of Problem Solving-Based to Solve Mathematical Problems in Elementary School [8]

Following CPPAL's review of the draft validation assessment report[1], CPPAL provided two additional documents to demonstrate the basis of the derivation of the control effectiveness criteria range and rating values:

– "Record of control effectiveness values for CPPAL AFAP assessment" that included references [7] and [8] as well as evidence of internal correspondences demonstrating how the effectiveness ratings were derived. Additionally, an embedded presentation was provided within this memorandum to demonstrate socialisation of CPPAL's AFAP control effectiveness approach at an external forum.
– "Record of control effectiveness values for CPPAL AFAP assessment_V2" that provided further information on how the references were either interpreted and/or directly utilised for the derivation of effectiveness ratings.

GHD reviewed all of the references provided by CPPAL, how control effectiveness is quantified within other risk assessment domains, (such as reliability assessments and human factors) and in other sectors, to validate the effectiveness ratings shown in Table 4.

[1] 12620988-GHD-00-00-RPT-RM-00000-S3-P01-Powercor AFAP Validation Report, issued 18 March 2024

2.2.3 Part three: Validation of AFAP recommendations

Scope element three aimed to validate the AFAP recommendations precipitating from the CPPAL AFAP assessment process. A total of 69 recommendations were put forward for minimising bushfire risk AFAP, while 39 recommendations were put forward for minimising network safety risks AFAP. The following steps were undertaken for validating the AFAP recommendations:

– Review of the AFAP options analysis reports with supporting calculations demonstrating the derivation of PVR values which are used to support justification for revenue allocation for AFAP recommendations. Documents reviewed and applicable for this Part are summarised in Table 5:

Table 5 Document list for Part three validation assessment

Document	Applicable sections	Relevancy to AFAP recommendation validation
CPPAL-RP-0003 Bushfire Risk AFAP Options Analysis Report_Confidential.xlsx	All tabs	Details the AFAP risk reduction strategies to manage the existing network assets. The scope of this assessment covers existing network assets per fire risk areas and evaluates the options accordingly.
CPPAL-RP-0007 Network Safety AFAP Options Analysis Report_Confidential.xlsx	All tabs	Details the AFAP risk reduction strategies to manage the existing network assets. The scope of this assessment covers existing network assets and evaluates the options accordingly.
Bushfire Risk_AFAP Options_Passed and Marginal not progressed_NRA 20Feb24.pdf	All	Details the reasons for not progressing options that either passed or marginally failed the AFAP test.
Single Wire Earth Return Early Fault Detection (SWER EFD) benefits estimate.docx	All	Deploying pre-fault detection on SWER lines was assessed outside of CPPAL-RP-0003 Bushfire Risk AFAP Options Analysis Report_Confidential.xlsx[2]. This document summarises the assessment.
REFCL exposures & benefits.docx	All	Zone Substation (ZSS) specific Rapid Earth Fault Current Limiter (REFCL) installations were assessed outside of CPPAL-RP-0003 Bushfire Risk AFAP Options Analysis Report_Confidential.xlsx[3]. This document summarises the assessment.
(STR-0006) Framework Value	Appendix A	Provides a summary of the disproportionality factors utilised by CPPALUE.
Application of disproportionality factors in a value framework	All	Details the findings from an independent study completed by AMCL+ on use of disproportionality factors.
Screenshots of the BRT	-	Demonstrates where the ‘Life loss risk fraction $ per annum” figures within CPPAL-RP-0003 came from.
VPN105024 Minimise bushfire risk of bare SWER lines with CC – Cost_benefit_20240215_VR0.76.xlsx[4]	All	Demonstrates the additional NPV cost and benefit analysis completed beyond the AFAP PVR assessment for minimising bushfire start risks from bare SWER lines with covered conductors. This document was provided in response to action 20 in the draft validation assessment report.
VPN105024 Minimise bushfire risk of bare 22kV lines with CC – Cost_benefit_20240215_VR0.87.xlsx	All	Demonstrates the additional NPV cost and benefit analysis completed beyond the AFAP PVR assessment for minimising bushfire start risks from bare 22kV non-REFCL lines with covered conductors. This document was provided in response to action 19 in the draft validation assessment report.

[2] Confirmed by Anwar Qayyum in an email received by GHD on 21 February 2024 titled “RE: CPPAL AFAP Validation CPPAL-RP-0003 queries.”
[3] See footnote 1.
[4] Spreadsheet provided following review of 12620988-GHD-00-00-RPT-RM-00000-S3-P01-Powercor AFAP Validation Report, issued 18 March 2024.

Document	Applicable sections	Relevancy to AFAP recommendation validation
SWER EFD Benefits estimate.docx[5]	All	This document is an updated version of the SWER EFD benefits estimate document provided initially. It explains the derivation of the SWER specific control effectiveness values that were provided earlier.
SWER EFD benefits estimations_V2.docx[6]	All	This document represents another update of the SWER EFD Benefits estimate.docx. In the revised version ("SWER EFD Benefits estimate.docx")[7] that was provided, the life loss per annum figures in the screen shots of the bushfire risk model were difficult to view or inconsistent with the AFAP assessment figures. Thus, an updated version was provided to address these points.
SWER DF & CC effectiveness.docx	All	Provides a summary of the derivation of the SWER control options effectiveness and resultant DFs per fire area.
REFCL exposures & benefits.docx[8]	All	This document is an updated version of the REFCL exposures & benefits.docx that was provided initially. It breaks down the expected risk reduction for a powerline supplied by a zone substation with a REFCL installed and includes the resultant AFAP PVR values for Horsham and Numkrah.
22kV DF & CC effectiveness.docx	All	Provides a summary of the derivation of the 22kVcontrol options effectiveness and resultant DFs per fire area.

– Verification of consistency between the calculations used for the AFAP options analysis report against the overarching investment procedure PR-2914.
– Review of DFs used for risk calculations against those typically used by Major Electricity Companies (MECs)
– Validation of each recommendation (69 identified for the bushfire risk AFAP analysis and 39 identified for the network safety risk AFAP analysis). This involved assessing whether the proposed recommendations support CPPAL's objective of minimising risks AFAP.

As part of this scope of works, GHD did not review the non-AFAP options (classified as other opportunities) noted within the documents listed in Table 5.

[5] Revised version provided following review of 12620988-GHD-00-00-RPT-RM-00000-S3-P01-Powercor AFAP Validation Report, issued 18 March 2024.
[6] See footnote 5.
[7] See footnote 5.
[8] See footnote 5.

3. Validation findings

3.1 Part one: Cross-validation of AFAP assessment methodology

3.1.1 Alignment with Section 98 of the Electricity Safety Act 1998

Section 98 of the ESA 1998 mandates MECs to design, construct, operate, maintain and decommission their supply networks to minimise the hazards and risks to safety, property and bushfire danger arising from the supply network AFAP. The Bushfire Risk Treatment Plan (BRTP) and Network Safety Risk Treatment Plan (NSRTP) both commence with explicitly stating that the purpose of these plans is to minimise risk AFAP in line with Section 98 of the ESA.

The methodology in Section 5.1 of the BRTP closely aligns with the requirements outline in Section 98 of the ESA 1998. It emphasises minimising catastrophic bushfire risks associated with electrical network assets to the extent that is practicable. This is achieved through a structured approach that includes identifying the current risk exposures, analysing risk causes, evaluating options for risk mitigation and making recommendations based on cost effectiveness and practicability, all of which are in keeping with the general duty of care and risk management principles mandated by the ESA.

Likewise, the methodology in Section 5.1 of the NSRTP aims to address network safety risk minimisation in accordance with the principles outline in Section 98 of the ESA. Given that the methodology provided is similar to that within the BRTP (excluding the use of the BRT) to evaluate the present risk exposure and estimating the cost to implement AFAP options per fire risk area), this approach aligns with the ESA's requirement for managing electrical network safety risks effectively.

With respect to cross-validation of the AFAP methodology presented in the BRTP and the NSRTP, no discrepancies or gaps were identified during this review.

3.1.2 Alignment with AFAP Investment Process PR-2914

The AFAP Investment Assessment details a structured approach for network investments with the objective of minimising risks AFAP, similar to the approaches outlines in the BRTP and the NSRTP. However, the AFAP Investment Assessment provides further details on the cost-benefit analysis procedure, the application of DFs and the structured decision-making framework for evaluating the documenting risk reduction initiatives, which are more elaborated that the methodology provided within the BRTP and the NSRTP.

Given that the purpose of the risk treatment plans is to provide an overview of the methodology, supplementing it with the outcomes, they reference the AFAP Investment Process in Section 5.1.3 noting that ideas categorised as AFAP options were subject to the analysis requirements as per PR-2914.

GHD note the following non-critical discrepancies and gaps identified during the cross-validation review:

1. There is a discrepancy between how the triage criteria is referred to within Section 5.1.3 *Options Analysis* within the BRTP and the NSRTP versus how it is discussed in Section 5.2 of the AFAP Investment Assessment. In the AFAP Investment Assessment it states that "before undertaking a full cost-benefit analysis, **all new controls or improvement initiatives** are required to undergo a preliminary triage to identify those that can be easily assessed. Although minor, the Risk Treatment Plan methodologies only specify that "**other opportunities** were triaged using the criteria noted…below." Despite being factually correct, GHD recommends that CPPAL update the text to read as "all new controls or improvement initiatives were triaged using the criteria noted in Figure 3 below."

3.1.3 Summary of findings

Based on the cross-validation completed, GHD validate that the CPPAL AFAP assessment methodology aligns with Section 98 of the ESA and PR-2914. Table 6 provides a summary of the AFAP methodology cross-validation findings.

Table 6 Summary of cross-validation assessment findings

Area	Criteria	Comments
Alignment with Section 98 of the Electricity Safety Act 1998	Critical discrepancy or gap	None identified
	Non-critical discrepancy or gap	None identified
	Observation or improvement opportunity	No improvement opportunities identified. Observations on alignment provided in Section 3.1.1 of this report
Alignment with PR-2914	Critical discrepancy or gap	None identified
	Non-critical discrepancy or gap	One (1) identified. Refer to Section 3.1.2 of this report, listed as point 1
	Observation or improvement opportunity	No improvement opportunities identified. Observations on alignment provided in Section 3.1.2 of this report

In addition to the points raised, GHD noted some inconsistencies in the documents reviewed. Although it is beyond the cross-validation scope, they are highlighted below for CPPAL's consideration:

2. In the BRTP reference is made to CPPAL's BRT that enables the computation of the likelihood of groundfire ignitions for a range of Fire Danger Indexes (FDIs), i.e. consequences, subsequently deriving the present risk exposure. In the revision sighted, there are no references provided to further contextualise this process. GHD are aware that this is a complex model that is beyond the scope of the AFAP documentation reviewed. Despite this, it is recommended that reference is made to an overarching, internal document to provide CPPAL readers with an opportunity to review details associated with the bushfire risk modelling.
3. Section 5.1.1 of the NSRTP provides the total annualised network safety risk per annum with and without the application of DFs. This demonstration of the difference in risk exposure prior to and after applying DFs is also applied in Section 5.1.2. Although there is a distinction between who the risk exposure is structured for bushfire risk versus network safety risk – with bushfire risk exposure estimated using the BRT while network safety risk exposure is calculated per asset class – CPPAL should investigate a way to present the information is a more consistent format. For example, providing a probabilistic profile percentage breakdown as per Table 1 in the BRTP to Table 2 in the NSRTP.
4. Append the data from the AFAP options analysis report and supporting justifications to the relevant risk treatment plans. Although the CPPAL Bushfire Risk AFAP Options Analysis Report (CPPAL-RP-0003) and the CPPAL Network Safety AFAP Options Analysis Report (CPPAL-RP-0007) are referred to within the body of the risk treatment plans, there is an opportunity to provide further detailed reading within an Appendix (or Appendices). Appreciating the confidential nature of the options analysis reports, CPPAL can potentially reconfigure the information to provide an overview list of the brainstormed options, brief rationale for selection, and how the AFAP recommendations map to the tables within the report for future auditability and clarity.

3.2 Part two: Validation of control effectiveness criteria

Once AFAP options are identified for assessment, their effectiveness across multiple causes is established in accordance with the ERMF. To assist with quantification of control effectiveness ratings across a number of causes, effectiveness ranges for control mitigation and overall effectiveness ratings were established by CPPAL as shown in Table 2 and Table 4 within the BRTP and the NSRTP respectively.

Initially, GHD conducted a literature search to determine if similar or other industries have percentage control effectiveness values that reinforce the figures adopted or highlight differences as part of validating the control effectiveness criteria. The initial literature searches did not yield additional figures for effectiveness ranges that could be applied across all controls, with a majority of the sources providing qualitative descriptors (ranging from "fully effective" to "ineffective").

Mirroring the way effectiveness is interpreted in Failure Modes, Effects (and Criticality) Analysis (FMEA/FMECA), a few sources derived the effectiveness criteria from a control based on the performance of that control (e.g., Fully effective administrative control could be 100% completion of routine maintenance activities [9]). Bowties, which is a technique commonly used in the resources and energy sectors, can utilise a software package known as BowtieXP. This package enables users to include an effectiveness rating for each control listed. Similar to principles used in FMECA, a frequency value can be input to then calculate the probability of a cause line being realised [10].

CPPAL representatives involved in this validation engagement initially emailed GHD a reference used as a basis for the derivation of these effective ranges and ratings, shown in Table 7. The effective ranges provided in Table 7 were used for assessments of hazardous process in an iron ore pelletising industry [6].

Table 7 Control measures and their effectiveness (Table 3 in ref [6])

Process steps	Effectiveness (%)
Eliminate the hazards completely	100
Engineering control measures: Create a barrier between the person and the hazard	70 – 90
Administration: Regulation, law, procedures, etc.	10 – 50
Provide personal protective equipment	20

Following the draft review of GHD's validation report, CPPAL provided two additional supporting documents that detailed other references used to inform the derivation of the control effectiveness criteria, as well as email correspondences showing preliminary socialisation of the quantitated effectiveness's to internal stakeholders. The documents were:

– *"Record of control effectiveness values for CPPAL AFAP assessment.docx"*.

  This document provided two references:

  - Broadleaf resource material on control Effectiveness [7]
  - Developing MITRA Learning Model of Problem Solving-Based to Solve Mathematical Problems in Elementary School [8]

  It also provided an email attachment to internal correspondences demonstrating how the effectiveness ratings were derived. Further, an embedded presentation was provided within this document, demonstrating initial socialisation of CPPAL's AFAP control effectiveness approach to other CPPAL stakeholders as well as United Energy personnel.

– *"Record of control effectiveness values for CPPAL AFAP assessment_V2.docx"*

  This document provided further information on how references [7] and [8] should be interpreted and/or directly utilised for the (1) translation of qualitative control designations to quantitative ranges and (2) the rationale for rating designations.

Given the specificity of this application of control effectiveness, CPPAL demonstrate in these two additional documents, using the provided references, that expressing control effectiveness ranges and set points quantitatively is a unique approach to completing AFAP assessments. Thus, utilising references from other sectors

– modelling, iron ore pelletising – was required to translate the qualitative control effectiveness criteria (as stipulated in the ERMF).

With respect to the setpoints assigned, there were minor discrepancies between the values within the email chain attached, PowerPoint presentation attached, and final control effectiveness figures used in the AFAP assessment reviewed. These differences are summarised in Table 8.

Table 8 Summary of control effectiveness criteria differences from sources provided

Control effectiveness ratings – per ERMF	AFAP assessment figures		Figures provided with the attached email chain[9]		Figures provided within the attached presentation[10]	
	Range (%)	Rating (%)	Range (%)	Rating (%)	Range (%)	Rating (%)
Effective	>80	98	>80	100	Not specified	98
Mostly effective	51 – 80	66	50 – 79	66	Not specified	65
Partially effective	21 – 50	36	20 – 49	36	Not specified	35
Ineffective	0 – 20	1	0 – 19	0	Not specified	2

Given the email thread and presentation are from 2021 and 2022 respectively, CPPAL stated that the ranges and setpoints have been refined since initial socialisation. GHD modified the set points – increasing and decreasing the control effectiveness ratings by 1% – and found that these modifications did not change the outcomes of the AFAP assessments reviewed as part of this validation engagement. Verbally, CPPAL conveyed that they have also completed robustness analysis internally which has led to the changes to the set points since the initial circulation of values.

As noted by CPPAL in *Record of control effectiveness values for CPPAL AFAP assessment_V2.docx*:

– For ineffective and effective set points:

  "Setpoints are established by setting ineffective & effective ratings setpoints closer to lowest and highest values respectively. It is noted that ineffective rating is set as 1% and not 0% to distinguish between not applicable & applicable controls with negligible impact on risk cause. Effective rating is set as 98% and not 100% to allow for some room for error."

– For partially effective and mostly effective set points:

  "Mid-points of the ranges were then used to establish the partially effective & mostly effective setpoints."

Additionally, for options where more data is available CPPAL customise the effectiveness setpoints to provide more granular control effectiveness values, as demonstrated in *SWER EFD benefits estimations_V2.docx.*

Thus, based on the additional information provided by CPPAL, in conjunction with the sensitivity analysis undertaken, the defined control effectiveness criteria utilised by CPPAL for their AFAP assessments yields appropriate outcomes.

The following critical and non-critical discrepancies and gaps were identified that will assist CPPAL in providing a stronger basis for the criteria used:

GHD note the following non-critical discrepancies and gaps identified during the validation review:

5. Based on email correspondence on 13 May 2024, CPPAL will formally communicate the current control effectiveness ranges and set points with stakeholders. It is expected that this will be actioned following the finalisation of the GHD validation report. Thus, to capture it as an action item, it has been included within this report, noting that progress is underway.
6. Reliability of electrical equipment and assets are increasing as technology advances. Therefore, it is recommended that the effectiveness ranges and effectiveness ratings are re-evaluated every 2 to 3 years.

[9] Email chain titled: *RE:AFAP initiative assessment template – (New Controls / Improved Controls assessment register)* provided by CPPAL embedded within "Record of control effectiveness values for CPPAL AFAP assessment.docx"
[10] PowerPoint presentation (pdf format) titled: *Determining the effectiveness of controls; Catastrophic bushfire risk* embedded within *"Record of control effectiveness values for CPPAL AFAP assessment.docx"*

GHD note the following opportunity:

7. Although two documents were provided to GHD to support the control effectiveness ranges and set points, it is recommended that CPPAL develop a formalised version to capture the history and references used for derivation.

3.2.1 Summary of findings

Table 9 provides a summary of the AFAP methodology cross-validation findings.

Table 9 Summary of control effectiveness validation assessment findings

Area	Criteria	Comments
Validation of control effectiveness criteria	Critical discrepancy or gap	None identified
	Non-critical discrepancy or gap	Two (2) identified, refer to Section 3.2, points 5 and 6
	Observation or improvement opportunity	One (1) improvement opportunity, refer to Section 3.2 point 7

No further observations resulted from this scope of the validation engagement.

3.3 Part three: Validation of AFAP recommendations

3.3.1 Validation of AFAP methodology

CPPAL have acted in accordance with safety-related legislative and other obligations by undertaking this AFAP assessment for the Bushfire Risk and Network Safety Treatment Plans. The quantitative risk-based cost-benefit analysis determines the approach and timing for risk management measures, consist with the AFAP principle for risk management as per Section 98 of the ESA.

AFAP recommendations put forth in the BRTP and NSRTP are controls which pass the DT whilst supporting fire risk reduction developments and reduce network safety incidents and their consequences. The recommendations consist of control measures bundled together to present the most efficient and effective risk reduction measures and avoid any overlap of cause mitigation. The AFAP recommendations stem from an assessment of 69 bushfire risk control options and 39 network safety risk control options. GHD have undertaken a validation exercise of these specific control options to determine whether the AFAP assessment process as per PR-2914 has been followed and whether these control measures adequately minimise the related risks.

The NSRTP notes the AFAP recommendations can retire ~$1.6m per annum of network risk across the CPPAL network. This constitutes a +17.6% reduction in the present network safety risk exposure. In contrast, the BRTP AFAP recommendations can retire 53.8% of the present bushfire risk exposure to a post risk reduction recommendations exposure of ~$24.5m per annum. Whilst the network safety risk exposure is significantly lower when compared to the bushfire risk exposure, GHD suggest that adding granularity to the effectiveness values assigned to each control may assist CPPAL in identifying additional recommendations which may be implemented to further reduce the present network safety risk exposure (see recommendation 8).

No further gaps have been identified in the validation of the AFAP assessment process at large, the PVR calculations that support the AFAP recommendations are conducted in line with the required methodology. Each control option was further reviewed to identify any critical gaps or missing data that may compromise the integrity of the AFAP assessment process.

Further, the effectiveness ratings assigned per AFAP recommendation were reviewed as part of the validation exercise. When reviewing each AFAP recommendation, the effective ratings against each potential causal line item (i.e., columns within the Option Analysis spreadsheets) were reviewed. As discussed in Section 3.2, the effectiveness ratings provided (“Effective”, “Mostly effective”, “Partially effective” and “Ineffective”), including their respective percentage effectiveness setpoints, were reviewed against commonly acknowledged levels of effectiveness in the industry. For options where more data was available (as demonstrated in *SWER EFD benefits estimations_V2.docx*), the effectiveness setpoints are more formally derived, providing GHD with supportive quantitative data for review.

The findings of this review are noted in sections below.

3.3.1.1 Review of Disproportionality Factors

Assigning DFs to different risks assists CPPAL with determining if the proposed risk reduction options meet the ‘gross disproportion’ test. These factors are intended to account for the inherent uncertainty in the variables involved in the risk analysis. An extract of the DFs applied by CPPAL is provided in Table 10 and found in the STR-0006 or PR-2914.

Table 10 Disproportionality Factors used by CPPAL

Category	DF value
Harm to property from network	1
Harm to property from bushfire	1
Harm to environment	1
Safety – public trespass	1
Safety – single fatality or serious injury (public or worker)	3

Category	DF value
Safety from bushfire in Hazardous Bushfire Risk Area	3
Safety – Multiple fatality or serious injury (public or worker)	6
Safety from bushfire in REFCL declared areas	6
Safety from bushfire in electrical line clearance areas (ELCA)	10

Table 11 summaries the DFs utilised by various energy / power companies within Australia. The elements (first column) represent catastrophic outcomes.

Table 11 Summary of disproportionality factors applied in the Australian power sector

Element	Transgrid [11]	AusNet Services [12]	Energy Queensland Limited [13]	SA Power Networks [13]	Ausgrid
Disproportionality rating scale	1 to 6	1 to 10	1 to 12	1 to 10	1 to 10
Disproportionality factor applied to death from electrical infrastructure	Single fatality: 3 Multiple fatality: 6	Public trespass: 1 Single fatality: 3 Multiple fatality: 6	Single fatality: 10 Multiple fatality: 12		10
Disproportionality factor applied to death from electrical infrastructure (Including bushfire)	6	Asset in LBRA: 1 Asset in HBRA: 3 Asset in REFCL Area: 6 Asset in Codified Area: 10		2 to 10	2 to 10

From above it can be seen that the disproportionality scale and assigned values vary across each company. However, Transgrid and AusNet Services (as well as United Energy which does not appear in Table 10 given that CPPALUE share the same documentations) apply the same DFs for single fatality and multiple fatality for death from electrical infrastructure (not including bushfires).

Gross disproportionality in industries other than energy were not found to be specific for bushfire or network safety risk but for fatality risk in general. Industries identified were rail and water storage and dams, with DFs summarised in Table 12.

Table 12 Summary of Disproportionality Factors applied in different sectors

Industry	DF
Light rail[11]	Workers – 3 Members of the public – range from 2 to 10
Rail [14]	Members of the public – range from 2 to 10
Dams [15]	Below limit of tolerability – 10 “Just above” limit of tolerability – 3

The DFs applied by CPPAL are consistent within the power sector and broadly aligned with other sectors, thus validating their current values. Further, it is consistent with the findings within the provided AMCL+ *Application of disproportionality factors in a value framework* report [16] provided to GHD.

8. Although classified as an opportunity, GHD recommend the CPPAL review the applied DFs for next financial year’s AFAP assessments to account for climate change and other variables that could alter CPPAL’s risk appetite. This future-thinking outlook will be needed as the DFs currently being utilised may not be suitable as environments change, particularly with respect to bushfire risk.

Despite this alignment, the risk appetite of organisations is constantly evaluated and as such are being refined. The derivation of DFs is maturing, taking into consideration climate change and other future elements, such as changing land value through increasing urban density, that may influence DFs moving forward.

[11] This was sourced from a confidential client. Therefore, GHD will not be able to disclose the source.

Upon review of the options analysis reports, specifically CPPAL-RP-0003, the following critical and non-critical gaps were identified:

9. Following the above, the DF per fire area refers to a life loss risk fraction figure obtained from the BRT as per advice from CPPAL. A reference to the source material for the life loss risk fraction $ per annum. value is not currently provided. It is recommended that these values are included in the BRTP for a record of the inputs. A record of the figures will also serve as a reminder for future updates to the calculations if the results of the BRT modelling change.

3.3.2 NSRTP recommendations review

The network safety risk AFAP risk reduction recommendations put forward in the NRTP provide a holistic approach to the management of network safety risks. The recommendations include actionable measures for CPPAL personnel to conduct inspections and maintenance of network assets to reduce hazards. Scanning and identification of dangerous public lighting poles or vulnerable substations has been proposed. Recommendations for increasing awareness of Look up & Live and No Go Zones to prevent and minimise contact with HV OHLs. A significant proportion of the network safety risk exposure arises from third part contact or impact with OHL. Therefore, measures such as community outreach to further increase public awareness and safety are crucial in minimising this risk.

GHD believe the NSRTP AFAP recommendations provide direct and effective actionable measures to protect, maintain and derisk network assets whilst simultaneously providing engagement with the public to further improve awareness in the community of No Go Zones and the Look up & Live signage and maps. No critical gaps have been identified in the recommendations; however, the following observation and improvement opportunity are suggested for CPPAL's consideration.

10. CPPAL-RP-0007 recommendation NS_24 is named differently across the calculation sheets in this file. AFAP WS Ideas (2022) noted NS_24 as "Enhanced NGZ awareness (for e.g. stronger industries, contractors & media saturation)". Whereas AFAP Options – Inputs and subsequent sheets refer to NS_24 as "Safety improvement initiative: Inadvertent 3rd party contacts with HV OHLs - Targeted Rota markers application". GHD recommend consistency in naming of the control options to avoid confusion to future readers.
11. It is noted that a variety of proposed control measures consist of inspections of equipment and network infrastructure. GHD suggest CPPAL consider adding a control measure for an audit of inspection specific equipment. This may be a periodic condition assessment or field personnel may be required to conduct calibration testing of equipment before undertaking any inspections. This measure can provide an added layer of risk reduction when considering network safety.

3.3.3 BRTP recommendations review

The three leading fire start causes as per the BRTP are insulator leakage, vegetation, and Low Voltage (LV) Fused Overhead Line Connection Boxes (FOLCBs), Fuse Switch Connectors (FSDs) and Junction Boxes (JBs). These three causes comprise of 70.9% of all ground fire starts on Total Fire Ban days (TFBDs). The review of the AFAP recommendations was conducted with a higher focus on assessing the recommendations against their effectiveness in reducing the likelihood of these three causes.

Recommendation BF_36 to proactively replace HV wooden crossarms with steel crossarms is a fully effective method of reducing the risk of a fire start from insulator leakage which constitutes 26.9% of fire starts on TFBD. Recommendations BF_15 and BF_77 together address some of the fire start risk associated with LV FOLCBs, FSDs and JBs. BF_106 calls for a replacement of FSDs and FOLCBs in ELCAs which is a fully effective control measure for mitigating this risk.

The installation of REFCL in more zone substations will significantly reduce the risk of fire starts due to vegetation. Recommendation 107 proposes a replacement of 22kV (non REFCL protected) and 12.7kV (SWER) bare overhead line (OHL) with covered conductor in highest risk exposed areas. When implemented, this will also further reduce the risk of fire starts due to vegetation.

GHD noted some opportunities for future control option considerations based on literature reviews. Although it is beyond the validation scope, they are highlighted below for CPPAL's consideration.

12. A review of the Energy Queensland Bushfire Risk Management Plan [17] has yielded potential additional options for CPPAL to consider as part of their own BRTP. Section 8.2.5 of this document discusses emergency restoration and isolation where CPPAL may wish to conduct a patrol of any isolated overhead mains in high bushfire risk areas before re-energising this equipment. This practice is to ensure that lines have not sustained damage from the bushfires and the network is safe to re-energise. Patrolling of areas where practical and in the best interest of the community may comprise a valuable activity to further reduce bushfire risks.

3.3.4 Summary of findings

Table 13 provides a summary of the AFAP recommendations validation findings.

Table 13 Summary of AFAP recommendations validation findings

Area	Criteria	Comments
Validation of AFAP recommendations	Critical discrepancy or gap	None identified.
	Non-critical discrepancy or gap	One (1) identified, refer to Section 3.3 point 9.
	Observation or improvement opportunity	One (1) observation on labelling discrepancy identified, provided in Section 3.3 point 10. Three (3) improvement opportunities identified, refer to Section 3.3 points 8, 11 and 12.

4. Conclusions and additional recommendations

GHD completed an independent validation assessment which comprised of cross-validation of CPPAL's AFAP assessment methodology with AFAP Investment Procedure (PR-2914) and the ESA; validation of the control effectiveness criteria used to rate and evaluate the identified options; and validation of the AFAP recommendations derived from the options analysis. The methodology applied to each of these scope elements (referred to as Part one, Part two, and Part three respectively) is detailed in Section 2.2, with details on the criteria used to structure the validation outcomes provided in Section 2.1. In summary, findings from the validation assessment were categorised as:

– Critical discrepancy or gap
– Non-critical discrepancy or gap
– Observations or improvement opportunities

Each point was colour coded throughout the report to visually convey their criticality to the reader. Refer to Section 2.1 for the colour scheme applied.

In summary, as part of this independent validation assessment, it was found that:

– For Part one, the AFAP assessment methodology used by CPPAL is consistent with the requirements of Section 98 of the ESA and the AFAP Investment Procedure, with no critical discrepancies or gaps found.
– For Part two, the control effectiveness criteria used by CPPAL has been derived from multiple references, taking learnings from a range of sectors given the unique application for an AFAP assessment. Based on the research undertaken; references provided; sensitivity analysis undertaken; and initial socialisation to key stakeholders documented; the control effectiveness ranges and criteria utilised for the AFAP assessment aligns with the overarching ERMF and is suitable for this application.
– For Part three:
    - Aside from the control effectiveness criteria used, no further gaps have been identified in the validation of the AFAP assessment process at large. The PVR calculations that support the AFAP recommendations are conducted in line with the required methodology.
    - The DFs applied by CPPAL are consistent with those used by other major electricity companies and sectors but may need to be reviewed and updated to account for changing risk profiles and uncertainties.
    - The AFAP recommendations proposed by CPPAL are generally valid and aligned with the AFAP Investment Procedure.

Table 14 provides a breakdown of the critical, non-critical, and observations and improvement opportunities associated with each section, referring to the reference numbers for CPPAL's reference.

Table 14 Summary of independent validation assessment

Scope	Report section	Validation finding summary
Part one	Section 3.1	– No critical discrepancies or gaps identified. – One (1) non-critical discrepancies or gaps identified. Point 1 in the report. – In addition to this, GHD suggests three (3) additional recommendations that relate to the material reviewed as part of this scope. These are labelled as 'observations or improvement opportunities' but are beyond the scope of the AFAP cross-validation assessment.
Part two	Section 3.2	– No critical discrepancies or gaps identified. – Two (2) non-critical discrepancies or gaps identified. Points 5 and 6 in the report.

Scope	Report section	Validation finding summary
		– One (1) improvement opportunities identified. Point 7 in the report
Part three	Section 3.3	– No critical discrepancies or gaps identified. – One (1) non-critical discrepancies or gaps identified. Point 9 in the report. – Four (4) improvement opportunities and observations identified. Points 8, 10, 11 and 12 in the report.

Although beyond the immediate validation scope of this engagement, GHD propose that CPPAL investigate the following:

– It is possible that the data used for the AFAP assessment may be conservative and therefore have inbuilt conservative margins. Controls are measured at job-specific and organisational-level for overall benefit input. For some of the recommendations validated as part of this engagement (e.g., REFCLs for Horsham ZSS) it was clear to distinguish its job-specific or organisational-level importance. For others, such as option 86 "*Improved veg management assessment and techniques. For e.g. Utilise satellite imaging data for Veg clearances real-time monitoring (TBC)"* this may be interpreted as applicable at both job and organisational levels.

– GHD understands that the DFs applied by CPPAL are in alignment with the guidance provided by the Australian Energy Regulator. There is an opportunity, beyond the scope of this AFAP assessment, to have a discussion through Energy Networks Australia (ENA) to collaborate with other MECs on this. As previous mentioned, climate change will influence the risk profile which could influence DFs or may affect the input data.

5. Acronyms and abbreviations

Table 15 Acronyms and abbreviations

Acronym or abbreviation	Meaning
AER	Australian Energy Regulator
AFAP	As Far as is Practicable
BCA	Bushfire Construction Areas
BRT	Bushfire Risk Tool
BRTP	Bushfire Risk Treatment Plan
CPPAL	CitiPower and Powercor
CPPALUE	CitiPower, Powercor and United Energy
DF	Disproportion Factor or Disproportionality Factor
DNSP	Distribution Network Service Providers
DFA	Distribution Feeder Automation
EDO	Expulsion Drop Out
EFD	Early Fault Detection (devices or systems)
ELCA	Electricity line construction area
ENA	Energy Networks Association
ERMF	Enterprise Risk Management Framework
ESA	Energy Safety Act 1998
ESMS	Electrical Safety Management Schemes
ESV	Energy Safe Victoria
FOLCB	Fused Overhead Line Connection Box
FDI	Fire Danger Index
FMEA / FEMCA	Failure Modes, Effects (and Criticality) Analysis
FSD	Fuse Switch Disconnector
GEIP	Good Electrical Industry Practice
HBRA	High Bushfire Risk Area
HV	High Voltage
INMS	Integrated Network Management System
JB	Junction Box
LBRA	Low Bushfire Risk Area
LV	Low Voltage
MEC	Major Electricity Company
NGZ	No Go Zone
NPV	Net Present Value
NSRTP	Network Safety Risk Treatment Plan
OH	Overhead
OHSE	Occupational Health, Safety and Environment
OHL	Overhead Line

Acronym or abbreviation	Meaning
OHSE	Occupational Health, Safety and Environment
PVR	Present Value Ratio
REFCL	Rapid Earth Fault Current Limiter
RIT-D	Regulatory Investment Test for Distribution
SWER	Single Wire Earth Return
TFBD	Total Fire Ban Days
UE	United Energy
VoSL	Value of Statistical Life
ZSS	Zone Substation

6. Bibliography

[1] Greenwire Consulting, “List of Electricity Retailers & Distributors,” Greenwire Consulting, [Online]. Available: https://greenwire.com.au/visitor/list-of-electricity-retailers-distributors-in-victoria/. [Accessed 12 February 2024].

[2] State Government of Victoria, “Electricity Safety Act,” 1998. [Online]. Available: https://www.legislation.vic.gov.au/in-force/acts/electricity-safety-act-1998/081. [Accessed 12 February 2024].

[3] CitiPower Pty. Ltd., Powercor Australia Ltd., and United Energy Services Pty. Ltd., “Process: AFAP Investment Assessment (PR-2914),” CitiPower Pty. Ltd., Powercor Australia Ltd., and United Energy Services Pty. Ltd., 2022.

[4] CitiPower Pty. Ltd., Powercor Australia Ltd., and United Energy Services Pty. Ltd., “Plan: Network Bushfire Mitigation Risk Treatment (PL-0014),” CitiPower Pty. Ltd., Powercor Australia Ltd., and United Energy Services Pty. Ltd., 2023.

[5] CitiPower Pty. Ltd., Powercor Australia Ltd., and United Energy Services Pty. Ltd., “Plan: Network Safety Risk Treatment (PL-0013),” CitiPower Pty. Ltd., Powercor Australia Ltd., and United Energy Services Pty. Ltd., 2023.

[6] B. Rout and B. Sikdar, “Hazard Identification, Risk Assessment, and Control Measures as an Effective Tool of Occupational Health Assessment of Hazardous Process in an Iron Ore Pelletizing Industry,” *Indian J Occup Environ Med,* vol. 21, no. 2, pp. 56-76, 2017.

[7] Broadleaf, “Control Effectiveness,” Broadleaf Capital International Pty. Ltd., May 2014. [Online]. Available: https://broadleaf.com.au/resource-material/control-effectiveness/. [Accessed 22 April 2024].

[8] R. Damayanti and M. Mawardi, “Developing MITRA Learning Model of Problem Solving-Based to Solve Mathematical Problems in Elementary School,” *Jurnal Prima Edukasia,* vol. 6 (1), pp. 1-10, 2018.

[9] R. Farrar, “Risk Tip #2 – how do we measure control effectiveness?,” Paladin Risk , 03 November 2016. [Online]. Available: https://paladinrisk.com.au/risk-tip-2-measure-control-effectiveness/. [Accessed 05 March 2024].

[10] rps group, “CGE Risk Management Solutions,” 18 March 2019. [Online]. Available: chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://bowtierisksolutions.com.au/wp-content/uploads/2019/08/BowTieXP-User-Manual-V9.2-Rev-39.pdf. [Accessed 05 March 2024].

[11] Transgrid, “Network Asset Risk Assessment Methodology,” 16 November 2021. [Online]. Available: https://www.aer.gov.au/documents/transgrid-network-asset-risk-assessment-methodology-16-november-2021. [Accessed 12 March 2024].

[12] AusNet Services, “AMS 01-09 Asset Risk Assessment Overview 2023-27 Transmission Revenue Reset PUBLIC,” 29 October 2020. [Online]. Available: https://www.aer.gov.au/documents/ausnet-services-supporting-technical-document-ams-01-09-asset-risk-assessment-overview-29-october-2020. [Accessed 12 March 2024].

[13] CulterMerz Pty. Ltd., “CBRM Model Value of Consequence Independent Report,” 09 December 2019. [Online]. Available: https://www.aer.gov.au/documents/sapn-revised-proposal-55-cutler-merz-cbrm-model-value-consequence-independent-report-december-2019. [Accessed 12 March 2024].

[14] G. Penney, G. Smith, S. Ridge and M. Cattani, “A Review of the Standard of Care Owed to Australian Firefighters from a Safety Perspective—The Differences between Academic Theory and Legal Obligations,” *Fire,* vol. 5, no. 3, p. https://doi.org/10.3390/fire5030073, 2022.

[15] Department of Environment, Land, Water and Planning (now known as the Department of Energy, Enviroment and Climate Action), “Guidance note on Dam safety decision principles,” Department of Environment, Land, Water and Planning, 2015.

[16] AMCL+, “Application of disproportionality factors in a value framework,” AMCL+, 2021.

[17] Energy Queensland Ltd., “Bushfire Risk Management Plan,” August 2022. [Online]. Available: https://www.energex.com.au/__data/assets/pdf_file/0007/1013686/Bushfire-Risk-Management-Plan-2022-24.pdf. [Accessed 14 March 2024].

[18] J. Marsden, L. McDonald, D. Bowles, R. Davidson and R. Z. Nathan, “Dam safety, economic regulation and society's need to prioritise health and safety expenditures,” in *IPENZ Proceedings of Technical Groups 33/2 (LD)*, 2007.

Appendices

Appendix A

Document summary

Table 16 Summary of documents reviewed for this engagement

Document name	Version	Summary
Documentation reviewed for 12620988-GHD-00-00-RPT-RM-00000-S3-P01-Powercor AFAP Validation Report		
Process AFAP Investment Assessment (PR-2914)	Version 1.1, Dated 6 April 2022	The document outlines the AFAP process which is used by CitiPower, Powercor and United Energy to evaluate the potential network investments based on their statutory obligations to minimise hazards and risks to health, safety and the environment. The process involves a gross disproportionality test to determine if the cost of a risk reduction measure is grossly disproportionate to the benefit. If not, the measure is deemed reasonably practicable and should be implemented. DFs play a crucial role in quantifying the benefits of risk reduction measures. These factors help in prioritizing investments that reduce risks to an acceptable level. The document details how these factors are applied in the investment decision-making process, detailing that safety-related expenditures are given precedence based on case law, legislation and industry practices. Non-safety risks, harm to property from network or bushfire or harm to the environment are assigned a DF of 1.
Strategy Bushfire Mitigation (STR-0005)	Version 1, Dated 9 December 2021	This document outlines CitiPower, Powercor and United Energy's commitment to minimising bushfire risks through effective asset management and bushfire mitigation activities, emphasising a zero-risk appetite for network assets causing bushfires. The strategy details compliance with ESV directions, legislation, and standards, focusing on risk management, vegetation management, compliance methodologies, and performance indicators like fire-safety metrics to assess and improve network fire-safety performance. It incorporates a structured approach to identifying and managing network ignition risks, with a significant emphasis on collaboration with communities and other agencies to ensure a coordinated fire risk management effort. This document also highlights the requirement to minimise risks AFAP in accordance with Section 98 of the Electricity Safety Act. These principles extend beyond compliance with safety standards, highlighting a proactive approach to risk minimisation. The strategy also acknowledges the general requirements under the Occupational Health and Safety Act, as well as Australian Standard (AS) 5577: Electricity Network Safety Management Systems.
Strategy Network Safety (STR-0003)	Version 1.1, Dated 15 October 2021	This document outlines CitiPower, Powercor and United Energy's approach to network safety management, in alignment with the ESA, employing Electrical Safety Management Schemes (ESMSs) accepted by ESA. This strategy is an integral part of the broader ESMS framework, detailing the policies and practices for risk management, including the AFAP assessment method. The strategy articulates CitiPower, Powercor and United Energy's commitment to minimising network safety risks by implement five key safety strategies: asset management, monitoring and evaluating safety metrics, prioritising health and safety without compromise, reducing the number of network incidents and their consequences, and maintaining an accepted ESMS. In alignment with STR-0005, this document highlights the requirements to minimise risks AFAP in accordance with Section 98 of the Electricity Safety Act, the general requirements under the Occupational Health and Safety

Document name	Version	Summary
		Act, as well as Australian Standard (AS) 5577: Electricity Network Safety Management Systems.
Enterprise Risk Management Framework; Victorian Power Networks (VPN) and United Energy (13-10-CPPCUE0005)	Version 4.0, Dated 02 September 2021	This document outlines the risk management framework, procedure and tools used to assess risks and controls as part of the risk management process for CitiPower, Powercor, United Energy and Beon. This framework is based on ISO 31000:2018. This document includes the following: – Overview of key roles and responsibilities for risk management – Guidelines on how to measure effectiveness of controls – Criteria on how to assess the reliance placed on controls – Criteria for control improvement and assessment planning – Measures of consequence, likelihood and risk and treatment plans based on risk ratings.
Procedure Network Investment (PR-0003)	Version 1, dated 20 December 2022	This document captures the processes involved in developing, reviewing and approving investments as they progress through the network investment planning cycle. It describes how the STR-0006 Value Framework, STR-0013 Portfolio Governance Framework and Project Governance Framework (April 2021) is applied within the network investment process; and establishes a consistent, repeatable and auditable network investment process. This procedure applies to investment in assets installed and operated as part of its electricity network consistent with the scope of the CPPAL and UE Integrated Network Management System (INMS). Section 5.2 describes the mandatory harm reduction (AFAP) projects that CPPAL and UE complete, referring to PR-2914 which explains the AFAP assessment approach.
Framework Value (STR-0006)	Version 1, dated 02 May 2023	The purpose of this Framework is to document CPPAL's and UE's assessment of the value of each investment to optimise long term capital portfolio. The Framework Value is comprised of a set of individual value measures that have been adopted by the business to evaluate investment decisions. Each value measure has its own set of predefined business rules. The scope of this Framework is consistent with INMS and applies to electricity distribution network assets installed and operated by CPPAL and UE, as well as Information Technology, fleet and property. Appendix A provides a summary of the key value metrics, including assignment of monetary values to safety consequences (table 6) and a list of the DFs related to a number of categories. These DFs were referenced and used for the AFAP assessment.
Plan Network Safety Risk Treatment (PL-0013)	Version 1, dated 12 December 2023	The Network Safety Risk Treatment Plan summarises the methodology and outcomes from the CPPAL and UE network safety risk AFAP assessments. The plan describes how CPPAL and UE address network safety risk on the networks, minimising risks AFAP in line with Section 98 of the ESA 1998. This Plan is incremental to the other business operational activities which contribute to minimising network safety risk, such as cyclic asset maintenance. The following are excluded from this Plan: – Fire risk (separately addressed in the Network Bushfire Mitigation Risk Treatment Plan (PL-0014)

Document name	Version	Summary
		– Occupational Health, Safety and Environment (OHSE) risks including work activity – Third party incidents involving vehicles into poles. A summary of the CPPAL network safety AFAP risk reduction recommendations is provided in Table 5, accompanied with the respective annualised risk reduction cost per annum.
Plan Network Bushfire Mitigation Risk Treatment (PL-0014)	Version 1, dated 13 December 2023	The Bushfire Risk Treatment Plan summarises the methodology and outcomes from the CPPAL and UE bushfire risk AFAP assessments. Similar to PL-0013, the plan also describes how the objective is to minimise risks AFAP (as per Section 98 of the ESA 1998), and that this plan is supplementary to other activities that also contribute to minimising bushfire risk. It outlines the initiatives required to minimise bushfire risks AFAP in ELCAs, REFCL protected areas and HBRAs. Areas defined as LBRA including all of the CitiPower network and parts of the Powercor and United Energy networks were excluded from the scope of this document given the relatively low bushfire risk and options not passing the AFAP analysis. A summary of the CPPAL bushfire AFAP risk reduction recommendations is provided in Table 3, accompanied with the respective annualised risk reduction cost per annum.
PL-0014 Table 3 (separate excel spreadsheet)	No version provided. Sent via email on 21 February 2024.	This table captures the bushfire risk reduction AFAP recommendations which were shown within PL-0014. Values are slightly different than the figures in Table 3 of PL-0014, as noted by CPPAL via email correspond on 21 February 2024.
CPPAL-RP-0003 Bushfire Risk AFAP Options Analysis Report_Confidential.xlsx	No version provided. Shared via Teams Page set up by CPPAL on 19 February 2024.	The document represents the detailed options analysis undertaken for the AFAP assessment, commencing with brainstorming ideas and then determining if the idea is an option for AFAP assessment, an opportunity (beyond the AFAP assessment scope) or for future consideration. The options selected for AFAP analysis were then analysed per fire start cause sub-category, yielding risk exposures and options overall effectiveness percentages. For the bushfire risk options analysis, the options were analysed based on fire areas. Risk exposures with and without DFs applied were calculated to then determine a collective AFAP PVR for each option.
CPPAL-RP-0007 Network Safety AFAP Options Analysis Report_Confidential.xlsx	No version provided. Shared via Teams Page set up by CPPAL on 26 February 2024.	The document represents the detailed options analysis undertaken for the AFAP assessment, commencing with brainstorming ideas and then determining if the idea is an option for AFAP assessment, an opportunity (beyond the AFAP assessment scope) or for future consideration. The options selected for AFAP analysis were then analysed per cause category for respective asset categories, yielding risk exposures and options overall effectiveness percentages. Risk exposures with and without DFs applied were calculated to then determine a collective AFAP PVR for each option.
Bushfire Risk_AFAP Options_Passed and Marginal not progressed_NRA 20Feb24	No version provided. Sent via email on 21 February 2024.	Details the reasons for not progressing options that either passed or marginally failed the AFAP test specifically for the bushfire risk AFAP options analysis.

Document name	Version	Summary
SWER EFD Benefits estimation	No version provided. Sent via email on 21 February 2024.	Deploying pre-fault detection on SWER lines was assessed outside of CPPAL-RP-0003 Bushfire Risk AFAP Options Analysis Report_Confidential.xlsx. This document summarises the assessment.
REFCL exposures and benefits	No version provided. Sent via email on 21 February 2024.	Zone Substation (ZSS) specific REFCL installations were assessed outside of CPPAL-RP-0003 Bushfire Risk AFAP Options Analysis Report_Confidential.xlsx. This document summarises the assessment.
Application of disproportionality factors in a value framework	Version 3.0 Dated 20 July 2021	AMCL completed an independent evaluation of disproportionality factors for CPPALUE as it forms a fundamental input to their value assessment analysis.
BRT screenshots	No version provided. Sent via Microsoft Teams channel on 13 March 2024. Provided as Appendix B within this report.	Screenshots of BRT to show where the 'Life loss risk fraction $ per annum" figures within CPPAL-RP-0003 came from.
Additional documentation was provided to GHD following the draft in response to *12620988-GHD-00-00-RPT-RM-00000-S3-P01-Powercor AFAP Validation Report* address raised action items.		
22kV DF & CC effectiveness	No version provided. Sent via email on 16 April 2024	Provides a summary of the derivation of the 22kV control options effectiveness and resultant DFs per fire area.
Record of control effectiveness values for CPPAL AFAP assessments	No version provided. Sent via email on 16 April 2024	A brief summary of additional references CPPAL have utilised as a basis for the quantitative control effectiveness ranges and set points. This document also had two attachments embedded: • RE:AFAP initiative assessment template – (New Controls / Improved Controls assessment register) email thread provided by CPPAL • A PowerPoint presentation titled: Determining the effectiveness of controls; Catastrophic bushfire risk, which was a presentation to industry on the way CPPAL complete their AFAP assessments
Record of control effectiveness values for CPPAL AFAP assessment_V2	No version provided. Sent via email on 13 May 2024	An updated version of Record of control effectiveness values for CPPAL AFAP assessments.docx.
REFCL exposures & benefits	No version provided. Sent via email on 16 April 2024	This document is an updated version of the REFCL exposures & benefits.docx that was provided initially. It breaks down the expected risk reduction for a powerline supplied by a zone substation with a REFCL installed and includes the resultant AFAP PVR values for Horsham and Numkrah.
SWER DF & CC effectiveness	No version provided. Sent via email on 16 April 2024	Provides a summary of the derivation of the SWER control options effectiveness and resultant DFs per fire area.
SWER EFD benefits estimations	No version provided. Sent via email on 16 April 2024	This document is an updated version of the SWER EFD benefits estimate document provided initially. It explains the derivation of the SWER specific control effectiveness values that were provided earlier.
SWER EFD benefits estimation_V2	No version provided. Sent via email on 13 May 2024	This document represents another update of the SWER EFD Benefits estimate.docx. In the revised version ("SWER EFD Benefits estimations.docx", 16 April 2024) that was provided, the life loss per annum figures in the screen shots of the bushfire risk model were difficult to view or inconsistent with the AFAP assessment figures. Thus, an updated version was provided to address these points.

Document name	Version	Summary
VPN105024 Minimise bushfire risk of bare 22kV lines with CC - Cost_benefit_20231110_VR0.87	No version provided. Spreadsheet dated 11 October 2023	Demonstrates the additional NPV cost and benefit analysis completed beyond the AFAP PVR assessment for minimising bushfire start risks from bare 22kV non-REFCL lines with covered conductors. This document was provided in response to action 19 in the draft validation assessment report.
VPN105024 Minimise bushfire risk of bare SWER lines with CC - Cost_benefit_20240215_VR0.76	No version provided. Spreadsheet dated 11 October 2023	Demonstrates the additional NPV cost and benefit analysis completed beyond the AFAP PVR assessment for minimising bushfire start risks from bare SWER lines with covered conductors. This document was provided in response to action 19 in the draft validation assessment report.

Appendix B

Bushfire Risk Tool (BRT) figures used within CPPAL-RP-0003

The following snapshots of the BRT were provided to GHD to assist with the validation assessment for Part three.

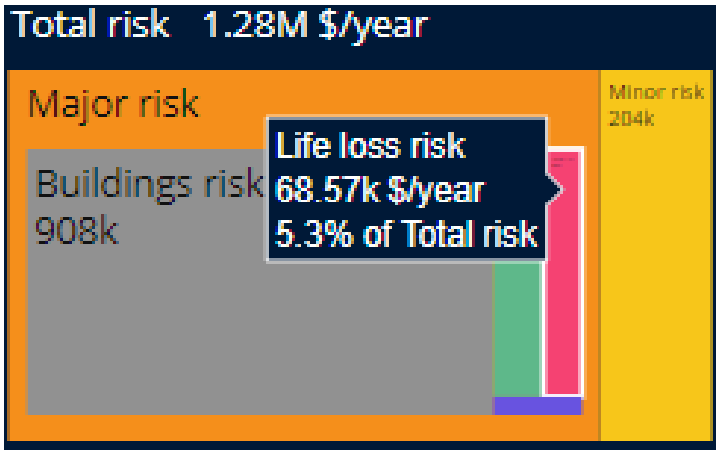

Figure 3 Bushfire construction areas (BCA) life loss risk fraction

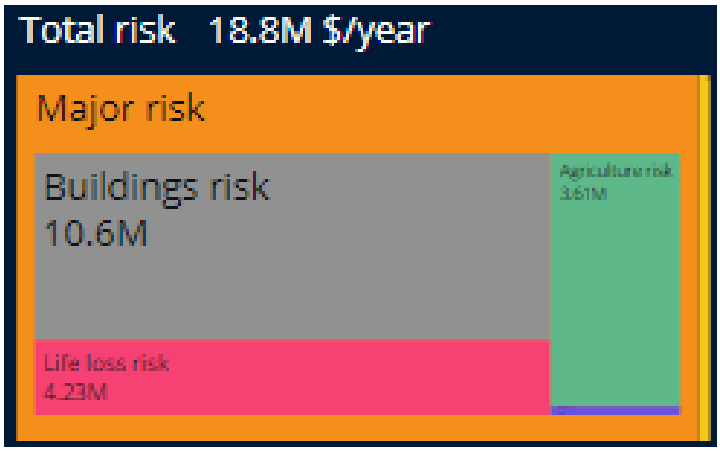

Figure 4 HBRA life loss risk fraction

Figure 5 LBRA life loss risk fraction

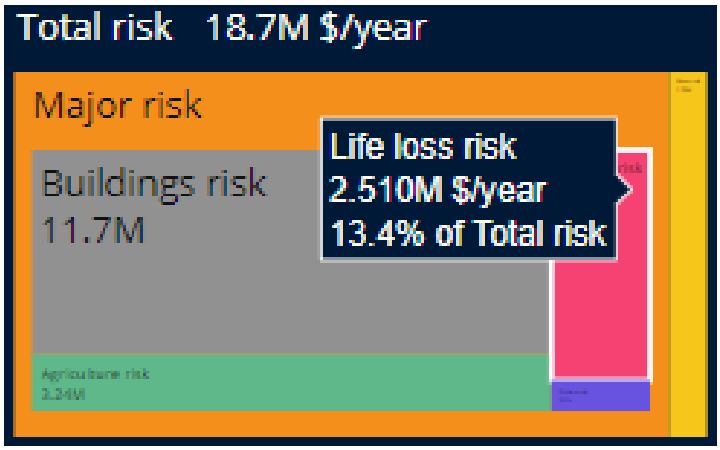

Figure 6 REFCL life loss risk fraction

As noted by Powercor, for REFCL areas ($2.03 million risk had been reduced by remaining REFCLs commissioned). Therefore, corrected value ($18.79-$2.03 million) was used in the analysis:

Appendix C

Tracking action resolution

As part of the draft CPPAL AFAP validation assessment report submission, a total of 24 actions were raised. Upon review, a number of these actions were already being addressed internally, had been actioned as part of other initiatives, or were not deemed practicable. This appendix captures the commentary against all of the actions, providing justification for their removal from body of the revised AFAP validation assessment report.

Table 17 Recommendation tracking summary following draft report review

Part	Previous ID	Rating	Recommendation	CPPAL response to high level categorisation	Discussed action	GHD response
Two	8	Critical discrepancies or gaps	Although the effectiveness ratings provided are likely to represent conservative values within the ranges proposed by CPPAL, the effectiveness may vary depending on the type of control being assessed (e.g., a fully effective administrative control versus a fully effective engineering control). It is understood that subject matter specialists within CPPAL were consulted to support the figures presented. However, based on the documents sighted, GHD are unable to validate additional rationale that may form the basis behind these figures. It is recommended that CPPAL develop a supporting memorandum / technical document that outlines the justification for using these control effectiveness ratings, providing a level of assurance across the whole methodology. Where possible, it is also recommended that further granularity is provided to distinguish how certain types of controls may have varying effectiveness. To assist, GHD recommend liaising with other MECs to determine if they use similar criteria in their AFAP assessments. These additional reference points will further reinforce the basis used AFAP recommendations moving forward. GHD acknowledge that cross industry collaboration may not be practicable but propose this as an option for CPPAL to consider in the development of the supporting memorandum / technical document.	Disagree	The allocation of effectiveness is in accordance with the ERM ratings of effective, mostly effective, partially effective, ineffective. Effectiveness values are aligned to the relevant references of control effectiveness in percentages. Send GHD control effectiveness record.	Updated information has been reviewed and recommendation has closed.
Two	9	Critical discrepancies or gaps	The effectiveness ratings presented are conversative in some categories, notably the “ineffective” rating. This may have significant influence on AFAP options that are converted into AFAP recommendations and ultimately receive funding. Appreciating that it is difficult to define the appropriate effectiveness values for a multitude of options being analysed, GHD recommend that supporting data or source material (e.g., REFCL effectiveness data) is linked to the recommendations that are presented within the risk treatment plans.	Disagree	Provide email of SMEs consultation re: setpoints.	Updated information has been reviewed and recommendation has been closed.

Part	Previous ID	Rating	Recommendation	CPPAL response to high level categorisation	Discussed action	GHD response
Two	11	Non-critical discrepancies and gaps	In the documentation provided, there is currently no reference to source material used to establish the effectiveness ranges for control mitigation and overall effectiveness ratings. Although provided to GHD via email, it is recommended that a reference is provided within the updated ERMF and the risk treatment plans.	-	Provide additional references and supporting documents to support control effectiveness derivations	Updated information has been reviewed and a new recommendation has been included (see point 7). This recommendation has been closed.
Three	14	Critical discrepancies or gaps	CPPAL-RP-0003 sheet Setup, Assumptions & Setpoints includes calculations for DF per fire area. It is not evident in the calculations whether these have been used to further the options analysis. GHD have identified this as a gap in the calculation sheet. The formulas used to calculate the fire area specific DFs are not available in the provided documentation. It is recommended that these figures are reviewed and removed if not relevant to the calculations. Else, the inclusion of the fire area specific DF should be documented within the AFAP Investment Assessment Process or BRTP and subsequently incorporated in the options analysis.	Discuss	DFs have been applied per our procedure. Agreed. Provide DF calculations.	Updated information has been reviewed and recommendation validated. Closed
Three	19	Critical discrepancies or gaps	BF_107 Replace 22kV & 12.7kV bare overhead (OH) covered conductor in highest risk exposed areas is included in the BRTP and PL-0014 Table 3_For Validation.xlsx. However, this recommendation is not a part of the calculations in CPPAL-RP-0003 and cannot at this stage be validated against the AFAP assessment process.	Discuss	Provide calculations extract and include PVRs in the extract.	Updated information has been reviewed and recommendation validated. Closed
Three	20	Critical discrepancies or gaps	Data provided in SWER EFD Benefits estimations.docx does not appear consistent with the risk reduction figures reported in BRTP and PL-0014 Table 3_For Validation.xlsx. SWER ELCA data is missing and therefore cannot be validated despite recommendation BF_5.1 noting ELCAs as applicable for the given recommendation. AFAP PVR calculations are not included in any of the provided documentation. GHD is therefore unable to validate recommendation BF_5.1 Deploy pre-fault detection on 50% of SWER lines (for example, Distribution Feeder Automation (DFA) and Early Fault Detection (EDF) technologies).	Discuss	Provide calculations extract and include PVRs in the extract.	Updated information has been reviewed and recommendation validated. Closed

Part	Previous ID	Rating	Recommendation	CPPAL response to high level categorisation	Discussed action	GHD response
Three	21	Critical discrepancies or gaps	Data provided in REFCL exposures & benefits.docx does not appear consistent with the risk reduction figures reported in BRTP and PL-0014 Table 3_For Validation.xlsx. Data on the cost of implementation of these recommendations has not been sighted in the documentation reviewed. AFAP PVR calculations are not included in the provided documentation. GHD is therefore unable to validate recommendations BF_112 New REFCL – Horsham ZSS and BF_113 New REFCL – Numurkah ZSS.	Discuss	Provide calculations extract and include PVRs in the extract.	Updated information has been reviewed and recommendation validated. Closed
One	3	Non-critical discrepancies or gaps	The BRTP and the NSRTP represent point in time documents, detailing the high-level AFAP procedure undertaken, and results yielded from that process. It is therefore recommended that the VoSL and DF used in the AFAP analysis are provided within the reports. This prevents confusion for future readers if values change in the referenced documents within the risk treatment plans in line with Appendix B of the AFAP Investment Assessment.	Discuss	VoSL & DFs are in accordance with AFAP investment procedure referred. Per INMS process, we will be reliant upon meta data within documents for references versions used. No further action.	
Two	10	Non-critical discrepancies or gaps	Both risk treatment plans reference the overarching ERMF within the options effectiveness portion of the methodology (Section 5.1.4 in the BRTP and NSRTP). From the revision reviewed, the control effectiveness criteria within the ERMF provides qualitative descriptors and does not provide the percentage values included within the BRTP and the NSRTP. It is recommended that the ERMF is updated to include the control effectiveness percentage values alongside the qualitative descriptors, noting that they are specific for the AFAP options analysis assessment.	Discuss	ERM is for whole of business. This exercise is specific to AFAP of NS & BF. No further action.	Closed
Three	18	Non-critical discrepancies or gaps	The reasoning behind the recommendation for the proactive replacement of Expulsion Drop Out (EDOs), FOLCBs and FSDs in ELCAs is unclear as presented in PL-0014 Table 3_For Validation.xlsx. As per CPPAL-RP-0003, a AFAP PVR of 0.04 has been calculated for ELCA. GHD suggest this recommendation and the associated calculations are reviewed as the recommendation currently does not align with the AFAP Investment Assessment Process.	Discuss	Include comment regarding HV fuse replacements (pre-funded).	Closed

Part	Previous ID	Rating	Recommendation	CPPAL response to high level categorisation	Discussed action	GHD response
Three	22	Non-critical discrepancies or gaps	The annualised risk retired $million per annum figure reported in the recommendations is the risk retired without DF considered. It is recommended that the distinction between the two risk retired figures (with and without DF) be made clear within the BRT. This will allow future readers to understand the document in conjunction with the calculations with better clarity. Additionally, the reported risk retired values in the BRT do not match with those presented in PL-0014 Table 3_For Validation.xlsx.	Discuss	Provide extract of outcomes with & without DF.	Closed
Three	24	Opportunity	Consideration has been given to fuel load removal at targeted poles and along targeted spans to reduce fire ignition risks. GHD recommend CPPAL elaborate and separate out the risks associated with motor vehicles, machinery, small engines, and hot equipment use. Advice can be given to field employees to utilise light patrol vehicles and reduce or stop the use of heavy trucks used for construction activities. Whilst hot work and related activities may be prohibited by state authorities during fire emergencies, it may benefit CPPAL to analyse and assess options for reduction of these risks at an enterprise level.	Discuss	Already have TFB days permit processes in place to cater for field activities. In addition the off-road vehicle certification process is implemented. It is managed through TFBD action plan. No further action.	Closed
One	2	Non-critical discrepancies or gaps	Section 5.5 in the AFAP Investment Assessment states that “in an AFAP regime, documenting why an idea was assessed as being unreasonable is just as important as document why we [CPPALUE] will proceed. Therefore, all rejected initiatives require documented support.” This aspect of the AFAP Investment Assessment is currently not clearly articulated in the methodologies presented within the BRTP and the NSRTP. GHD recommends that CPPAL update the methodology to include reference to the process involved in rejecting AFAP options which been considered for sensitivity analysis and further analysis.	Clarification required	There are two options which are marginal i.e. Pole Management Improvement Program (PMIP) in BCAs & LV fibre glass cross-arm replacements in HBRAs. Both of these options have been outworked in detailed withing respective Asset Management Plans. PMIP is implemented as BAU WIP whereas, LV fibre glass cross-arm replacements are still under consideration.	Closed
One	7	Opportunity	Although a more detailed approach, there may be benefit from applying the lessons learned from the bushfire risk exposure profiling to the broader network safety AFAP assessment through the application of more nuanced risk factors. Further discussion about the evolution of DFs is provided in Section 3.3 for CPPAL’s consideration.	Clarification required	-	Closed

All other recommendations were accepted by CPPAL. A list of these accepted recommendations, their former IDs, is provided in Table 18.

Table 18 Revised ID for accepted recommendations

ID	Revised ID	Action	
1	1	There is a discrepancy between how the triage criteria is referred to within Section 5.1.3 Options Analysis within the BRTP and the NSRTP versus how it is discussed in Section 5.2 of the AFAP Investment Assessment. In the AFAP Investment Assessment it states that "before undertaking a full cost-benefit analysis, all new controls or improvement initiatives are required to undergo a preliminary triage to identify those that can be easily assessed. Although minor, the Risk Treatment Plan methodologies only specify that "other opportunities were triaged using the criteria noted…below." Despite being factually correct, GHD recommends that CPPAL update the text to read as "all new controls or improvement initiatives were triaged using the criteria noted in Figure 3 below."	Non-critical discrepancies and gaps
12	6	Reliability of electrical equipment and assets are increasing as technology advances. Therefore, it is recommended that the effectiveness ranges and effectiveness ratings are re-evaluated every 2 to 3 years.	Non-critical discrepancies and gaps
15	9	Following the above, the DF per fire area refers to a life loss risk fraction figure obtained from the BRT as per advice from CPPAL. A reference to the source material for the life loss risk fraction $ per annum. value is not currently provided. It is recommended that these values are included in the BRTP for a record of the inputs. A record of the figures will also serve as a reminder for future updates to the calculations if the results of the BRT modelling change.	Non-critical discrepancies and gaps
4	2	In the BRTP reference is made to CPPAL's BRT that enables the computation of the likelihood of groundfire ignitions for a range of Fire Danger Indexes (FDIs), i.e. consequences, subsequently deriving the present risk exposure. In the revision sighted, there are no references provided to further contextualise this process. GHD are aware that this is a complex model that is beyond the scope of the AFAP documentation reviewed. Despite this, it is recommended that reference is made to an overarching, internal document to provide CPPAL readers with an opportunity to review details associated with the bushfire risk modelling.	Opportunity
5	3	Section 5.1.1 of the NSRTP provides the total annualised network safety risk per annum with and without the application of DFs. This demonstration of the difference in risk exposure prior to and after applying DFs is also applied in Section 5.1.2. Although there is a distinction between who the risk exposure is structured for bushfire risk versus network safety risk – with bushfire risk exposure estimated using the BRT while network safety risk exposure is calculated per asset class – CPPAL should investigate a way to present the information is a more consistent format. For example, providing a probabilistic profile percentage breakdown as per Table 1 in the BRTP to Table 2 in the NSRTP.	Opportunity
6	4	Append the data from the AFAP options analysis report and supporting justifications to the relevant risk treatment plans. Although the CPPAL Bushfire Risk AFAP Options Analysis Report (CPPAL-RP-0003) and the CPPAL Network Safety AFAP Options Analysis Report (CPPAL-RP-0007) are referred to within the body of the risk treatment plans, there is an opportunity to provide further detailed reading within an Appendix (or Appendices). Appreciating the confidential nature of the options analysis reports, CPPAL can potentially reconfigure the information to provide an overview list of the brainstormed options, brief rationale for selection, and how the AFAP recommendations map to the tables within the report for future auditability and clarity.	Opportunity
13	8	Although classified as an opportunity, GHD recommend the CPPAL review the applied DFs for next financial year's AFAP assessments to account for climate change and other variables that could alter CPPAL's risk appetite. This future-thinking outlook will be needed as the DFs currently being utilised may not be suitable as environments change, particularly with respect to bushfire risk.	Opportunity
16	10	CPPAL-RP-0007 recommendation NS_24 is named differently across the calculation sheets in this file. AFAP WS Ideas (2022) noted NS_24 as	Opportunity

ID	Revised ID	Action	
		"Enhanced NGZ awareness (for e.g. stronger industries, contractors & media saturation)". Whereas AFAP Options – Inputs and subsequent sheets refer to NS_24 as "Safety improvement initiative: Inadvertent 3rd party contacts with HV OHLs - Targeted Rota markers application". GHD recommend consistency in naming of the control options to avoid confusion to future readers.	
17	11	It is noted that a variety of proposed control measures consist of inspections of equipment and network infrastructure. GHD suggest CPPAL consider adding a control measure for an audit of inspection specific equipment. This may be a periodic condition assessment or field personnel may be required to conduct calibration testing of equipment before undertaking any inspections. This measure can provide an added layer of risk reduction when considering network safety.	Opportunity
18	12	A review of the Energy Queensland Bushfire Risk Management Plan [15] has yielded potential additional options for CPPAL to consider as part of their own BRTP. Section 8.2.5 of this document discusses emergency restoration and isolation where CPPAL may wish to conduct a patrol of any isolated overhead mains in high bushfire risk areas before re-energising this equipment. This practice is to ensure that lines have not sustained damage from the bushfires and the network is safe to re-energise. Patrolling of areas where practical and in the best interest of the community may comprise a valuable activity to further reduce bushfire risks.	Opportunity

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