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BUSHFIRE CONSULTING

Technical Paper 10 – Bushfire

Central-West Orana Renewable Energy Zone Transmission Project

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Glossary

This section defines those core terms and concepts which are adopted throughout the body of this report.

Project term	Definition / notes
Access roads	Permanent access roads to switching stations and energy hubs.
Access tracks	Temporary and permanent access tracks to transmission lines.
Asset Protection Zone (APZ)	A fuel-reduced area surrounding a built asset or structure which provides a buffer zone between a bushfire hazard and an asset. The APZ includes a defendable space within which firefighting operations can be carried out. The size of the required APZ varies with slope, vegetation and Forest Fire Danger Index (as per the PBP definition).
Bush fire	An unplanned fire burning in vegetation; also referred to as wildfire (as per the PBP definition).
Bushfire Attack Level (BAL)	A means of measuring the severity of a building's potential exposure to ember attack, radiant heat, and direct flame contact. The BAL is used as the basis for establishing the requirements for construction to improve protection of building elements (as per the PBP definition). The Asset Protection Zone defines the bushfire attack level.
Bushfire Prone Land (BPL)	An area of land that can support a bushfire or is likely to be subject to bushfire attack, as designated on a bushfire prone land map (as per the PBP definition).
Bushfire Hazard	Any vegetation that has the potential to threaten lives, property, or the environment (as per the PBP definition).

Project term	Definition / notes
Bushfire risk	Is the likelihood and consequence of a bushfire igniting, spreading and causing life loss or damage to buildings of value to the community.
Bushfire Threat	Potential bushfire exposure of an asset due to the proximity and type of a hazard and the slope on which the hazard is situated.
Central-West Orana REZ (CWO REZ)	A geographic area of approximately 20,000 square kilometres centred on the regional towns of Dubbo and Dunedoo and extending west to Narromine and east beyond Mudgee and to Wellington in the south and Gilgandra in the north, that will combine renewable energy generation, storage and HV transmission infrastructure to deliver energy to electricity consumers.
Construction area	The area that would be directly impacted by construction of the project including (but not limited to) transmission towers and lines, brake and winch sites, access roads to switching stations and energy hubs energy hubs, access tracks, energy hubs, switching stations, communications infrastructure, workforce accommodation camps, construction compounds and laydown and staging areas.
Construction compound	An area used as the base for construction activities, usually for the storage of plant, equipment and materials, and/or construction site offices and worker facilities. It can also comprise concrete batching plant, crushing, grinding and screening plant, testing laboratory and wastewater treatment plant.
Enabling works	Activities that would be carried out before the start of substantial construction in order to make ready the key construction sites (including workforce accommodation camps and compounds), facilitate the commencement of substantial construction, manage specific features or issues and collect additional information required to finalise the final design and construction methodology.

Project term	Definition / notes
EnergyCo	The Energy Corporation of New South Wales constituted by section 7 of the *Energy and Utilities Administration Act 1987* as the NSW Government statutory authority responsible for the delivery of NSW's REZs.
Energy hub/s	An energy hub is a substation where energy exported from renewable energy generators or storage is aggregated, transformed to 500 kV (where required) and exported to the transmission network.
Essential Energy	The asset owner of multiple 66 kV and 132 kV transmission lines in the region that cross the project at multiple locations.
Fire Danger Index	A relative number denoting the potential rates of spread, or suppression difficulty for specific combinations of temperature, relative humidity, drought effects and wind speed.
Hazard	A hazard is any source of potential harm or a situation with a potential to cause loss. A hazard is therefore the source of risk.
Inner Protection Area (IPA)	The component of an APZ which is closest to the asset (measured from unmanaged vegetation). It consists of an area maintained to minimal fuel loads so that a fire path is not created between the hazard and the building (as per the PBP definition).
Likelihood	The chance of an event occurring. Likelihood may be represented as a statistical probability (such as an annual exceedance probability), or whether this is not possible, it can be represented qualitatively using measures such as 'likely', 'possible' and 'rare'.
Managed land	Land that has vegetation removed or maintained to a level that limits the spread and impact of bushfire. This may include developed land (residential, commercial, or industrial), roads, golf course fairways, playgrounds, sports fields, vineyards, orchards, cultivated

Project term	Definition / notes
	ornamental gardens and commercial nurseries. Most common will be gardens and lawns within curtilage of buildings. These areas are managed to meet the requirements of an APZ (as per the PBP definition).
Mitigation	The lessening or minimising of the adverse impacts of a bushfire event. The adverse impacts of bushfire cannot be prevented fully, but their scale or severity can be substantially lessened by various strategies and actions. Mitigation measures include engineering techniques, retrofitting and hazard-resistant construction as well as on ground works to manage fuel and separate assets from bushland.
Operation area	The area that would be occupied by permanent components of the project, including transmission line easements, transmission lines and towers, energy hubs, switching stations, communications infrastructure, access roads to the switching stations and energy hubs, maintenance facilities and permanent access tracks to the easements.
Planning for Bushfire Protection 2019 (PBP)	NSW Rural Fire Service publication effective from 1 March 2020 which is applicable to all new development on bushfire prone land in NSW.
(the) project	The Central-West Orana REZ Transmission project as described in the Environmental Impact Statement (EIS).
Renewable energy generators	A renewable energy provider to the CWO REZ.
Renewable energy projects	The various renewable energy and storage projects within the CWO REZ that would be delivered by others, such as wind farms and solar farms.

Project term	Definition / notes
Renewable Energy Zone (REZ)	A geographic area identified and declared by the NSW Government as a REZ .
Resilience	The ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management.
Risk assessment	A systematic process of evaluating the potential risks that may be involved in a projected activity or undertaking, having regard to factors of likelihood, consequence, vulnerability, and tolerability.
Study area	The study area spans across Warrumbungle, Mid-Western Regional, Upper Hunter and Dubbo Regional Local Government Areas and includes the: • construction compounds, • energy hubs, • switching stations (including the new Wollar Switching Station), • transmission lines, • transmission towers, • accommodation workforce camps (during construction), and • associated Asset Protection Zones.
Substation	A facility used to increase or decrease voltages between incoming and outgoing lines (e.g. 330 kV to 500 kV).
Switching station	A facility used to connect two or more distinct transmission lines of the same designated voltage.

Project term	Definition / notes
Transmission line easement	An area surrounding and including the transmission lines which is a legal 'right of way' and allows for ongoing access and maintenance of the transmission lines. Landowners can typically continue to use most of the land within transmission line easements, subject to some restrictions for safety and operational reasons.
Twin transmission line	A pair of transmission lines running parallel
Workforce accommodation camps	Areas that would be constructed and operated during construction to house the construction workforce.

Abbreviations

Project term / Acronym	Definition / notes
APZ	Asset Protection Zone
BAL	Bushfire Attack Level
BEEP	Bushfire Emergency and Evacuation Plan
BFPL	Bushfire Prone Land
BFMC	Bushfire Management Committee
CEMP	Construction Environmental Management Plan
EIS	Environmental Impact Statement
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
FDI	Fire Danger Index
LGA	Local Government Area
PBP	Planning for Bush Fire Protection (NSW Rural Fire Service, 2019)
SEARs	Secretary Environmental Assessment Requirements issued in response to an SSI application
SEPP	State Environmental Planning Policy

Project term / Acronym	Definition / notes
SEPP (Planning Systems) 2021	State Environmental Planning Policy (Planning Systems) 2021
SSI	State significant infrastructure
State	the State of NSW

Summary

This technical paper addresses the potential bushfire risks associated with the construction and operation of the Central-West Orana Renewable Energy Zone Transmission project (the project) and has been prepared to support and inform the Environmental Impact Statement (EIS) for the project.

The bushfire risks have been assessed in accordance with the Secretary's Environmental Assessment Requirements (SEARs) issued by the NSW Department of Planning and Environment (DPE) and against relevant legislation and guidelines as they apply to bushfire.

Project overview

The NSW Government is leading the development of Renewable Energy Zones (REZ) across NSW to deliver renewable energy generation and storage, supported by high voltage transmission infrastructure. Energy Corporation of NSW (EnergyCo) is proposing the construction and operation of new high voltage electricity transmission infrastructure and new energy hubs and switching stations required to connect new energy generation and storage projects within the Central-West Orana REZ to the existing electricity network (the project).

The project is located within the Warrumbungle, Mid-Western Regional, Dubbo Regional and Upper Hunter Local Government Areas (LGAs) and generally extends north to south from Cassilis to Wollar and east to west from Cassilis to Goolma.

The project would enable 4.5 gigawatts of new network capacity to be unlocked by the mid-2020s (noting the NSW Government's proposal to amend the Central-West Orana REZ declaration to allow for a transfer capacity of six gigawatts), and enable renewable energy generators within the Central-West Orana REZ who are successful in their bids to access the new transmission infrastructure to export electricity to the rest of the network. Importantly, the development of renewable energy generation projects in the Central-West Orana REZ is the sole responsibility of private generators and subject to separate planning and environmental approvals.

Legislative and policy context

Potential bushfire risks associated with construction and operation of the project have been assessed in accordance with the relevant legislation and guidelines as they apply to bushfire risk assessment. Key legislation and guidelines considered as part of this assessment includes:

- *Electricity Supply Act 1995*
- *Electricity Supply (Safety and Network Management) Regulation 2014*
- *Environmental Planning and Assessment Act 1979*
- *National Parks and Wildlife Act 1974*
- *Rural Fires Act 1997*
- *Rural Fires Regulation 2022*
- *Planning for Bushfire Protection (NSW Rural Fire Service, 2019)*
- *AS3959 (2018) – Australian Standard Construction of buildings in bushfire-prone areas*
- *Standards for Asset Protection Zones* (NSW Rural Fire Service, undated)
- *Industry Safety Steering Committee 20 (ISSC20) – Guideline for the Management of Activities Within Electricity Easements and Close to Electricity Infrastructure (ISSC, 2012)*
- *Guide for the Management of Vegetation in the Vicinity of Electricity Assets (2016)*

Methodology

The approach taken to the assessment of bushfire risk involved:

- an assessment of the risks to public safety, paying particular attention to bushfire risks, emergency egress and evacuation, and demonstrate compliance with *Planning for Bush Fire Protection 2019* (RFS, 2019)
- determining the bushfire hazards and risk associated to the project from surrounding areas (i.e. bushfire impacting the project)
- consideration of construction and operational activities that may have the potential to cause risks from the project, staff and public (community) health and safety (i.e. the project starting bushfires)
- assessment to determine bushfire attack levels and the required asset protection zones (APZs) for construction and operation of key infrastructure
- identification of recommended bushfire mitigation measures for the construction and operation of the project.

Existing environment and bushfire history

The project is covered by four Bush Fire Management Committees (BFMCs) including Cudgegong, Orana, Castlereagh and Warrumbungle and Liverpool Range.

The typical/average climate in the BFMC areas is varied with warm to temperate conditions in the western and northern areas and temperate to cool at higher elevations. The Bush Fire Danger Period generally runs from the beginning of October to the end of March however it is not unusual for this period to be extended. Prevailing weather conditions associated with the bush fire season in the BFMC areas are north-westerly to south-westerly winds with moderate to high temperatures and moderate levels of humidity. Dry lightning storms occur frequently during the bushfire season. Periods of higher temperatures and lower humidity lasting several days also occurs during the bush fire season.

Many areas of the project are located within designated Bushfire Prone Land. The project and broader landscape has a history of bushfires, and was impacted by large bushfires as recently as 2006 and 2017. Regardless of the fire history, bushfires can occur at any time of the year. All parts of the study area can be subject to bushfire impact.

Potential construction impacts

There are a range of activities that have the potential to initiate bushfire during construction. These include:

- accidental ignitions (e.g. cigarettes)
- construction vehicles, plant and equipment , electrical faults
- vegetation removal including mulching
- hot works (e.g. welding and grinding), blasting (if required)
- chemical fires
- activities undertaken at construction compounds and accommodation camps
- arson.

During construction of the project, work practices such as complying with Total Fire Ban requirements would assist in minimising the risk posed by these ignition sources.

Provision of managed areas in the form of APZs would be established to limit the spread of fire starting within the identified works areas. Detailed recommendations relating to construction management measures and relevant work practices have been provided.

Potential operational impacts

The operation of the project has the potential to initiate bushfire. The aerial and on-ground energy transmission infrastructure is a potential source of ignition and poses a risk of causing widespread and significant bushfire damage should a network fault occur during periods of high bushfire risk. EnergyCo will be required to develop and implement various strategies to prevent or minimise the occurrence of fire ignition from its energy network assets. Strategies related to bushfire mitigation include:

- identification of hazardous bushfire areas that the transmission network traverses focusing on Bushfire Prone Land
- asset condition monitoring involving pre-summer aerial inspections of high-risk network locations
- vegetation management
- asset maintenance and refurbishment
- network planning
- design and construction standards
- fire start reporting and analysis.

Management measures

Environmental management for the project would be carried out in accordance with an approved Construction Environmental Management Plan (CEMP). Hazards and risks would be managed in accordance with the Networks Operator's Safety Management system, policies and guidelines. This would seek to avoid, to the greatest extent possible, risks to public safety.

A comprehensive *Bushfire Emergency Management and Evacuation Plan* would be prepared as part of the construction emergency response plan for the project, including:

- establishment of Asset Protection Zones (APZs) around energy hubs, sub-stations, switching stations and transmission infrastructure during the construction phase to achieve compliance with the requirements of *Planning for Bushfire Protection* (RFS, 2019).
- protocols for the relocation of workers to nominated safe refuge zones during a bushfire emergency, either within or remote to the work zone (Bushfire Emergency and Evacuation Plan (BEEP)
- protocols for the management of bushfire risk and fuel management during construction. This would include the restriction and/or prevention of certain activities that present bushfire risks on days with a fire danger rating of equal to or greater than 'high', and as directed by relevant state authorities

- training to inform construction workers of bushfire risks and preventative actions, including risks associated with the operation (and maintenance) of vehicles, plant and equipment.

The CEMFP would also include strategies and measures for:

- management of hazardous materials and dangerous goods
- management of other hazards and risks to the general public and the environment.

Detailed mitigation and management measures have been provided.

1. Introduction

1.1 Background

New South Wales (NSW) is currently undergoing an energy sector transformation that will change how we generate and use energy. The NSW Government is leading the development of Renewable Energy Zones (REZ) across NSW to deliver renewable energy generation and storage projects, supported by transmission infrastructure. A REZ connects renewable energy generation and energy storage systems to transmission infrastructure via energy hubs new, requiring the coordination of power generation, power storage and transmission infrastructure. By doing so, REZs capitalise on economies of scale to deliver cheap, reliable and clean electricity for homes, businesses and industry in NSW.

The Central-West Orana REZ was formally declared on 5 November 2021 under the Electricity Infrastructure Investment Act 2020 As NSW's first REZ, the Central-West Orana REZ will play a pivotal role in underpinning NSW's transition to a clean, affordable and reliable energy sector.

The Central-West Orana REZ declaration (November 2021) provides for an initial intended network capacity of three gigawatts. The NSW Government is proposing to amend the declaration to increase the intended network capacity to six gigawatts, which would allow for more renewable energy from solar, wind and storage projects to be distributed through the NSW transmission network.

The proposed amendment is consistent with the NSW Network Infrastructure Strategy (EnergyCo, 2023) which identifies options to increase network capacity to 4.5 gigawatts initially under Stage 1 (which would be based on the infrastructure proposed in this assessment) and up to six gigawatts by 2038 under Stage 2 (which would require additional infrastructure beyond the scope of this assessment, and subject to separate approval). The proposed amendment also supports recent modelling by the Consumer Trustee in the draft 2023 Infrastructure Investment Objectives Report (AEMO, 2023) showing more network capacity will be needed to meet NSW's future energy needs as coal-fired power stations progressively retire.

Energy Corporation of NSW (EnergyCo), a NSW Government statutory authority, has been appointed as the Infrastructure Planner under the *Electricity Infrastructure Investment Act 2020*, and is responsible for the development and delivery of the Central-West Orana REZ. EnergyCo is responsible for coordinating REZ transmission, generation, firming and storage projects to deliver efficient, timely and coordinated investment.

EnergyCo is seeking approval for the construction and operation of new high voltage electricity transmission infrastructure and new energy hubs and switching stations that are required to connect energy generation and storage projects within the Central-West Orana REZ to the existing electricity network (the project).

1.2 Purpose of this paper

This technical paper has been prepared by Blackash Bushfire Consulting as part of the Environmental Impact Statement (EIS) for the project. The purpose of this technical paper is to identify and assess the potential impacts of the project in relation to bushfire risk.

This technical paper has been prepared to address the relevant Secretary's environmental assessment requirements (SEARs) issued by the Secretary of the NSW Department of Planning and Environment for the project on 7 October 2022, and the supplementary SEARs on 2 March 2023. The SEARs relevant to the assessment of bushfire are presented in Table 1.

Table 1 SEARs relevant to this paper

Reference	Assessment requirement	Location where it is addressed within this Technical Paper 10
Hazards and risks	*Bushfire and Emergency - an assessment of the risks to public safety, paying particular attention to bushfire risks, emergency egress and evacuation, and demonstrate compliance with Planning for Bush Fire Protection 2019:*	
	• *public safety*	*Section 8*
	• *bushfire risk*	*Section 4* *Sections 5 & 6*
	• *emergency egress and evacuation*	*Section 7*
	• *demonstrate compliance with Planning for Bush Fire Protection 2019*	*Section 8*

1.3 Project overview

The project comprises the construction and operation of new electricity transmission infrastructure, energy hubs and switching stations within the Central-West Orana REZ. The project would enable 4.5 gigawatts of new network capacity to be unlocked by the mid-2020s (noting the NSW Government's proposal to amend the Central-West Orana REZ declaration to allow for a transfer capacity of six gigawatts)and enable renewable energy generators within the Central-West Orana REZ who are successful in their bids to access the new transmission infrastructure to export electricity onto the National Electricity Market (NEM). A detailed description of the project, including a description of key project components, the construction methodology and how it would be operated is provided in Chapter 3 of the EIS.

1.3.1 Features

The project comprises the following key features :

- a new 500kV switching station (the New Wollar Switching Station), located at Wollar to connect the project to the existing 500 kV transmission network
- around 90 kilometres of twin double circuit 500 kV transmission lines and associated infrastructure to connect, two energy hubs to the existing NSW transmission network via the New Wollar Switching Station
- energy hubs at Merotherie and Elong Elong (including potential battery storage at the Merotherie Energy Hub) to connect renewable energy generation projects within the Central-West Orana REZ to the 500 kV network infrastructure
- around 150 kilometres of single circuit, double circuit and twin double circuit 330 kV transmission lines, supported on towers, to connect renewable energy generation projects within the Central-West Orana REZ to the two energy
- thirteen switching stations along the 330 kV network infrastructure at Cassilis, Coolah, Leadville, Merotherie, Tallawang, Dunedoo, Cobbora and Goolma, to transfer the energy generated from the renewable energy generation projects within the Central-West Orana REZ onto the project's 330 kV network infrastructure
- underground fibre optic communication cables along the 330 kV and 500kV transmission lines between the energy hubs and switching stations
- a maintenance facility within the Merotherie Energy Hub to support the operational requirements of the project
- microwave repeater sites at locations along the alignment, as well as outside of the alignment at Botobolar, to provide a communications link between the project and the existing electricity transmission and distribution network. The Botobolar site would be subject to assessment at the submissions report stage.

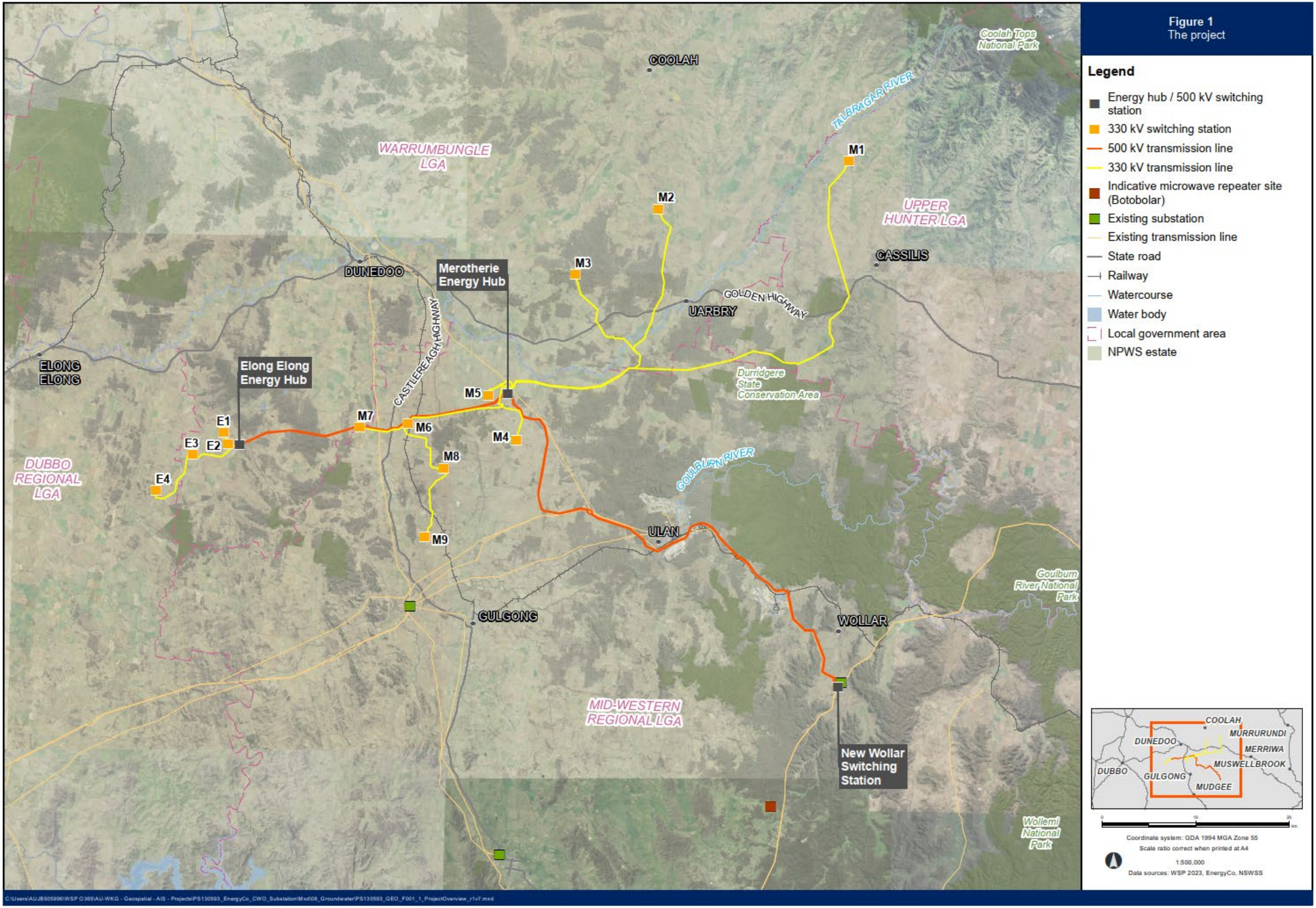
- establishment of new, and upgrade of existing access tracks for transmission lines, energy hubs, switching stations and other ancillary works areas within the construction area, (such as temporary waterway crossings, laydown and staging areas, earthwork material sites with crushing, grinding and screening plants, concrete batching plants, brake/winch sites, site offices and workforce accommodation camps)
- property adjustment works to facilitate access to the transmission lines and switching stations. These works include the relocation of existing infrastructure on properties that are impacted by the project
- utility adjustments required for the construction of the transmission network infrastructure, along with other adjustments to existing communications, water and wastewater utilities. This includes adjustments to Transgrid's 500kV transmission lines 5A3 (Bayswater to Mount Piper) and 5A5 (Wollar to Mount Piper) to provide a connection to the existing NSW transmission network, including new transmission line towers along the Transgrid network along the frontage of the New Wollar Switching Station, and other locations where there is an interface with Transgrid's network.

1.4 Location

The project is located in central-west NSW within the Warrumbungle, Mid-Western Regional, Dubbo Regional and Upper Hunter Local Government Areas. It extends north to south from Cassilis to Wollar and east to west from Cassilis to Goolma. The location is shown in figure 1.

1.5 Timing

Construction of the project would commence in the second half of 2024, subject to NSW Government and Commonwealth planning approvals, and is estimated to take about four years. The project is expected to be commissioned / energised (i.e. become operational) in late 2027.


COOLAH
Coolah Tops National Park
TALBRAGAR RIVER
WARRUMBUNGLE LGA
M1
M2
UPPER HUNTER LGA
CASSILIS
DUNEDOO
Merotherie Energy Hub
M3
GOLDEN HIGHWAY
UARBRY
ELONG ELONG
Elong Elong Energy Hub
CASTLEREAGH HIGHWAY
Durridgere State Conservation Area
M5
M7
M6
M4
E1
E3
E2
M8
DUBBO REGIONAL LGA
E4
GOULBURN RIVER
ULAN
M9
Goulburn River National Park
GULGONG
WOLLAR
MID-WESTERN REGIONAL LGA
New Wollar Switching Station
Wollemi National Park
Figure 1
The project
Legend
Energy hub / 500 kV switching station
330 kV switching station
500 kV transmission line
330 kV transmission line
Indicative microwave repeater site (Botobolar)
Existing substation
Existing transmission line
State road
Railway
Watercourse
Water body
Local government area
NPWS estate
COOLAH
MURRURUNDI
DUNEDOO
MERRIWA
MUSWELLBROOK
DUBBO
GULGONG
MUDGEE
Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:500,000
Data sources: WSP 2023, EnergyCo, NSWSS

1.6 Construction

Key construction activities for the project would occur in the following stages:

- enabling works
- construction works associated with the transmission lines
- construction works associated with energy hubs and switching stations
- pre-commissioning and commissioning of the project
- demobilisation and rehabilitation of areas disturbed by construction activities.

Earthworks would be required within the construction area for the project to provide level surfaces, to create trenches for drainage, earthing, communications infrastructure and electrical conduits and to construct and upgrade access tracks.

Construction vehicle movements would comprise heavy and light vehicles transporting equipment and plant, construction materials, spoil and waste from construction facilities and workforce accommodation camp sites. There would also be additional vehicle movements associated with construction workers travelling to and from construction areas and accommodation camp sites. These movements would occur daily for the duration of construction.

To support the construction of the project a number of construction compounds would be required including staging and laydown facilities, concrete batching plants, workforce accommodation camps and construction support facilities. The main construction compounds would be established as enabling work and demobilised at the completion of construction. The size of the construction workforce would vary depending on the stage of construction and associated activities. During the peak construction period, an estimated workforce of up to around 1,800 people would be required.

1.7 Operation

During operation, the project would transfer high voltage electricity from the Central West-Orana REZ to the NEM. Permanent project infrastructure would be inspected by field staff and contractors on a regular basis, with other operational activities occurring in the event of an emergency (as required). Regular inspection and maintenance activities are expected to include:

- regular inspection (ground and aerial) and maintenance of electrical equipment and easements
- fault and emergency response (unplanned maintenance)
- general building, asset protection zone and landscaping maintenance
- fire detection system inspection and maintenance
- stormwater maintenance
- remote asset condition monitoring
- network infrastructure performance monitoring.

The project would require the establishment of transmission line easements. These easements would be around 60 metres for 330kV transmission lines and 70 metres for 500kV transmission lines. Where network infrastructure is collocated, easement widths would increase accordingly (for example, a twin double circuit 500kV transmission line would have an easement about 140 metres wide). Vegetation clearing would be required to some extent for the full width of the transmission line easement, depending on the vegetation types present.

1.8 Structure of the paper

The structure and content of this paper is as follows:

- Chapter 1 – Introduction: (this chapter)
- Chapter 2 – Legislative and policy context: Provides an overview of the regulatory context for the assessment
- Chapter 3 - Methodology: Outlines the methodology adopted for this assessment.
- Chapter 4 – Existing Environment and Bushfire History: Provides the bushfire context for the project
- Chapter 5 – Bushfire Risk Assessment (Construction)
- Chapter 6 – Bushfire Risk Assessment (Operation)
- Chapter 7 - Emergency egress and evacuation
- Chapter 8 – Summary compliance with Planning for Bushfire Protection and the SEARs
- Chapter 9 - Management and mitigation measures: Details recommended mitigation and management measures to minimise bushfire impacts
- Chapter 10 - References

The appendices to this paper are:

Appendix 1 - Bushfire Prone Land

Appendix 2 - Bushfire History

Appendix 3 - Bushfire Attack Levels – Switching Stations

Appendix 4 – Asset Protection Zones – Switching Stations

Appendix 5 - Bushfire Attack Levels – Energy Hubs

Appendix 6 – Asset Protection Zones – Energy Hubs

Appendix 7 - Bushfire Attack Levels – Construction Compounds

Appendix 8 – Asset Protection Zones – Construction Compounds

Appendix 9 - Inner Protection Area Requirements

2. Legislative and Policy Context

This section describes the legislation and policy context relevant to the assessment of bushfire impacts.

2.1 NSW legislation

The following sections identify the statutory and regulatory requirements relevant to the assessment of bushfire risk for the project.

2.1.1 Electricity Supply Act 1995

The *Electricity Supply Act 1995* (ESA) requires network operators to take appropriate action to ensure public safety. This includes actions in relation to infrastructure that is considered an ignition source. 'Appropriate action' can include modifying the infrastructure, removing hazardous items in proximity to the infrastructure, and trimming/removing vegetation.

Under Division 2A (Special Powers for bush fire prevention) a network operator may direct a private landowner to undertake bushfire risk mitigation work on vegetation or aerial consumer mains on the premises if the network operator has determined that there's a potential cause of bushfire.

Bushfire prevention works on aerial consumer mains required under Section 53 of this Act supersedes environmental planning instruments including approval or consent requirements under other Acts (including EP&A Act, *Biodiversity Conservation Act 2016*, *Local Land Services Act 2013* (Part 5A), *National Parks and Wildlife Act 1974* (NPW Act). However, this does not apply to vegetation in the vicinity of transmission lines in protected areas, such as national parks (Section 48).

2.1.2 Electricity Supply (Safety and Network Management) Regulation 2014

The *Electricity Supply (Safety and Network Management) Regulation 2014* (ES(SNM) Regulation) requires a network operator to take all reasonable steps to ensure that all aspects of its network are safe. This includes preventing network assets from igniting bushfires. Bushfire risk management must be part of an operator's safety management system. This includes ensuring the network is safe in its design, construction, and operation and supports the:

- safety of members of the public
- safety of persons working on networks

- protection of property
- management of safety risks arising from the protection of the environment (for example, preventing bush fires that may be ignited by network assets).

2.1.3 Environmental Planning and Assessment Act 1979

The project has been declared as Critical State Significant Infrastructure (CSSI) and is subject to assessment under Division 5.2 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

As the project is located on 'bushfire prone land' for the purposes of Section 10.3 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), it necessitates the application of the specifications and requirements of *Planning for Bushfire Protection 2019* (PBP). Electrical infrastructure should be designed and housed in such a way as to minimise the impact of bushfires on the capabilities of the infrastructure during bushfire emergencies. It should also be designed and maintained so that it will not serve as a bushfire risk to surrounding bush.

2.1.4 Rural Fires Act 1997

The *Rural Fires Act 1997* (RF Act) establishes the NSW Rural Fire Service, defines its functions, and makes provision for the prevention, mitigation and suppression of bush and other fires in Local Government Areas (or parts of areas) and other parts of the State constituted as rural fire districts.

Section 63 of the RF Act requires public authorities such as EnergyCo and owners and occupiers of land to prevent bushfires and to manage land they are responsible for. This requires a proactive approach to managing the starting of fires and mitigating the impact of fires.

Under Part 5.23 of the EP&A Act, the proposal, which is CSSI, does not require authorisation for development on bushfire prone land from a bushfire authority under section 100B of the *Rural Fires Act*.

2.1.5 Rural Fires Regulation 2022

The *Rural Fires Regulation 2022* (RF Reg) is the statutory instrument made under the RF Act to implement and regulate the functions of the RF Act.

2.1.6 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NP&W Act) has the explicit intent of conserving the natural and cultural heritage values of the state of New South Wales whilst fostering public interest in the protection of the values for which land is reserved under the Act and the appropriate management of those lands.

Construction, inspection and ongoing vegetation maintenance activities associated with fire management of transmission lines within and adjacent to National Parks will need to ensure compliance with control measures and directives given by the National Parks and Wildlife Service. However, section 5.23 of the EP&A Act specifies that directions, orders or notices cannot be made or given so as to prevent or interfere with the carrying out of approved CSSI including a remediation direction under Division 1 (Stop work orders) and Division 3 (Remediation directions) of Part 6A of the NP&W Act.

2.2 Policy, standards and guidelines

Government policies and guidelines that are relevant to the assessment of bushfire risk for the project include:

- *Planning for Bushfire Protection 2019* (PBP) which contains specifications for planning and building on land identified as bushfire prone. The level of bushfire risk to and from the project means PBP can be used to inform the bushfire management of the project in the construction and operational phases. Further commentary regarding the applicability of *Planning for Bushfire Protection* (2019) for high voltage transmission projects is provided below in Section 3.4.
- Councils of Standards Australia *AS3959 (2018) – Australian Standard for the Construction of buildings in bushfire-prone areas* which provides guidance for all new buildings in Bushfire Prone Areas.
- *Standards for Asset Protection Zones NSW Rural Fire Service* which provides standards for the establishment and maintenance of asset protection zones.
- *Industry Safety Steering Committee 20 (ISSC20) – Guideline for the Management of Activities Within Electricity Easements and Close to Electricity Infrastructure* (ISSC, 2012) which was written to protect public safety and electricity assets by offering guidance on the management of activities in electricity easements including an assessment of access and safety aspects associated with the operation and maintenance, repair, replacement, upgrade or renewal of electricity infrastructure on property, whilst being mindful of the property owner's rights to maximise use and enjoyment of the land.
- *Guide for the Management of Vegetation in the Vicinity of Electricity Assets (2016)* provides requirements for the management of the risks associated with the impact of vegetation on Electricity Assets for the benefit of public safety, community amenity

and electricity supply reliability. It has been written for the purposes of assisting Network Operators achieve the safety requirements specified in the *NSW Electricity Supply (Safety and Network Management) Regulation 2014* (NSW) and Australian Standard (AS) 5577 "Electricity Network Safety Management Systems" 2013.

3. Methodology

3.1 Overview

This section describes the methods used to assess potential bushfire risk associated with the project.

The assessment addresses the SEARS, pertaining to safety and the potential risk to life, and the capability of the project to comply with various bushfire objectives.

The purpose of the bushfire risk assessment is to determine the suitability of the project from a bushfire perspective. In this context, the bushfire risk assessment must ensure that the project does not significantly increase the chance (likelihood) of bushfire ignition and bushfire impact (consequence) on the project infrastructure and people during the construction and operational phases.

Bushfire risk assessment is as an important measure for understanding the bushfire risk both to the project (i.e. bushfire impacting the project) and from the project (i.e. the project starting bushfires). The physical design and layout of the project, as well as the implementation of bushfire mitigation measures, are central to managing the bushfire risk within tolerable levels.

3.2 Risk Assessment Process

A qualitative risk assessment has been completed through the specific lens of risk-based assessment as required within PBP and using the processes outlined by the *National Emergency Risk Assessment Guidelines* (NERAG) published by the Australian Institute for Disaster Resilience (AIDR) as well as *AS/NZS ISO 31000:2009 – Risk management: Principles and guidelines* (ISO 31000).

Having regard to bushfire prone land and bushfire history within the study area, the likelihood of extreme fire weather and large-scale fires impacting the project infrastructure is considered 'almost certain'.

Using the NERAG table in Figure 2, given the range of potential ignition sources during elevated fire danger, during construction and operation (see Section 5), the ignition potential is likely, with a major or catastrophic consequence level, dependent on the size and intensity of fire, creating an extreme risk. Intervention by firefighting operations and implementation of recommended mitigation measures during the construction and operational phase (see Section 5 and 6) of the project can reduce the risk (potentially to high) by reducing the likelihood of impact even though the consequence remains the same.

	CONSEQUENCE LEVEL				
LIKELIHOOD	INSIGNIFICANT	MINOR	MODERATE	MAJOR	CATASTROPHIC
ALMOST CERTAIN	Medium	Medium	High	Extreme	Extreme
LIKELY	Low	Medium	High	Extreme	Extreme
UNLIKELY	Low	Low	Medium	High	Extreme
RARE	Very low	Low	Medium	High	High
VERY RARE	Very low	Very low	Low	Medium	High
EXTREMELY RARE	Very low	Very low	Low	Medium	High

Figure 2 **Qualitative Risk Assessment**

If fires do start from electrical infrastructure and cause damage of consequence, the impacts are significant with reputational impact, potential class actions, law suits and damages arising from the ignitions are likely. Thus, the management of ignitions is important and significant effort would be undertaken during both construction and operation to mitigate the ignition potential from the project.

Consideration of bushfire risk requires an understanding of the landscape context, the risk profile of the proposed infrastructure, and the ability to apply risk management principles to adequately mitigate identified risks. Where there are competing policy objectives, such as biodiversity conservation and fuel reduction, an agreed methodology or guidance is critical. An approach to vegetation management that balances the need to retain biodiversity values while minimising bushfire risk has been development for the project and will continue to be refined in subsequent design stages.

The approach taken within this paper to the assessment of bushfire risk involved:

- an assessment of the risks to public safety, paying particular attention to bushfire risks, emergency egress and evacuation, and demonstrate compliance with *Planning for Bush Fire Protection 2019*
- determining the bushfire hazards and risk to the project from surrounding areas (i.e. bushfire impacting the project)
- assessing the potential for construction and operational activities to be an ignition source and causing a bushfire risk to people and the environment
- assessing the bushfire risk to project infrastructure, including an assessment of the applicable assessing bushfire attack levels and the required asset protection zones (APZs)
- identification of recommended bushfire mitigation measures for the construction and operation of the project.

3.3 Study area

This desktop assessment included the bushfire assessment for the project infrastructure and assets shown in Figure 3. The project overview map shows the project infrastructure and inset maps that are used within the bushfire risk assessment for detailed site assessment in accordance with PBP in the determination of the indicative Bushfire Attack Levels (BALs).

The study area spans across Warrumbungle, Mid-Western Regional, Upper Hunter and Dubbo Regional Local Government Areas and includes the:

- construction compounds,
- energy hubs,
- switching stations (including the new Wollar Switching Station),
- transmission lines,
- transmission towers,
- accommodation workforce camps (during construction), and
- associated Asset Protection Zones.

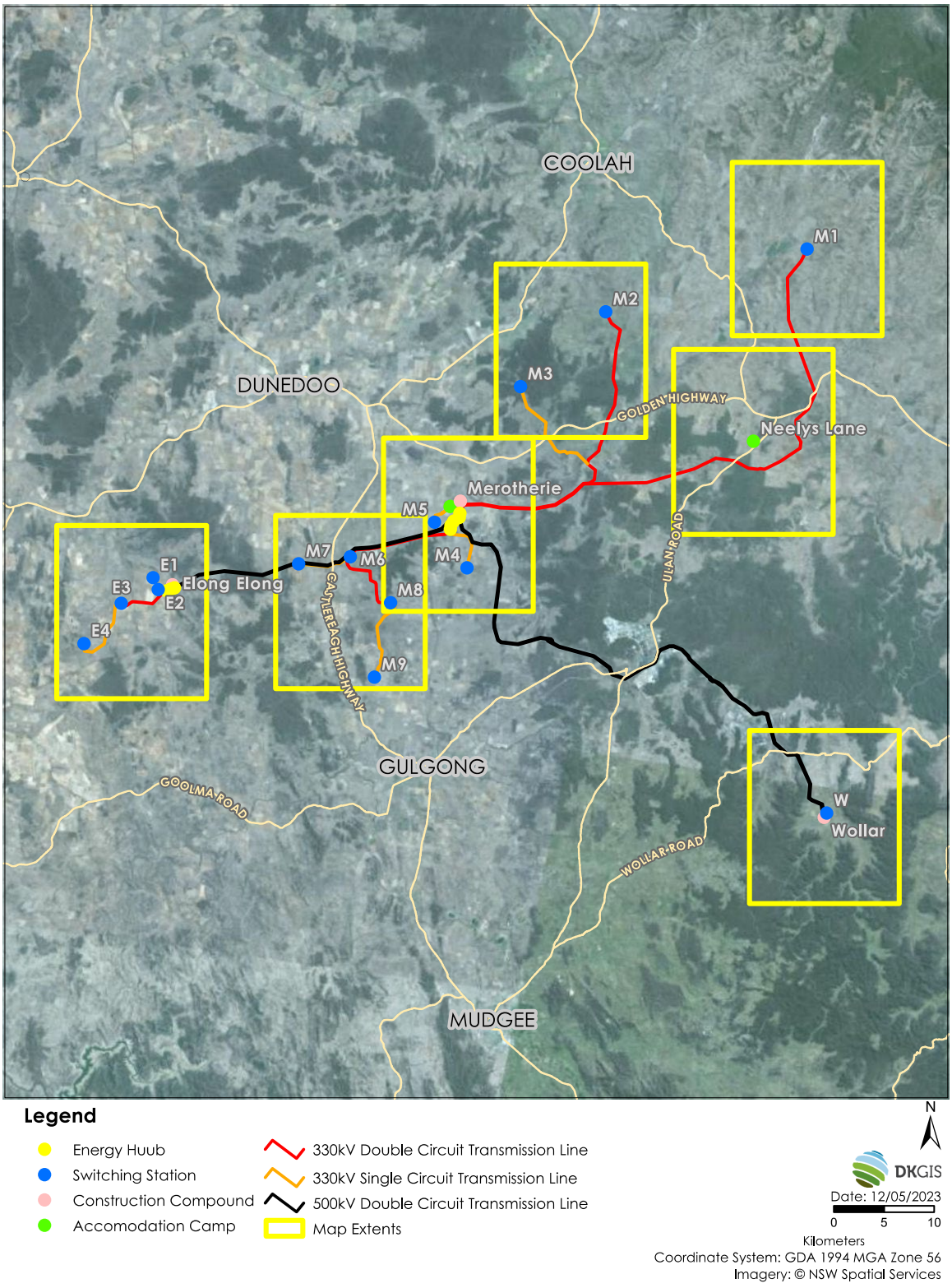


Figure 3 **Project Overview Map showing inset areas of bushfire risk assessment**

3.4 Planning for Bush Fire Protection 2019

The **aim** of PBP (p. 10) is:

- *to provide for the protection of human life and minimise impacts on property from the threat of bushfire, while having due regard to development potential, site characteristics and protection of the environment.*

The **objectives** (PBP p. 10) are to:

- *afford buildings and their occupants protection from exposure to a bushfire*
- *provide for a defendable space to be located around buildings*
- *provide appropriate separation between a hazard and buildings which, in combination with other measures, prevent the likely fire spread to buildings*
- *ensure that appropriate operational access and egress for emergency service personnel and occupants is available*
- *provide for ongoing management and maintenance of Bushfire Protection Measures*
- *ensure that utility services are adequate to meet the needs of firefighters.*

Section 1.1 of PBP identifies that all development on bushfire prone land must satisfy the aim and objectives of PBP. Similarly, the SEARs stipulate that the EIS is to demonstrate compliance with PBP. Accordingly, this bushfire risk assessment considers if the project is appropriate in the bushfire hazard context at a strategic or landscape scale, and within the boundaries of the project (see Figure 3). It also provides the ability to assess the strategic implications of future development for bushfire mitigation and management.

The broad principles for strategic planning which apply as required within PBP to reduce likelihood and consequence of bushfire are[1]:

- ensuring land is suitable for development in the context of bushfire risk and broader environmental impacts
- ensuring new development on BFPL will comply with the minimum requirements of PBP
- minimising reliance on performance-based solutions

[1] Planning for Bushfire Protection 2019 p. 34

- providing adequate infrastructure for emergency evacuation and firefighting operations
- facilitating appropriate ongoing land management practices.

Bushfire risk assessment is as an important measure for understanding the bushfire risk both to the project (i.e. bushfire impacting the project) and from the project (i.e. the project starting bushfires).

PBP provides limited guidance and requirements for critical infrastructure such as energy and power within Bushfire Prone Areas. Brief commentary is included on requirements for wind and solar farms (section 8.3.5 pf PBP) and telecommunications towers (section 8.3.7 of PBP), however it does not provide specifications or requirements for energy transmission infrastructure. While wind/solar farms and telecommunication facilities are not identical to the infrastructure being delivered as part of the project, these provide a framework for the consideration of bushfire risk, and the methodology within PBP has been used to assess the APZ requirements to limit bushfire attack on the project infrastructure (including switching stations, substations, construction camps, electricity network).

Notwithstanding, Section 2.4 of PBP identifies that:

> *"If a development of a type not specifically addressed in this document is proposed on BFPL, the development must meet the Aim and Objectives of PBP and the consent authority can refer the proposal to the NSW RFS for advice".*

This generally accords with the process described in Section 2.4.2 (and illustrated in Figure 2.4) of PBP which details that for State Significant projects in bush fire prone areas, DPE would determine the project in consultation with RFS.

Chapter 8 of PBP articulates the assessment framework for 'Other Development' in NSW (including infrastructure), along with a series of assessment considerations that are required before a determination can be made regarding a project. As noted above, PBP does not provide specific requirements for energy infrastructure, so the bushfire risk assessment has used the framework for wind and solar farms as a comparative assessment framework. PBP notes (p. 77) that:

> *Wind and solar farms require special consideration and should be provided with adequate clearances to combustible vegetation as well as firefighting access and water. The following should be provided for wind and solar farms:*

- *a minimum 10m APZ for the structures and associated buildings/infrastructure; and*
- *the APZ must be maintained to the standard of an Inner Protection Area (IPA) for the life of the development.* See Appendix 9 for IPA requirements.

Essential equipment should be designed and housed in such a way as to minimise the impact of bush fires on the capabilities of the infrastructure during bush fire emergencies. It should also be designed and maintained so that it will not serve as a bush fire risk to surrounding bush.

PBP also provides commentary on other critical infrastructure such as telecommunications towers stating (p. 78) that:

Essential telecommunication infrastructure should be designed in such a way as to minimise the impact of bush fires and ensure that communications capabilities are not compromised during bush fire emergencies. Bushfire Protection Measures (BPMs) should be commensurate with the bush fire risk and criticality of the infrastructure.

There should be a minimum APZ around the tower/ buildings/associated infrastructure which will increase based on the assessed level of risk and criticality.

Telecommunication towers should be constructed from non-combustible materials, and designed to mitigate the risk of flame damage, ember attack and radiant heat.

While PBP is not explicit for energy infrastructure, a risk-based approach needs to be taken limiting the impact of the project starting bushfires and limiting the impact of bushfires on project infrastructure.

Asset Protection Zones around key project assets have been determined based on tolerable radiant heat thresholds of ≤29kW/m2 (i.e. BAL-29). The tolerable radiant heat threshold has been determined by EnergyCo.

3.5 Approach to impact assessment

This assessment has used a bushfire risk methodology as identified within PBP. The methodology looks broadly at the strategic level and landscape scale risks including the bushfire history and bushfire prone nature of the study area. Focussed assessments have been completed for the key project assets to determine the bushfire risk and APZs that could be used to mitigate the risk to and from these assets. From an impact assessment perspective, the establishment and ongoing management of APZs has a consequential impact to

biodiversity which has been assessed in the Biodiversity Development Assessment Report. The ongoing maintenance and management of APZs would require a significantly modified landscape during the operational phase of the project to reduce the intensity of bushfire at an asset.

The methodology used in the bushfire risk assessment requires the consideration of a range of factors which influence bushfire behaviour and intensity, including:

- Bushfire Prone Land Mapping
- Landscape Characteristics
- Bushfire Hazard
- Fire Weather
- Vegetation Types and extent
- Slope characteristics
- Asset Protection Zones
- Bushfire Attack Levels

Each of these factors are described in further detail in Sections 3.5.1to 3.5.8.

For the specific determination of bushfire risk, the following methodology from PBP has been used to determine the bushfire attack level (BAL) for the project components:

Step 1: Determine bushfire prone land and the potential for bushfire in the landscape

Step 2: Determine the relevant Fire Danger Index (FDI) for the council area in which the development is to be undertaken.

Step 3: Determine vegetation formation in all directions around the building or asset to a distance of 140 metres.

Step 4: Determine the effective slope of the land from the building or asset for a distance of 100 metres.

Step 5: Determine the separation distance by measuring from the edge of the unmanaged vegetation to the closest external wall of the building or asset.

Step 6: Match the relevant FFDI, appropriate vegetation, distance and effective slope to determine the appropriate BAL and corresponding APZ using the relevant tables in PBP.

With regard to the above assessment methodology, the predetermined BAL for key project assets (i.e. BAL-29), as determined by EnergyCo, has dictated the associated APZ setback requirements.

3.5.1 Bushfire Prone Land

Parts of the study area are identified as being within 'bushfire prone land' (BFPL) (see Appendix 1) for the purposes of Section 10.3 of the EP&A Act and the legislative requirements for development on bushfire prone lands are applicable.

BFPL is land that has been identified by council, which can support a bushfire or is subject to bushfire attack. BFPL maps are prepared by local council and certified by the Commissioner of the NSW RFS. BFPL maps provide a trigger for the development assessment provisions and consideration of sites that are bushfire prone. All development on BFPL must consider and comply with PBP.

BFPL maps are an indication of potential bushfire attack and are not a risk assessment of land. Some of the study area is not mapped as being Bushfire Prone Land. However, this is most likely an artefact of out of date mapping that does not reflect the current RFS *Guidelines for Bushfire Prone Land Mapping (Mapping Guidelines)*. Since 2015, grassland areas, including crops and grazed country is required to be designated as being bushfire prone land. The RFS *Guide for bushfire-prone land mapping* (RFS, 2015) identifies three categories of BFPL; namely:

- *Vegetation Category 1 is considered to be the highest risk for bushfire and represented as red on the bushfire-prone land map. This category has the highest combustibility and likelihood of forming fully developed fires including heavy ember production, and consists of forest, woodland, heaths, forested wetlands and timber plantations.*
- *Vegetation Category 2 is considered to be a lower bushfire risk than Category 1 and Category 3 but higher than the excluded areas and represented as light orange on the bushfire-prone land map. This category has lower combustibility and/or limited potential fire size due to the vegetation area shape and size, land geography and management practices. This category consists of rainforests, lower risk vegetation parcels and remnant vegetation.*
- *Vegetation Category 3 is considered to be medium bush fire risk vegetation. It is higher in bush fire risk than category 2 (and the excluded areas) but lower than Category 1. It is represented as dark orange on a Bush Fire Prone Land map and will be given a 30 metre buffer. This category consists of: Grasslands, freshwater wetlands, semi-arid woodlands, alpine complex and arid shrublands.*

Vegetation excluded from being mapped as bushfire prone includes:

- single areas of vegetation less than 1 hectare in area and greater than 100 metres separation from other areas of Category 1,2, or 3 vegetation
- multiple areas of vegetation less than 0.25 hectares in area and not within 30 metres of each other
- strips of vegetation less than 20 metres in width, regardless of length and not within 20 metres of other areas of Category 1,2 or 3 vegetation
- Areas of "managed grassland" including grassland on, but not limited to, recreational areas, commercial/industrial land, residential land, airports/airstrips, maintained public reserves and parklands, commercial nurseries and the like
- areas of managed gardens and lawns within curtilage of buildings
- non-vegetated areas, including waterways, roads, footpaths, buildings and rocky outcrops
- managed botanical gardens
- agricultural lands used for annual and/or perennial cropping, orchard, market gardens, nurseries and the likes are excluded
- saline wetlands including mangroves
- other areas that, due to their size, shape and overall risk are not considered Category 1, 2 or 3 vegetation.

The bushfire prone land mapping relevant to the project is illustrated in Appendix 1 and summarised below in Table 2.

Table 2 Bushfire Prone Land Summary

Project location	Comment
Elong Elong	Predominantly Category 2 vegetation with small areas of Category 1 vegetation. The Eastern area of the BFPL map is designated as grassland areas. Switching stations E1 and E2 are correctly designated as BFPL. The energy hub at Elong Elong has Category 1 vegetation within or in close proximity. The western area of BFPL map does not designate grassland areas as BFPL. This is not in keeping with the requirements of the Mapping Guidelines. Site E4 is within grassland hazard area. Transmission lines are within grassland hazard areas with some interspersed trees.

Project location	Comment
Hannahs Bridge	The Hannahs Bridge BFPL map has been correctly mapped as BFPL. The M2 switching station is within predominantly grassland area with some interspersed trees. The transmission line generally traverses in a northerly direction from the Golden Highway along the boundary of Category 1 and Category 2 mapped vegetation, before continuing through Category 2 vegetation through to the terminus at the M2 switching station.
Merotherie	The eastern part of the Merotherie Energy Hub (generally east of the Talbragar River and the Cockabutta Creek) has been correctly mapped with Category 1 and Category 2 vegetation. Areas generally to the west of the Talbragar River and the Cockabutta Creek have not been correctly mapped but are considered BFPL. The switching stations at M4 and M5 are within what should be designated as grassland (Cat 2) hazard areas. The energy hub infrastructure is within grassland which should be designated as hazard (Cat 2) areas. The construction compound is within what should be designated as grassland hazard area (Cat 2). The transmission lines are within predominantly what should be designated as Category 2 BFPL with some areas in the west of Category 1 forest.
Rotherwood Crossing	The Rotherwood Crossing BFPL vegetation categories have been correctly mapped. The M1 switching station is within Category 3 vegetation which is predominantly open woodland. The transmission line passes through Category 3 vegetation.

Project location	Comment
Tallawang	The Tallawang BFPL has not been correctly mapped with the eastern areas not designated. The switching station M8 is at elevated bushfire risk with forest vegetation to the north and northwest of the switching station. Switching station M6 is within a grassland area what should be designated as Category 2 as are the transmission lines. The M7 switching station is within designated Cat 2 grassland which is correct.
Wollar	The BFPL map for the Wollar switching station, construction compound and transmission lines has been correctly designated as Category 2 vegetation.

For those parts of the study area that are not mapped as BFPL but should be designated as being able to carry bushfire, the BFPL maps across the state are in the process of being updated. The *RFS Guide for bushfire-prone land mapping* (RFS, 2015) document requires councils to identify and map grassland hazard areas. As demonstrated in Table 2, this has not been adequately completed by councils and the RFS for much of the study area. Broadly, grassed areas capable of sustaining a bushfire should be designated as BFPL. The only areas of a BFPL map that should not be designated is managed land which is land considered by the council and RFS as not being capable of sustaining bushfire. Managed land as defined in the *RFS Guide for bushfire-prone land mapping* (p. 4) is:

> *land that has vegetation removed or maintained to limit the spread and impact of bush fire. It may include existing developed land (i.e. residential, commercial or industrial), roads, golf course fairways, playgrounds or sports fields, vineyards, orchards, cultivated ornamental gardens and commercial nurseries. Most common will be gardens and lawns within curtilage of buildings. These areas will be managed to meet the requirements of an Asset Protection Zone.*

All non-managed land within the study area should be considered for all intents and purposes as Bushfire Prone Land.

3.5.2 Landscape Characteristics

The bushfire landscape assessment considers the likelihood of a bushfire, its potential severity and intensity and the potential impact on life and property in the context of the broader surrounding landscape. The likelihood of a bushfire, its severity and intensity, and the potential impact on life and property varies depending on where a site is located in the landscape. There are a number of factors that influence the potential bushfire behaviour at a landscape scale, including:

- extent and continuity of vegetation
- topography
- accessibility of the landscape for fire response and fire suppression. This can greatly influence the potential fire-fighting strategies and their success
- the potential fire run (potential size of the fire determined by available fuel) and area that is likely to be impacted by the fire. For example, a large bushfire may impact areas many kilometres in front of the main fire
- the location and exposure of urban areas, townships, and isolated rural areas to a bushfire
- the extent of neighbourhood-scale damage the bushfire may produce.

The project (Figure 3) is within designated BFPL which is subject to a range of environmental and topographical features including complex water catchments, escarpments, bushfire vegetation corridors, existing farming land and physical assets which have been considered in the potential fire behaviour characteristics.

The project is exposed to both landscape scale risk (broader landscape) and localised bushfire risk. It is located within a landscape comprising areas of relatively complex terrain with a mix of remnant forest and woodland areas, and grassland hazards which are likely to result in varied fire behaviour based upon localised terrain, fuel and wind conditions.

Grassland fires are fast moving fires that often move quickly through the landscape and are highly dependent on curing (dryness of the grass) and the underlying dryness of the landscape. They can generate enormous amounts of heat, with an average flame height from between 2 to 5 metres. The taller and drier the grass, the more intensely it burns.

3.5.3 Bushfire Hazard Characteristics

PBP provides a methodology to determine the bushfire threat and commensurate size of any APZ that may be required to offset possible bushfire attack. The vegetation formations (bushfire fuels) and the topography (effective slope) combine to create the bushfire threat that may affect bushfire behaviour within the construction and operation area and the project assets

such as energy hubs, switching stations, transmission lines, accommodation camps, construction compounds and access roads. The bushfire hazard is determined by Fire Danger Index, vegetation, slope and distance of the asset from the unmanaged vegetation.

3.5.4 Fire Weather

The fire season in the central west of NSW generally corresponds with high temperatures during summer, low rainfall and low humidity from September to April, and a proclaimed bushfire danger period from the beginning of October to the end of March.

Bushfires are a normal part of the landscape in the central west and are predicted to become more severe, more frequent and an increasingly common part of life. Climate change modelling predicts increasing frequency and severity of fire events correlating with altered rainfall and drought patterns and increasing numbers of severe and intense heat events. As the dryness of more areas increases beyond levels historically considered 'normal', the footprint of areas with a propensity to burn are likely to increase. PBP assumes a credible worst-case fire burning under a 1:50 year weather or fire event. This design fire could underrepresent the intensity and frequency of bushfires with climate change.

Fire weather is presented as a Fire Danger Index (FDI), which identifies the chance of a fire starting, its rate of spread, its intensity and the difficulty potential for its suppression, considering various factors such as temperature, humidity, wind and drought effects. FDI is used within PBP and assumes a credible worst-case scenario and an absence of any other mitigating factors relating to aspect or prevailing winds. The FDI is based on local government boundaries.

The fire weather districts applicable to the project LGAs are:

- Mid Western Regional LGA - Central Ranges Fire Weather District – FDI 80
- Warrumbungle LGA - North Western Fire Weather District – FDI 80
- Dubbo Regional LGA - Lower Central West Plains Fire Weather District – FDI 80
- Upper Hunter LGA - Fire Weather District – FDI 80.

The applicable FDI for the project bushfire risk assessment is FDI 80.

3.5.5 Vegetation Characteristics

Vegetation is the fundamental physical component of determining the bushfire behaviour. Vegetation provides the available fuel to be consumed by a bushfire. Fuel load represents a considerable component in dictating the behaviour of fire in terms of intensity, rate of spread and flame height, and typically relates to fuel that is grass, leaves, bark and twigs less than 6mm in diameter that ignite readily and are burnt rapidly when dry (AFAC 2012).

Vegetation type, density and arrangement can further influence fire behaviour and intensity. Vertical and horizontal continuity is also a significant element. Thus, vegetation is a key input to the bushfire risk assessment required by PBP which forms a key consideration within this report.

The vegetation assessment has been completed in accordance with PBP. The predominant vegetation is classified by structure or formation using the system adopted in PBP. Vegetation types give rise to radiant heat and fire behaviour characteristics. The predominant vegetation has been determined for the site over a distance of at least 140 metres in all directions from the proposed asset boundaries within the project. Where a mix of vegetation types exist, the type providing the greater hazard is said to predominate. The vegetation classification is incorporated into the BAL assessments for each asset.

3.5.6 Slopes Influencing Bushfire Behaviour

PBP requires assessment of slope. The slope of the land under the classified vegetation has a direct influence on the rate of fire spread, the intensity of the fire and the ultimate level of radiant heat flux. The effective slope is the slope of the ground under the hazard (vegetation). In identifying the effective slope, it may be found that there are a variety of slopes covering different distances within the vegetation. The effective slope is considered to be the slope under the vegetation which will most significantly influence the bushfire behaviour for each transect. This is usually the steepest slope.

Assessment of the slope has been completed to determine the BAL for each asset. The project and surrounds are gently undulating and flat.

3.5.7 Asset Protection Zones

The bushfire risk assessment utilises the methodology as provided in Section 3.4, to determine the APZs for the specific infrastructure/asset depending on a tolerable radiant heat threshold of ≤29kW/m2 (i.e. BAL-29).

Critical infrastructure associated with the project should be designed in such a way as to minimise the impact of bushfire on the infrastructure and ensure that critical infrastructure does not cause a bushfire, or that capabilities are not compromised during bushfire emergencies. Bushfire Protection Measures should be commensurate with the bush fire risk and criticality of the infrastructure.

The *Electricity Supply (Safety and Network Management) Regulation 2014* (ES(SNM) Regulation) requires a network operator to take all reasonable steps to ensure that all aspects of its network are safe. This includes preventing network assets from igniting bushfires and that bushfire risk management must be part of an operator's safety management system. This includes ensuring the network is safe in its design, construction, and operation.

A key part of managing the risk is the provision of APZs, which is a is a fuel-reduced, physical separation between an asset and bushfire hazards, to achieve a prescribed radiant heat level on the relevant building / structure. BAL maps have been provided within the Appendices that provide the radiant heat levels from the project assets (switching stations, construction compounds and energy hubs).

PBP provides for 'deemed to satisfy' APZs for the varying development types. The minimum APZ deemed-to-satisfy requirements are provided in Appendix 1of PBP.

With regard to key project assets APZ setback distances have been aligned with achieving ≤29kW/m2 (BAL-29) at the built asset.

With regard to transmission line easements the project would require the establishment and management of fuel reduced APZs. Typical easement widths include:

- 140 metres for twin 500 kV transmission lines
- 60 metres for a single 330kV transmission line
- 120 metres for twin 330kV transmission lines
- 200 metres for twin 500kV alongside single 330kV.

Easements would provide a right of access for the construction and operation of the transmission line and other associated assets (such as transmission towers). The easements would also ensure safe electrical clearances during operation of the transmission lines. Figure 3 shows typical transmission line easements for the 500 kV and 330 kV network infrastructure.

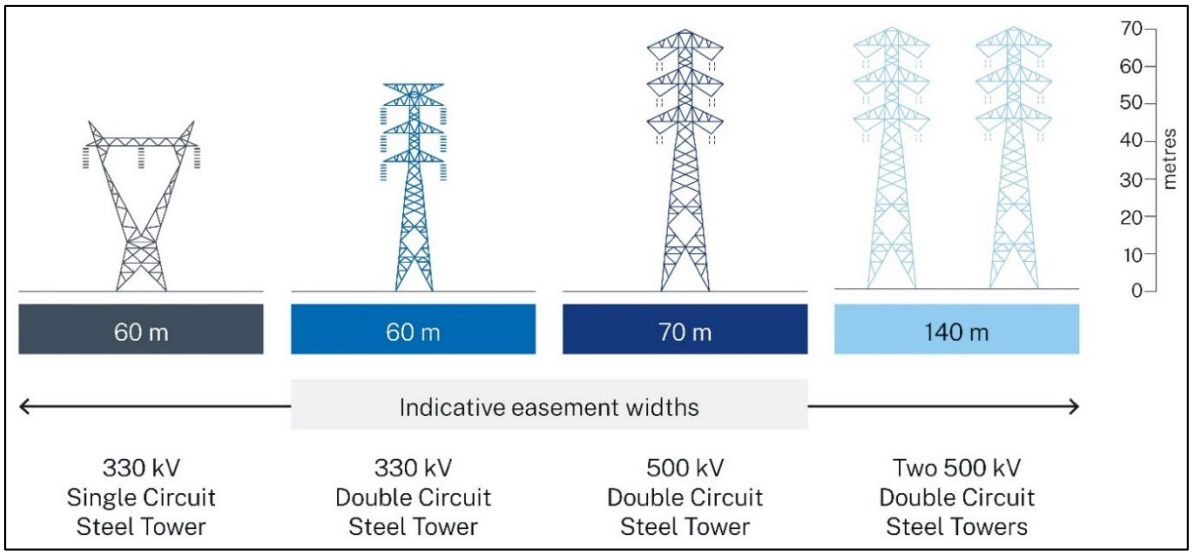


Figure 4 **Typical easement widths for APZ for 330kV and 500kV lines (source WSP).**

For the temporary workforce accommodation camps, PBP does not require a minimum APZ as the buildings are temporary in nature and are not categorised in the National Construction Code. However, PBP would require a setback providing safety and refuge for the occupants if a fire were to impact the site. The building types and setbacks will be determined during detailed design and will include an APZ from the buildings that provides for life safety of occupants. Proposed APZs for the workforce accommodation camps are provided in Appendix 8.

3.5.8 Bushfire Attack Levels

The BAL is a means of measuring the ability of a building to withstand attack from bushfire. The form of bushfire attack (wind, ember, radiant heat, direct flame contact) and the severity will vary according to the conditions (FDI, vegetation, slope and setback) for the assets being assessed.

To provide a better understanding of anticipated BALs commensurate with vegetation setbacks Blackash has provided a series of maps in the Appendices that illustrates radiant heat thresholds as they occur across the nominated switching stations, construction compounds and energy hub sites.

The BAL assesses the severity of a building's potential exposure to ember attack, radiant heat and direct flame contact, using increments of radiant heat expressed in kilowatts per square metre, which is the basis for establishing the requirements for APZs and for construction to improve protection of a building from potential attack by a bushfire, as defined in AS 3959:2018.

As required by AS3959:2018 and included in the site assessment methodology (see Section 3.4) within PBP, each asset's interface area was divided and classified accordingly by vegetation type, slope class and associated distances for BAL Flame Zone, BAL 40, BAL 29, BAL 19 and BAL 12.5. Each site boundary was used as a basis for identifying the required APZ to achieve a specific radiant heat threshold. Where vegetation is existing, it can be managed to achieve a required radiant heat level.

EnergyCo have determined the tolerable radiant heat threshold for the key project assets as ≤29kW/m2 (i.e. BAL-29). APZ setbacks commensurate with BAL-29 are provided within Appendices 4 to 8.

The BAL ratings are used as the basis for establishing the requirements for design and construction and identifying APZs to improve protection of a building or to determine the vulnerability of a building/structure to potential bushfire attack. The radiant heat levels and impacts are described in Figure 5.

Heat flux exposure	Description	AS 3959 construction level
N/A	Minimal attack from radiant heat and flame due to the distance of the building from the vegetation, although some attack by burning debris is possible. There is insufficient threat to warrant specific construction requirements.	BAL-LOW
≤12.5	Attack by burning debris is significant with radiant heat (not greater than 12.5kW/m²). Radiant heat is unlikely to threaten building elements (such as unscreened glass). Specific construction requirements for ember protection and accumulation of debris are warranted.	BAL-12.5
>12.5 ≤19	Attack by burning debris is significant with radiant heat flux (not greater than 19kW/m²) threatening some building elements (such as screened glass). Specific construction requirements for embers and radiant heat are warranted.	BAL-19
>19 ≤29	Attack by burning debris is significant and radiant heat flux (not greater than 29kW/m²) threatens building integrity. Specific construction requirements for ember and higher levels of radiant heat are warranted. Some flame contact is possible.	BAL-29
>29 ≤40	Radiant heat flux and potential flame contact could threaten building integrity.	BAL-40
>40	Significant radiant heat and significantly higher likelihood of flame contact from the fire front will threaten building integrity and result in significant risk to residents.	BAL-FZ

Figure 5 **Radiant Heat Levels**

For people, critical radiant heat levels are generally above 10kW. For built assets, including project infrastructure, the nominated tolerable radiant heat threshold of ≤29kW/m² (i.e. BAL-29) will be reviewed during detailed design.

4. Existing Environment and Bushfire History

4.1 Bushfire Risk Management Plans

In accordance with Part 3 Division 4 of the RF Act, Bush Fire Management Committees are established for each area of the state subject to bushfire risk. Each committee is required to prepare a Bushfire Risk Management Plans (BRMP). The project is covered by four BFMCs including:

- Cudgegong Bush Fire Management Committee (applies to Mid-Western Regional LGA)
- Orana Bush Fire Management Committee (applies to Dubbo Regional LGA)
- Castlereagh Bush Fire Management Committee (applies to the Warrumbungle LGA)
- Liverpool Range Bush Fire Management Committee (applies to the Upper Hunter LGA)

The typical/average climate in the BFMC areas is varied with warm to temperate conditions in the western and northern areas and temperate to cool at higher elevations. The Bush Fire Danger Period generally runs from October to the end of March however it is not unusual for this period to be extended. Prevailing weather conditions associated with the bush fire season in the BFMC areas are north-westerly to south-westerly winds with moderate to high temperatures and moderate levels of humidity. Dry lightning storms occur frequently during the bushfire season. Periods of higher temperatures and lower humidity lasting several days also occur during the bush fire season.

The BFMCs have a high number of bushfires each year:

- The Cudgegong BFMC area has on average 217 bushfires per year, of which one on average can be considered to be major fires.
- The Castlereagh BFMC area has on average 80 bushfires per year, of which 3 on average can be considered to be major fires.
- The Liverpool Range BFMC area has on average 300 bush fires per year, of which around three on average can be considered to be major fires.

The main sources of ignition in the BFMC areas are:

- lightning
- escape from legal burns
- farm machinery

- incendiaries
- campfires
- accidental ignitions by machinery, equipment and vehicles
- intentionally lit fires (arson), primarily around major population centres.

4.2 History of Bushfires

The broader landscape has a history of large bushfires. The most significant fires were 2011 – 2012 and 2016 – 2017. Appendix 2 shows the proximity of historically recorded bushfires to the study area. The Elong Elong area was the only recorded area not impacted by bushfires. Regardless of the fire history affecting the study area and the broader surrounding area, bushfires can occur at any time of the year. Table 2 summarises the bushfire prone nature of the land as described in Section 3.5.1. All parts of the study area can be subject to bushfire impact.

The Australasian Fire and Emergency Services Council (AFAC) Bushfires and Community Safety Position Paper (p. 3) outlines nationally agreed positions for the fire services which states that:

> *Bushfire loss can be reduced or avoided in some cases but cannot be entirely prevented. A balance needs to be struck between measures taken to reduce or avoid harm and loss due to bushfire, and the protection of other values.*

The position paper (p. 3) recognises that

> *Bushfire is a normal part of Australia's natural environment, particularly in eucalypt forests and grasslands. However, the frequency and intensity of bushfires varies throughout the landscape and the seasons. Bushfires are a common occurrence during the drier periods of the year in most places.*

And that

> *Bushfires of low or moderate intensity often pose little threat to life, property and community assets, but the potential for changes in wind direction can be a significant hazard. However, bushfires that burn in heavy fuels, steep terrain or on hot, dry and windy days often spread rapidly, crown in forests, produce powerful convection columns and create extensive spot fires ahead of the fire front, often making their control impossible until weather conditions moderate.*
>
> *As the Fire Danger Rating reaches 'Extreme', bushfires are often described as 'firestorms' and become impossible to control. When the Fire Danger Rating*

approaches 'Catastrophic', the risk of serious injury or death to people in the path of a bushfire increases significantly, and many properties and other community infrastructure can become difficult or impossible to defend.

The NSW planning framework accepts this fundamental premise and PBP is based on credible worst-case fires affecting the project. The response to potential fires affecting the project are determined by the risk management and Bushfire Protection Measures contained within PBP that are incorporated into the detailed design of the project. PBP does not seek to stop fires, rather, it recognises the fundamental risk of bushfire affecting new development and puts in place minimum requirements to provide a tolerable approach to risk management. For critical infrastructure, it is up to the asset owner to determine the tolerable risk. Detailed work is being completed which will be included with design details.

4.3 Electricity caused bushfires

Bushfire risk and electrical infrastructure is well recorded. The following is a summary of Miller et al (2017), *Electrically caused wildfires in Victoria, Australia are over-represented when fire danger is elevated*. Electrical distribution lines and associated infrastructure have been associated with the cause of many wildfires with particular note being Victoria. NSW and the study area are subject to prolonged bushfire danger periods and extreme fire weather conditions. The State of Victoria, Australia, has a long history of numerous large-scale wildfire events attributed to the electricity distribution network with the majority occurring on days with extreme fire weather conditions. Examples include the February 12, 1977 and "Ash Wednesday", February 16, 1983 fires. More recently, six of the major fires on "Black Saturday", February 7, 2009, were caused by faults in the electrical distribution network. These wildfires collectively burnt over 270 000 ha, caused the death of 159 people and destroyed 1832 homes.

With the impact of climate change expected to increase the frequency and severity of peak fire danger days around the world, understanding the factors that influence the occurrence of such fires is critical to reducing their impact, particularly in landscapes not previously prone to such fires.

Electricity infrastructure can ignite wildfires through arcs, molten and combusting metal particles that are expelled when vegetation contacts wires, and from burning insulation fluids in equipment such as transformers and re-closers. When these small but very hot sources come in contact with fuel, such as grass and leaf litter, they can ignite a fire. If the conditions of the day are conducive to fire spread such ignitions can escalate into wildfires with significant damage potential.

Of note the research concludes that electrical fires have a propensity to become large fires compared to those from most other fire ignition causes, because they are more likely to occur when conditions are conducive for rapid fire spread. As such, the risk of bushfire ignition on days of elevated fire danger is high and the consequences are high. The management of risk is addressed in Section 5 of this paper.

5. Bushfire Risk Assessment – Construction

5.1 Overview

This section describes the bushfire risk assessment during construction of the project. Where relevant, the discussion on the construction bushfire risk assessment has been separated into two parts (with subheadings) as follows:

1) Risk posed by bushfire to the project (i.e. Where a fire originating from outside the project construction area threatens the area under construction (including associated site and accommodation facilities), and

2) Risk posed by bushfire ignited by construction activities.

Where the risk posed by bushfire can be clearly articulated without the need for separate discussion, consolidated commentary has been provided.

5.2 Potential Risk Considerations

The landscape potential of fires impacting the construction area during construction are significant. The broader landscape has significant potential to carry large scale and intense bushfires. Wind and topography of the land create the potential path that a fire would take. The topography of the land through which the project infrastructure is located and where the transmission line traverses is typically level or gently undulating within a predominantly open landscape. Fires which occur in this landscape have the potential to spread in the direction of the wind with the dominant fire spread likely from the north-west, west and south-west.

The area surrounding the construction area is designated as being BFPL with a history of large-scale bushfire within the bounds of the project or proximity of the project. Fires can approach any of the project infrastructure from any aspect with potential for small fires and large fires impacting the site.

Design and construction standards assist with fire risk management by ensuring network construction quality. This builds resilience of the network to unplanned breakdown and therefore, fire start risk. This is incorporated into the network design, procurement, construction, and commissioning phases.

In addition to the main sources of ignition in Section 4.2, the potential sources of ignition of bushfires resulting from the construction of the project include:

- accidental ignitions such as cigarettes
- construction equipment including bulldozers, excavators and cranes
- motor vehicles
- vegetation removal including mulching
- hot works such as welding and grinding
- electrical faults in equipment
- chemical fires
- activities undertaken at construction compounds and accommodation camps
- arson
- blasting (if required).

5.3 Risk posed by bushfire for project elements

5.3.1 Construction compounds

Hot works undertaken within the construction compounds including equipment maintenance which includes welding and grinding and vegetation management such as mechanical slashing can produce sparks which have the capacity to spread for some distance on the wind, resulting in an extreme level of risk of ignition of cured (dry) vegetation. To reduce the level of risk, each of the construction compounds would be managed as an Inner Protection Area (IPA) or as a fuel free area. Precaution would be used during all external hot works with shielding and a water supply (such as with an appropriately sized water fire extinguisher or fire fighting pumps) provided close to the works.

External cooking fires (such as BBQ), electrical faults and the inappropriate discarding of lit cigarettes can cause ignition of grassland within and external to the construction compound. This risk can be managed in accordance with RFS Total Fire Ban requirements and a water supply (such as with an appropriately sized water fire extinguisher) provided. Fuel free areas within the construction compounds would be provided that would not provide for ignition of materials.

APZs, established during the construction phase, will be provided to the construction compounds to mitigate the risk of fire spreading from these locations and fire impacting the compounds.

Table 3 Risk Analysis using NERAG matrix (Section 3.2 of this report)

Action	Likelihood	Consequence	Risk without mitigation	Mitigation Measure	Residual Risk
Ignition of vegetation by sparks from hot works and/or external cooking fires.	Likely	Major	**Extreme**	An APZ will be provided in accordance with Appendix 4 of Planning for Bushfire Protection 2019 and the NSW Rural Fire Service's document Standards for asset protection zones. Firefighting equipment will be maintained and made available for use during the construction phase in accordance with *Planning for Bushfire Protection 2019* (RFS 2019*)* including the following: — a minimum static water supply tank of 20,000 litres will be provided at the construction compounds for firefighting purposes — 38 millimetres metal Storz outlet with a gate or ball valve will be provided as an outlet on each of the tanks	**High**

Action	Likelihood	Consequence	Risk without mitigation	Mitigation Measure	Residual Risk
				— non-combustible water tank and fittings will be used. — firefighting equipment (inclusive of a slip on unit) will be maintained at and/or accessible to all active construction site personnel during the declared bushfire danger season and site personnel trained in its use.	

With the proposed protection measures in place, the potential bushfire risk to the proposed construction compounds is reduced to high.

5.3.2 Worker accommodation camps

Risk to workers accommodation camps includes bushfire activity within the area isolating crews and impacting on life safety.

Buildings within the workforce accommodation camps would be constructed in accordance with AS3959 with commensurate APZs. APZs would be provided to the workforce accommodation camps to mitigate the risk of fire spreading from these locations and fire impacting the workforce accommodation camps.. A detailed *Bushfire Emergency Management and Evacuation Plan* would be developed and implemented for the two workforce accommodation camps that would focus on life safety and leaving isolated bushfire prone areas when the fire weather risk is too high (i.e. above high) or when uncontrolled fires are burning in the landscape that could impact the workforce accommodation camps.

Table 4 Risk Analysis using NERAG matrix (Section 3.2 of this report)

Action	Likelihood	Consequence	Risk without mitigation	Mitigation Measure	Residual Risk
Bushfire Activity originating from outside the camp isolating crews and impacting life safety Ignition of vegetation by sparks from external cooking fires.	Likely	Catastrophic	**Extreme**	Where required Workers accommodation camps, will be provided in accordance with AS3959-2018 Construction of Buildings in Bushfire Prone Areas. An APZ will be provided in accordance with Appendix 4 of Planning for Bushfire Protection 2019 and the NSW Rural Fire Service's document Standards for asset protection zones. Firefighting equipment will be maintained and made available for use during the construction phase in accordance with *Planning for Bushfire Protection 2019* (RFS 2019) including the following: — a minimum static water supply tank of 20,000 litres will be provided at the workers accommodation camps for firefighting purposes	**Extreme**

Action	Likelihood	Consequence	Risk without mitigation	Mitigation Measure	Residual Risk
				— 38 millimetres metal Storz outlet with a gate or ball valve will be provided as an outlet on each of the tanks — non-combustible water tank and fittings will be used. The bushfire emergency management and evacuation plan will be prepared in accordance with NSW Rural Fire Service's Guide to Developing a Bushfire Emergency Management Plan and meet the requirements of Australian Standard AS3745-2010 Planning for Emergencies in facilities.	

The risk to personnel in the workers accommodation camps following implementation of recommended mitigation measures is still considered extreme as a result of consequence to life safety.

5.3.3 Construction activities within the project corridor

Risk posed by bushfire ignited by construction activities

Heavy construction equipment used for vegetation removal including bulldozers, and excavators for excavating pads and drilling bore holes can create situations where these activities can give off sparks when steel blades encounter rock, resulting in a high level of risk of ignition of vegetation. This risk can occur over a wider area from the machine operational area.

To reduce the likelihood and thus level of risk, the use of this equipment in areas where rock is known to occur would be accompanied by a fire-fighting appliance such as a 'slip-on' fire-fighting unit or tanker trailers. This work would also need to include restriction and/or prevention of certain activities that present bushfire risks on days with a fire danger rating of equal to or greater than 'high' based on a risk assessment endorsed by an appropriately qualified person being completed.

Controlled blasting may be used in some locations to loosen and break up existing rock to allow for creation of transmission tower pads and or other project infrastructure. Blasting should not be undertaken on Total Fire Ban days. Where blasting is undertaken, to reduce the level of risk of ignition of the surrounding vegetation, the contractor would be required to ensure first response fire-fighting resources (slip on tanks) are available before blasting occurs.

Motor vehicle exhaust systems may ignite grassland vegetation through hot engines, exhaust and particle emission. Diesel powered trucks with pollution control devices in the exhaust system have the potential to emit burning diesel particles which ignite grassland vegetation and forest ground fuels, resulting in a high level of risk of ignition of vegetation. These risks can be managed by provision of water fire extinguishers in vehicles, and communications protocols for escalating fires.

Table 5 Risk Analysis using NERAG matrix (Section 3.2 of this report)

Action	Likelihood	Consequence	Risk without mitigation	Mitigation Measure	Residual Risk
Ignition of grass by motor vehicle exhausts	Likely	Major	**Extreme**	Water extinguishers in vehicles. Communications Protocols.	**High**
Ignition of vegetation by sparks from construction equipment and bulldozer blades and blasting rock operations	Likely	Major	**Extreme**	Hot work (activities involving high temperatures) and fire risk work (activities involving heat or with the potential to generate sparks) will be managed with measures including suspension of activities	**High**

Action	Likelihood	Consequence	Risk without mitigation	Mitigation Measure	Residual Risk
				on days of elevated fire danger. Firefighting equipment will be maintained and made available for use during the construction phase inclusive of: — a slip-on unit which will be maintained at and/or accessible to all active construction site personnel during the declared bushfire danger season and site personnel trained in its use.	

The risk of fire starting and spreading following mitigation measures is reduced to high.

Risk posed by bushfire to the project

Significant potential exists for fires to start that are not associated with the project. These fires have potential to run into the construction area, isolating the construction crews and causing bushfire attack on vulnerable assets.

A detailed *Bushfire Emergency Management and Evacuation Plan* would be developed and implemented for the construction area that would focus on life safety and leaving isolated bushfire prone areas when the fire weather risk is too high (i.e. above high) or when uncontrolled fires are burning in the landscape that could impact construction areas.

During the bushfire danger period, this risk would be managed by a range of actions to monitor the weather and any ignition that starts within proximity to the project, in line with the *Bushfire Emergency Management and Evacuation Plan*. Any fires that have potential to isolate or

impact the site would trigger the *Bushfire Emergency Management and Evacuation Plan* for construction and or operation. This risk can be managed as detailed below in Table 6.

The *Bushfire Emergency Management and Evacuation Plan* would outline actions to take if to notify emergency services in the case of a fire impacting the construction area.

Table 6 Risk Analysis using NERAG matrix (Section 3.2 of this report)

Action	Likelihood	Consequence	Risk without mitigation	Mitigation Measure	Residual Risk
Fire Activity within the construction area isolating crews and impacting life safety	Likely	Catastrophic	**Extreme**	A construction emergency response plan will be developed to ensure evacuation and emergency response access is maintained during the construction period. This will include a comprehensive bushfire emergency management and evacuation plan which will include details of emergency egress. The bushfire emergency management and evacuation plan will be prepared in accordance with NSW Rural Fire Service's Guide to Developing a Bushfire Emergency Management Plan and meet the	**Extreme**

Action	Likelihood	Consequence	Risk without mitigation	Mitigation Measure	Residual Risk
				requirements of Australian Standard AS3745-2010 Planning for Emergencies in facilities.	

The risk to personnel in the construction area following mitigation measures is still considered to be extreme as a result of life safety consequences.

6. Bushfire Risk Assessment – Operation

6.1 Overview

This section describes the bushfire risk assessment during operation of the project. Where relevant, the discussion on the operational bushfire risk assessment has been separated into two parts (with subheadings) as follows:

1) Risk posed by bushfire to the project (i.e. Where a fire originating from outside the operation area threatens the transmission infrastructure), and

2) Risk posed by bushfire ignited by transmission infrastructure

Where the risk posed by bushfire can be clearly articulated without the need for separate discussion, consolidated commentary has been provided.

6.2 Switching stations/ Energy Hubs APZs

The concept design for the project comprises the construction of two energy hubs (Merotherie and Elong Elong), 13 switching stations along the 330kV network for generation connections and a switching station at New Wollar to connect the transmission line to the NEM.

The energy hubs and switching stations include switchyards, transformers, synchronous condensers, potential battery storage, a maintenance facility and other support equipment and infrastructure.

Using the methodology described in Section 3, an analysis of the bushfire risk was undertaken for each of the individual infrastructure elements. The switching stations and energy hubs would be provided with APZs in accordance with Appendix 4 and 6 and established during the construction phase. Buildings would be provided in accordance with AS3959 BAL-29 with commensurate APZs. APZs would be provided to the switching stations and energy hubs and cyclically managed to mitigate the risk of fire spreading from these locations and fire impacting the switching stations and energy hubs. The risk to personnel during the operation following mitigation measures is considered low as these would not be occupied or would be occupied infrequently.

Table 5 Risk Analysis using NERAG matrix (Section 3.2 of this report)

Action	Likelihood	Consequence	Risk without mitigation	Mitigation Measure	Residual Risk
Bushfire impact to switching stations and energy hubs.	Likely	Major	**Extreme**	Energy hubs, and switching stations, will be designed and constructed in accordance with AS3959-2018 *Construction of Buildings in Bushfire Prone Areas,* BAL-29. An APZ will be established at construction and managed during operation in accordance with Appendix 4 and 6 of this report and the requirements within Appendix 4 of Planning for Bushfire Protection 2019 and the NSW Rural Fire Service's document Standards for asset protection zones. Access for firefighting appliances will be provided in accordance with Section 2 of the NSW Rural Fire Service Fire Trails Standards.	**High**

The risk to personnel in the construction area following mitigation measures is reduced to high.

6.3 Transmission Lines

Risk posed by bushfire ignited by transmission lines

The distribution of electricity via high voltage transmission lines and associated equipment has the potential to cause ignition of bushfire fuels, either within or adjoining the transmission line easement. Electricity infrastructure can ignite wildfires through arcs, molten and combusting metal particles that are expelled when vegetation contacts wires, and from burning insulation fluids in equipment such as transformers and re-closers. When these small but very hot sources come in contact with fuel, such as grass and leaf litter, they can ignite a fire. Ignition sources which can be attributable to high voltage transmission lines and associated equipment include:

- trees or tree branches falling/touching conductors and bird strikes
- equipment malfunction – transmission line failure including damage caused by high winds, lightning strike or mechanical damage (i.e. aircraft strike)
- wind causing transmission lines to contact each other
- arc to ground and arc between conductors caused by ionised particles in dense bushfire smoke
- heat causing power lines to sag and connect with the ground/vegetation/structures
- lightning strikes
- human error – faulty installation
- failure of power line including breakage of wires, poles, cross arms, insulators and associated equipment
- pole-top fires caused by dust build up on insulators, causing arcing from the conductor to the tower/cross arm
- electrically induced fire – current or voltage transfer due to fault and failure of the earthing system at transmission line towers.

As discussed in Section 4.3, if one of these ignition sources occurred especially during prolonged drought conditions when combustible fuels are available, the risk of ignition is high, necessitating monitoring and rapid response to any incident/emergency that is likely to cause line failure and therefore the potential for fire ignition within the bushfire prone vegetation.

EnergyCo would be required to develop and implement various strategies to prevent or minimise the occurrence of fire ignition from its energy network assets. Strategies related to bushfire mitigation include:

- Identification of hazardous bushfire areas that the transmission network traverses, focusing on
    - Category 1 Bushfire Prone Land
    - Category 3 Bushfire Prone Land
    - Category 2 Bushfire Prone Land
- asset condition monitoring (inspections) - strategic pre-summer aerial inspections of high risk network locations
- vegetation management
- asset maintenance and refurbishment
- network planning
- design and construction standards
- fire start reporting and analysis

Table 6 Risk Analysis using NERAG matrix (Section 3.2 of this report)

Action	Likelihood	Consequence	Risk without mitigation	Mitigation Measure	Residual Risk
Bushfire ignited by transmission lines	Likely	Major	**Extreme**	Asset condition monitoring (inspections) - strategic pre-summer aerial inspections of high risk network locations Vegetation management Asset maintenance and refurbishment Network planning	**High**

Action	Likelihood	Consequence	Risk without mitigation	Mitigation Measure	Residual Risk
				Design and construction standards Fire start reporting and analysis	

The risk to personnel in the construction area following mitigation measures is reduced to high.

Risk posed by offsite bushfire impacting transmission lines

There is a high probability that the transmission lines could be impacted by a bush/grass fire when ignition occurs in any unmanaged vegetation during periods of high fire danger, when excessive dry (cured) fuel is available and weather conditions result in high temperatures, low humidity and strong winds travelling across the landscape from the northwest, west and southwest direction.

The risk to the transmission lines under these conditions would be dependent on the scale (size) of the fire. The risk from large scale fire events would be high to extreme. However, the transmission lines would be constructed within easements which would be cleared of vegetation / maintained in line with the following principles:

- Vegetation with growth heights of two metres and above would be removed during operation.
- In relation to the transmission lines proposed, the vertical clearance distances required are expected to be:
    - nine metre clearance between vegetation on the ground and maximum conductor sag point for the 330kV line: and
    - eleven metre clearance between vegetation on the ground and maximum conductor sag point for the 500kV line.
- For the 60 metre wide 330kV easement, vegetation clearing would generally only be required for the centre 60 metre wide section (which includes the centreline cleared area, inner and outer maintenance zones combined). Vegetation which would

encroach within the easement that would encroach on these clearance distances would be removed.

- For the 70 metre wide 500kV easement, vegetation clearing would be required for whole of the 70 metre wide easement (which includes the centreline cleared area, inner and outer maintenance zones combined). Vegetation which would encroach within the easement that would encroach on these clearance distances would be removed.
- Hazard/high risk trees located inside and outside the transmission line easement would be removed. Hazard/high risk trees are defined as any tree or part of a tree that if it were to fall would infringe on the vegetation clearance requirements at maximum conductor sag of the transmission lines. Hazard/high risk trees would be confirmed based on the final design (considering the transmission line conductor profile) and following qualified arborist assessment of the tree. All hazard/high risk trees confirmed as posing a risk to the corridor would be removed.

Table 7 Risk Analysis using NERAG matrix (Section 3.2 of this report)

Action	Likelihood	Consequence	Risk without mitigation	Mitigation Measure	Residual Risk
Bushfire ignited by transmission lines	Likely	Major	**Extreme**	Asset condition monitoring (inspections) - strategic pre-summer aerial inspections of high risk network locations Vegetation management Asset maintenance and refurbishment Network planning Design and construction standards Fire start reporting and analysis Access for firefighting appliances will be provided in accordance with Section 2 of the NSW Rural Fire Service Fire Trails Standards.	**High**

The risk to personnel in the construction area following mitigation measures is reduced to high.

7. Emergency egress and evacuation

There are no identified difficulties in accessing and suppressing fires that could occur within the operation area. The overall operation area is characterised by gently undulating grasslands and some discrete areas of woodland and forest vegetation. The areas surrounding the project are broken up by farmed areas, roads, powerline easements and other small breaks providing a range of suppression options (both land and aerial) based on specific conditions during a bushfire.

The project provides for safe access for safe firefighting operations within the APZs. Water within key locations would be provided as part of the detailed design for construction and operation. The project has existing and new connections to the surrounding road networks that service the region. This enables the effective distribution of traffic from the project to the wider road network. The *Bushfire Emergency Management and Evacuation Plan* would outline a series of trigger points for the construction and operational phase of the project to provide a system that does not expose personnel to unreasonable risks.

The national position of fire agencies is that *the safest action to protect life is for people to be away from the bushfire or threat of bushfire*[2]. This is underpinned by comprehensive emergency management arrangements and operational fire management systems from the RFS that focus on the provision of information, advice, and warnings to assist communities to make informed decisions prior to the impact of bushfire and if necessary be out of Bushfire Prone Areas well before the impact of fire.

Within the NSW Bushfire planning system and PBP, there is a hierarchy of controls in place to mitigate bushfire risk to communities. The Bushfire Protection Measures work in unison to enhance resilience by the provision of minimum standards for new development while reducing the vulnerability of negative impacts on occupants (including fire fighters) of these areas.

[2] Australasian Fire and Emergency Services Authorities Council. (2019) *Bushfires and Community Safety Position* (AFAC Publication No. 2028)

The evacuation options that would be outlined in the *Bushfire Emergency Management and Evacuation Plan* provide flexibility and alternate routes to take if for some reason the primary route to a safer location is blocked.

8. Summary – compliance with Planning for Bushfire Protection

This section evaluates the project against the bushfire strategic planning requirements of PBP and is shown in Table 8.

Table 8 Strategic bushfire study - compliance with PBP Table 4.2.1

Issue	Detail	Assessment considerations	Evidence	Suitable site
Bush fire landscape assessment	A bushfire landscape assessment considers the likelihood of a bush fire, its potential severity and intensity and the potential impact on life and property in the context of the broader surrounding landscape.	The bushfire hazard in the surrounding area including: • Vegetation • Topography • Weather	Bush Fire Risk Management Plan review, acceptable solution asset protection zones for infrastructure, work compounds and construction camps and consideration of BPMs.	**YES**
		The potential fire behaviour that might be generated based on the above	Potential fires in the landscape have been considered, and commensurate APZs have been developed.	**YES**
		Any history of bush fire in the area.	Appendix 2 shows fire history within the vicinity of the project. Asset Protection Zones and other bushfire measures in combination have been applied to the project in accordance with Planning for Bushfire Protection 2019.	**YES**

Issue	Detail	Assessment considerations	Evidence	Suitable site
		The difficulty in accessing and suppressing a fire, the continuity of bush fire hazards or the fragmentation of landscape fuels and the complexity of the associated terrain.	No identified difficulties for accessing and suppressing the type of fires that may occur here. Gently undulating terrain, good local road network, close to major urban development etc.	**YES**
Land use assessment	The land use assessment will identify the most appropriate locations within the masterplan area or site layout for the proposed land uses.	The risk profile of different areas of the development layout based on the landscape study	The risk profile of the project has been considered with a range of mitigation measures able to be implemented to reduce the risk, in most circumstances to tolerable levels.	**YES**
		The most appropriate siting of different land uses based on risk profiles within the site (i.e. not locating development on ridge tops, SFPP development to be located in lower risk areas of the site); and	The project is on lower bushfire risk areas with a range of risk management strategies able to be implemented, including the variety of lot sizes and APZs to be managed in perpetuity.	**YES**
Access and egress	A study of the existing and proposed road networks both within and external to the masterplan area or site layout.	The capacity for the proposed road network to deal with evacuating residents and responding emergency services, based on the existing and proposed community profile;	The access roads/trails provide connections into the public road network which meet the requirements of PBP.	**YES**

Issue	Detail	Assessment considerations	Evidence	Suitable site
		The location of key access routes and direction of travel; and	The access roads/trails provide connections into the public road network which meet the requirements of PBP.	**YES**
		The potential for development to be isolated in the event of a bush fire.	The access roads/trails provide connections into the public road network which meet the requirements of PBP.	**YES**
Emergency services	An assessment of the future impact of new development on emergency services.	Consideration of the increase in demand for emergency services responding to a bush fire emergency including the need for new stations/brigades; and	No new emergency services generated by this development alone.	**YES**
		Impact on the ability of emergency services to carry out fire suppression in a bush fire emergency.	Insignificant negative impact. May have positive impact with more water supplies, and active land management.	**YES**
Infrastructure	An assessment of the issues associated with infrastructure and utilities.	The ability of the water system to deal with a major bush fire event in terms of pressures, flows, and spacing of hydrants; and	To be considered at future stage	**YES**

Issue	Detail	Assessment considerations	Evidence	Suitable site
		Life safety issues associated with fire and proximity to high voltage power lines, natural gas supply lines etc.	No life safety issues identified.	**YES**
Adjoining land	The impact of new development on adjoining landowners and their ability to undertake bush fire management.	Consideration of the implications of a change in land use on adjoining land including increased pressure on BPMs through the implementation of Bush Fire Management Plans.	No significant negative impact identified.	**YES**

9. Recommended management and mitigation measures

9.1 Management

Environmental management for construction of the project would be carried out in accordance with a Construction Environmental Management Plan(CEMP). Hazards and risks would be managed in accordance with the Network Operator's Safety Management system, policies and guidelines. This would seek to avoid, to the greatest extent possible, risks to public safety.

A comprehensive *Bushfire Emergency Management and Evacuation Plan* would be prepared as part of the construction and operation emergency response plan for the project. A bushfire emergency management and evacuation plan would be prepared in accordance with NSW Rural Fire Service's *Guide to Developing a Bushfire Emergency Management Plan* and meet the requirements of Australian Standard *AS3745-2010 Planning for Emergencies in facilities* and would include:

- protocols for the relocation of workers to nominated safe refuge zones during a bushfire emergency, either within or remote to the work zone (Bushfire Emergency and Evacuation Plan (BEEP)
- protocols for the management of bushfire risk and fuel management during construction and operation. This would include the restriction and/or prevention of certain activities that present bushfire risks on days with a fire danger rating of equal to or greater than 'high', and as directed by relevant state authorities
- training to inform workers of bushfire risks and preventative actions, including risks associated with the operation (and maintenance) of vehicles, plant and equipment.

The CEMP would also include strategies and measures for:

- management of hazardous materials and dangerous goods
- management of other hazards and risks to the general public and the environment.

9.2 Mitigation measures

The measures that would be implemented to mitigate potential impacts from hazards and risks based on the assessment in Sections 5 and 6 are listed in Table 9.

Table 9 Proposed mitigation measures

Ref	Bushfire Risk	Mitigation measures	Timing	Applicable location(s)
BF1	Exposure of energy assets to radiant heat beyond the design tolerance of the asset	Asset Protection Zones (APZs) for switching stations and energy hubs (including the maintenance facility) will be established in accordance with the requirements of the NSW Rural Fire Service's documents *Planning for Bushfire Protection 2019* (Appendix 4) and *Standards for asset protection zones.*	Pre-construction/construction	Key project assets in the operational area that require protection from the impact of radiant heat and direct flame contact associated with a bushfire.
BF2	Exposure of energy assets to radiant heat beyond the design tolerance of the asset	Energy hubs, and switching stations, will be designed and constructed in accordance with BAL-29 in accordance with *AS3959-2018 Construction of Buildings in Bushfire Prone Areas*.	Pre-construction/ construction	Operation area
BF3	Insufficient access to the construction and operation area for fire fighting	Access for firefighting appliances will be provided in accordance with Section 2 of the *NSW Rural Fire Service Fire Trails Standards*.	Pre-construction/ construction/ operation	All locations

Ref	Bushfire Risk	Mitigation measures	Timing	Applicable location(s)
BF4	Bushfire risk from construction	Hot work (activities involving high temperatures) and fire risk work (activities involving heat or with the potential to generate sparks) will be undertaken with appropriate safeguards to minimise the risk of ignition and spread of fire from construction activities, including suspension of hot work and fire risk work on days of elevated fire danger.	Construction	All locations
BF5	Bushfire risk during construction	Firefighting equipment will be maintained and made available for use during the construction phase in accordance with *Planning for Bushfire Protection 2019* (RFS 2019) including the following: — static water supply tanks with a minimum volume of 20,000 litres (each) will be provided at the construction compounds and workforce accommodation camps for firefighting purposes	Construction	All locations

Ref	Bushfire Risk	Mitigation measures	Timing	Applicable location(s)
		— 38 millimetre metal Storz outlets with a gate or ball valve will be provided as an outlet on each of the tanks — non-combustible water tanks and fittings will be used. — firefighting equipment (inclusive of a slip on unit) will be maintained at and/or accessible to all active construction site personnel during the declared bushfire danger season and site personnel trained in its use.		
BF6	Bushfire risk during operation	The project APZ will be established at construction and managed during operation in accordance with Appendix 4 of *Planning for Bushfire Protection 2019* and the NSW Rural Fire Service's document Standards for asset protection zones.	Operation	All locations

10. References

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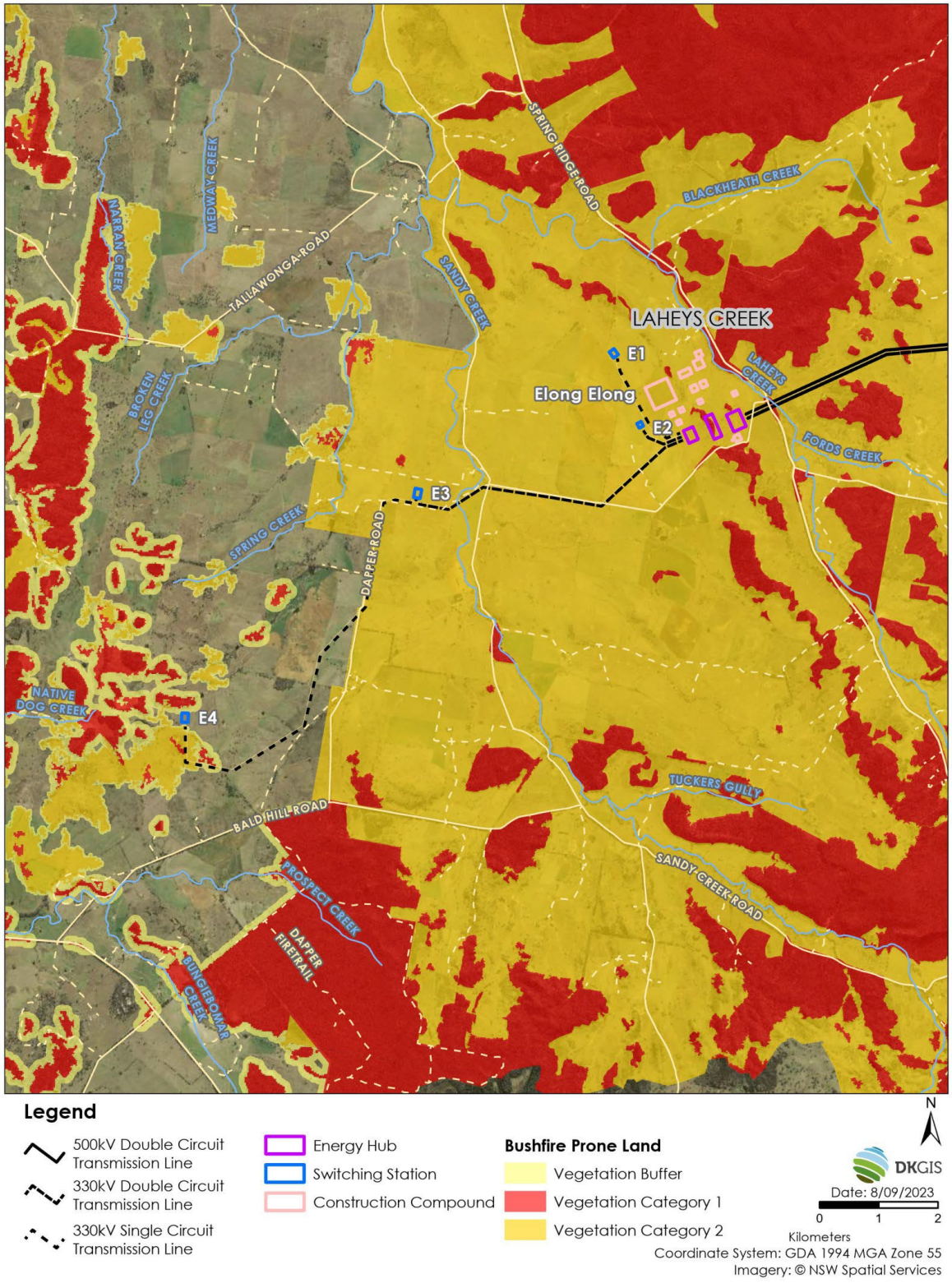
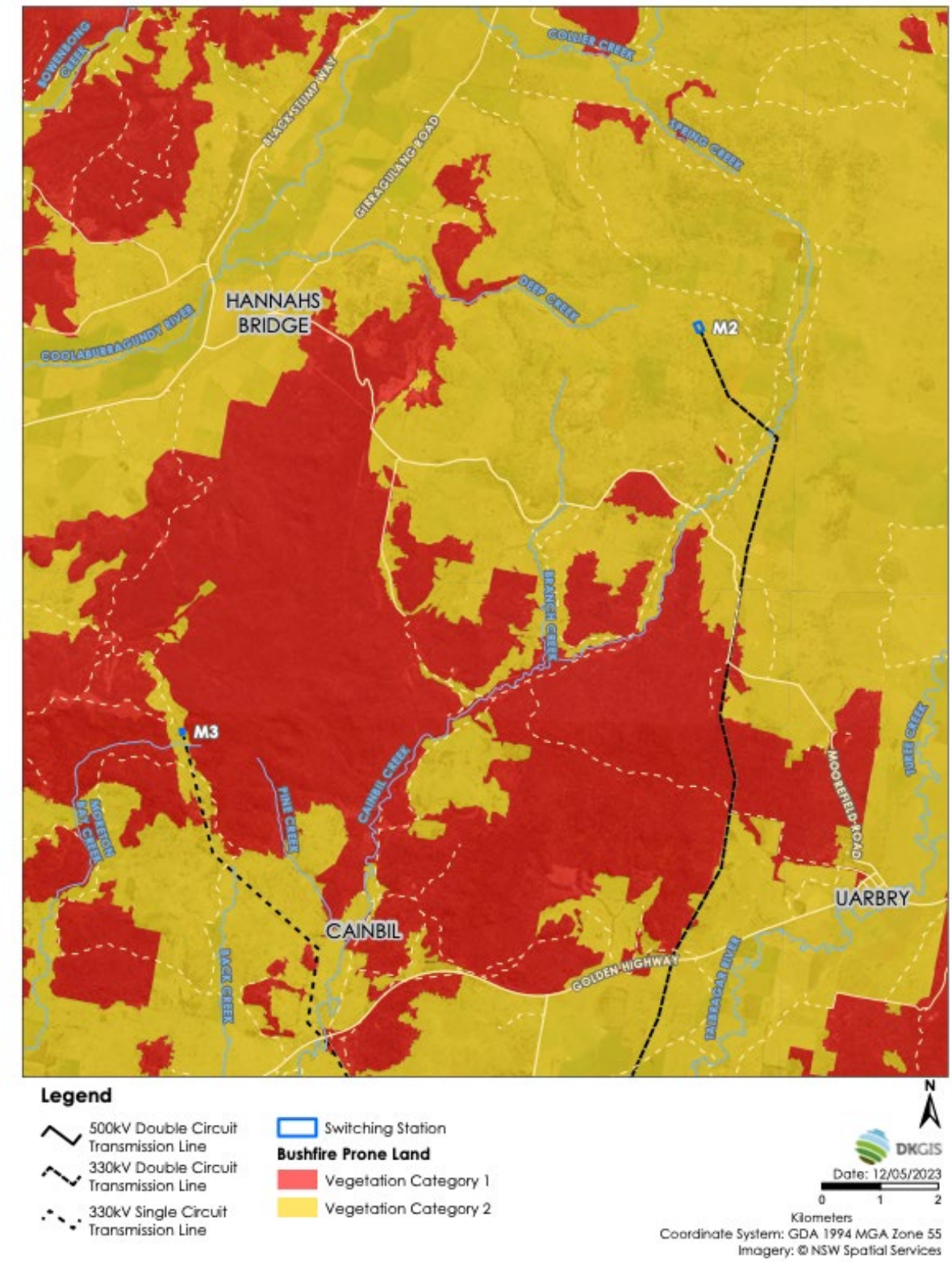
NSW Rural Fire Service (2019) Planning for Bushfire Protection: A Guide for Councils, Planners, Fire Authorities, Developers and Homeowners. Australian Government Publishing Service, Canberra

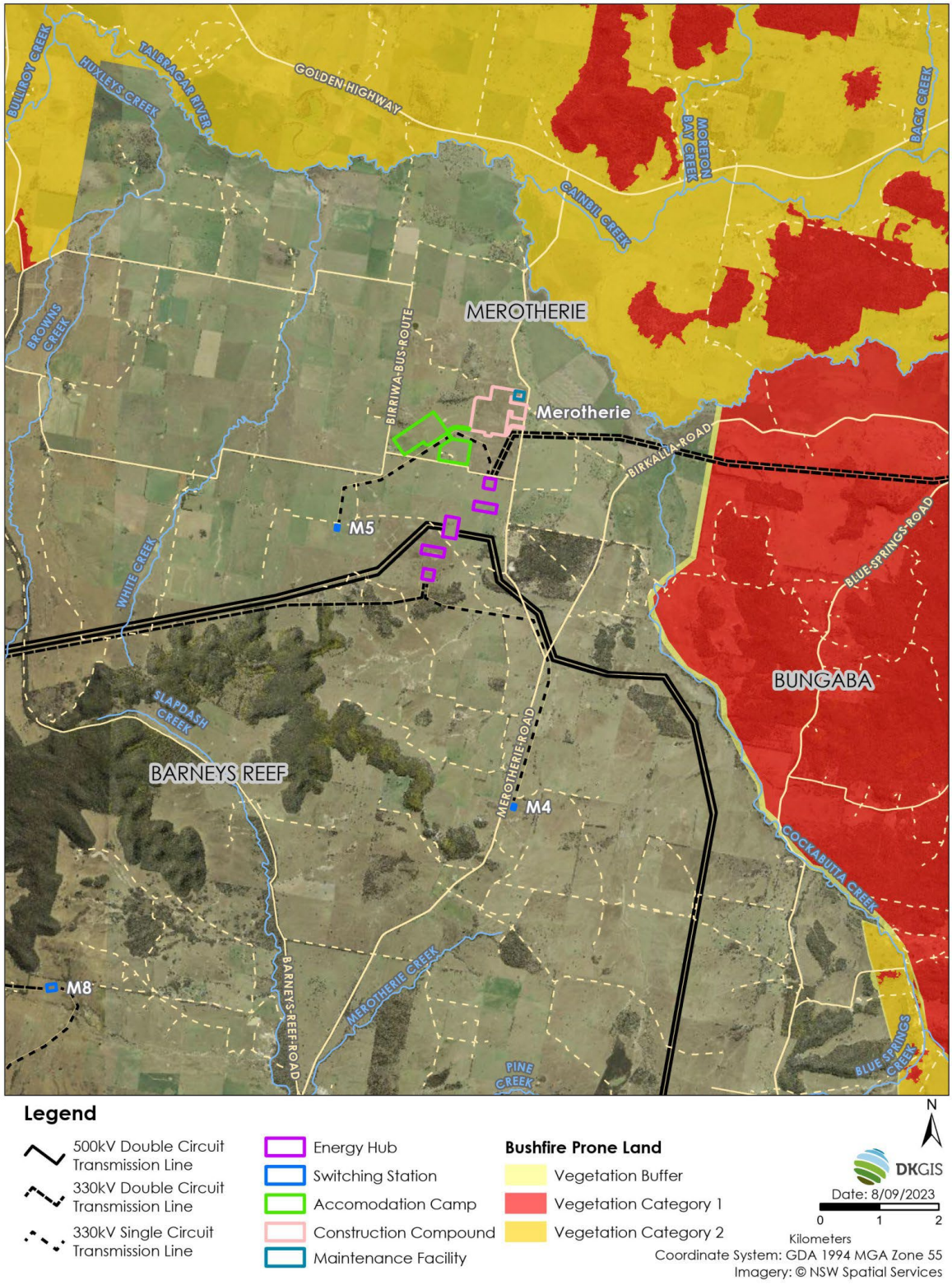
Appendix 1 - Bushfire Prone Land



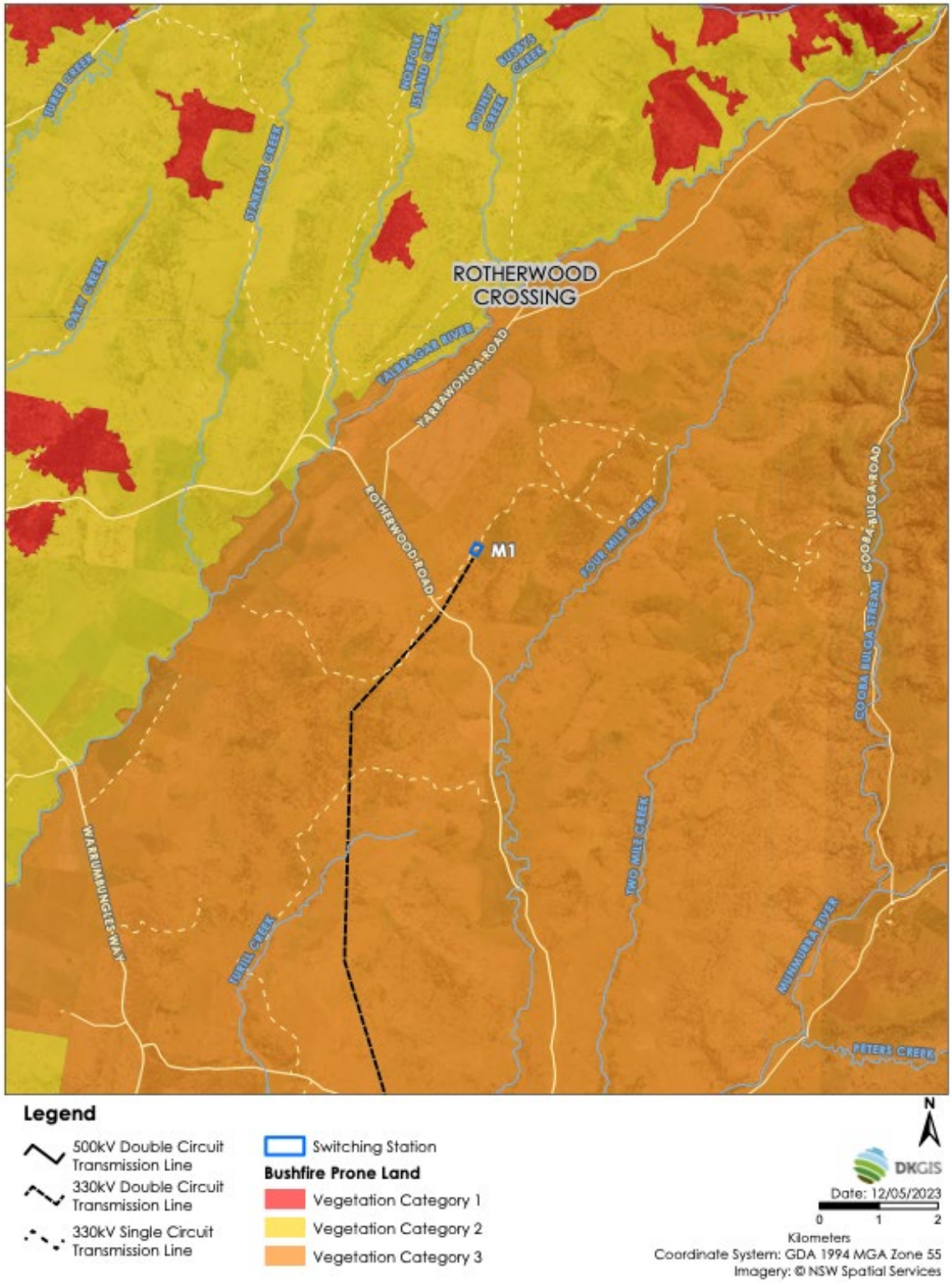
Bushfire Prone Land Map Elong Elong



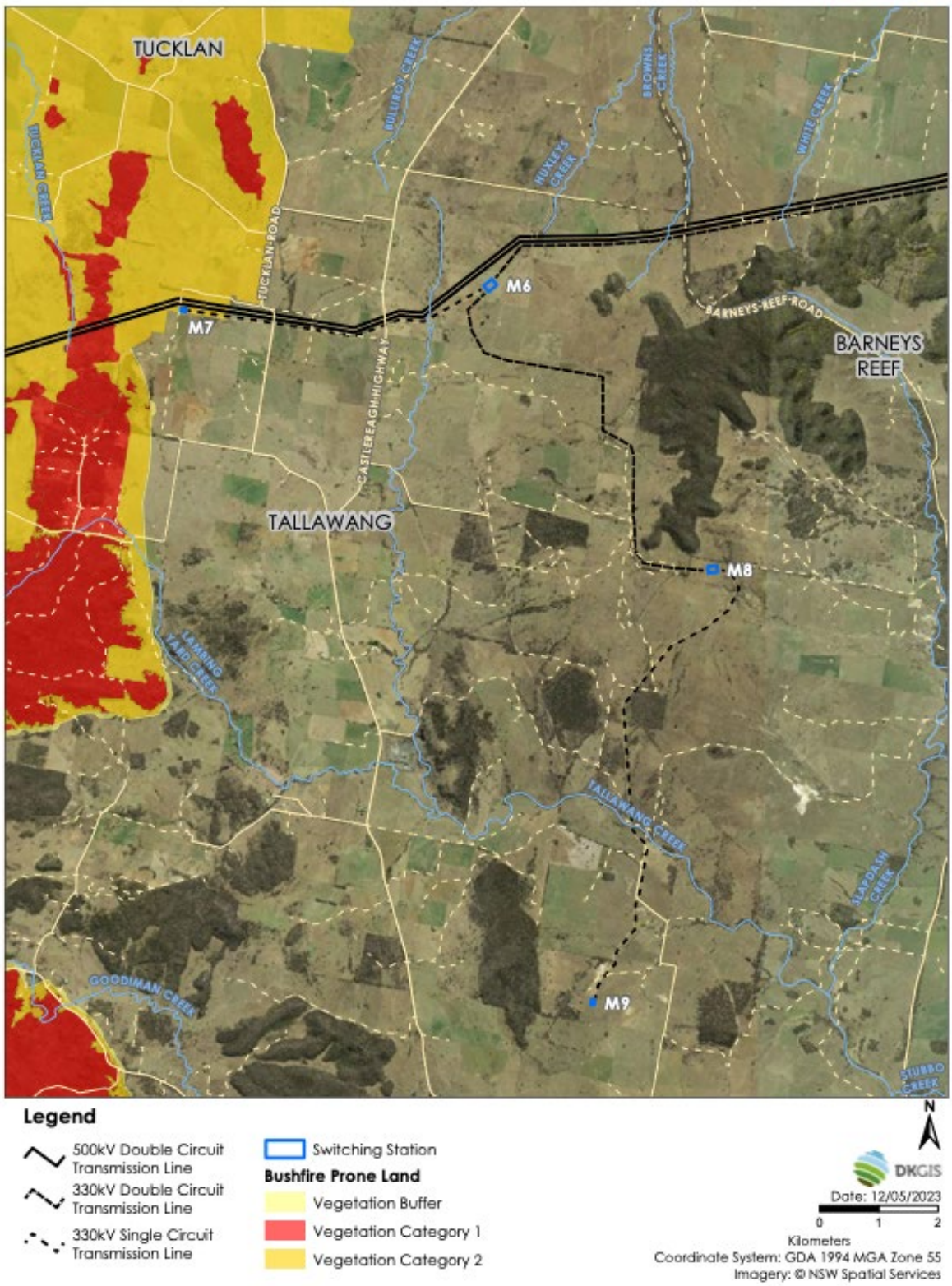
Bushfire Prone Land Map Hannahs Bridge



Bushfire Prone Land Map Merotherie



Bushfire Prone Land Map Rotherwood Crossing



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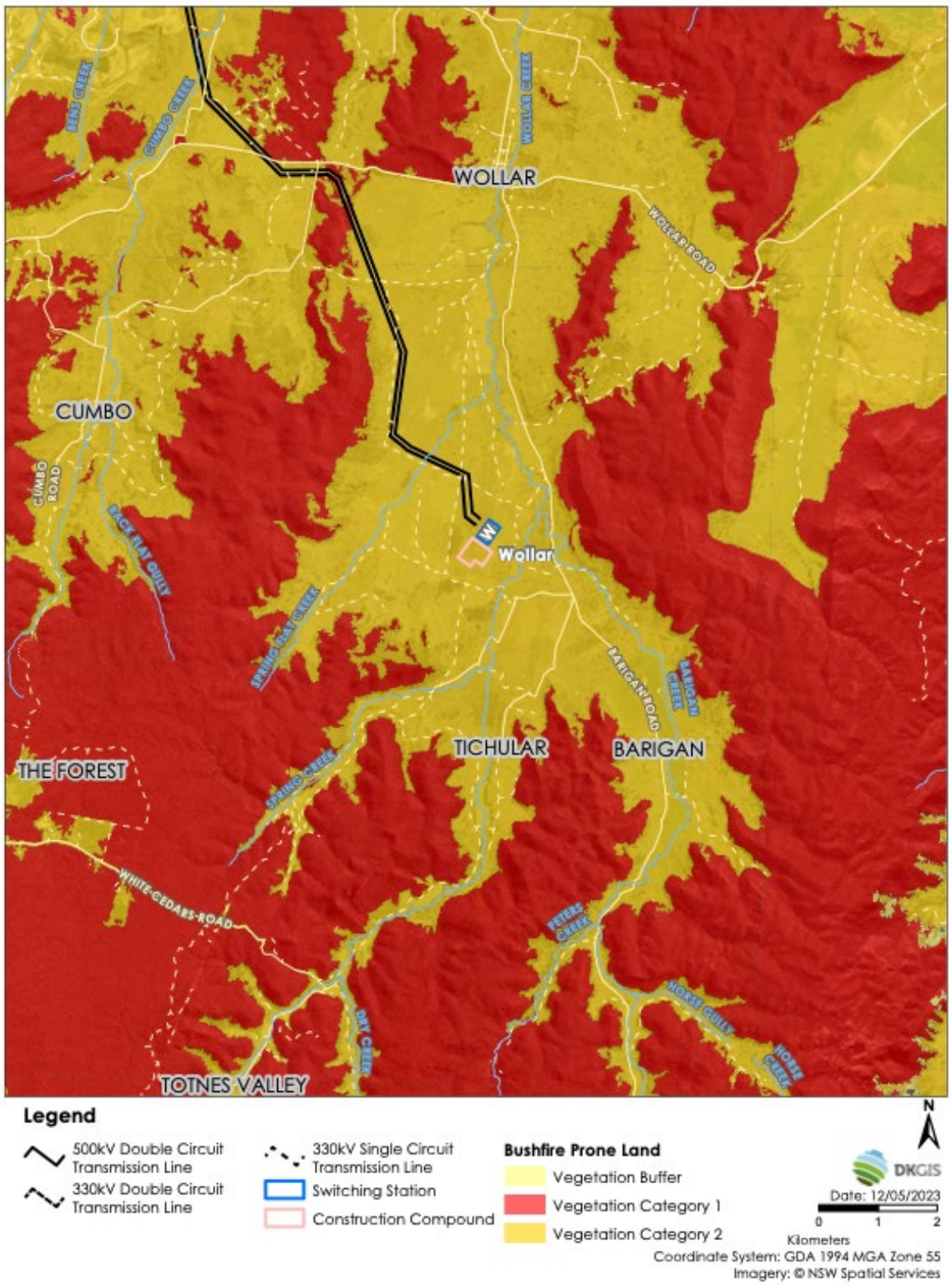
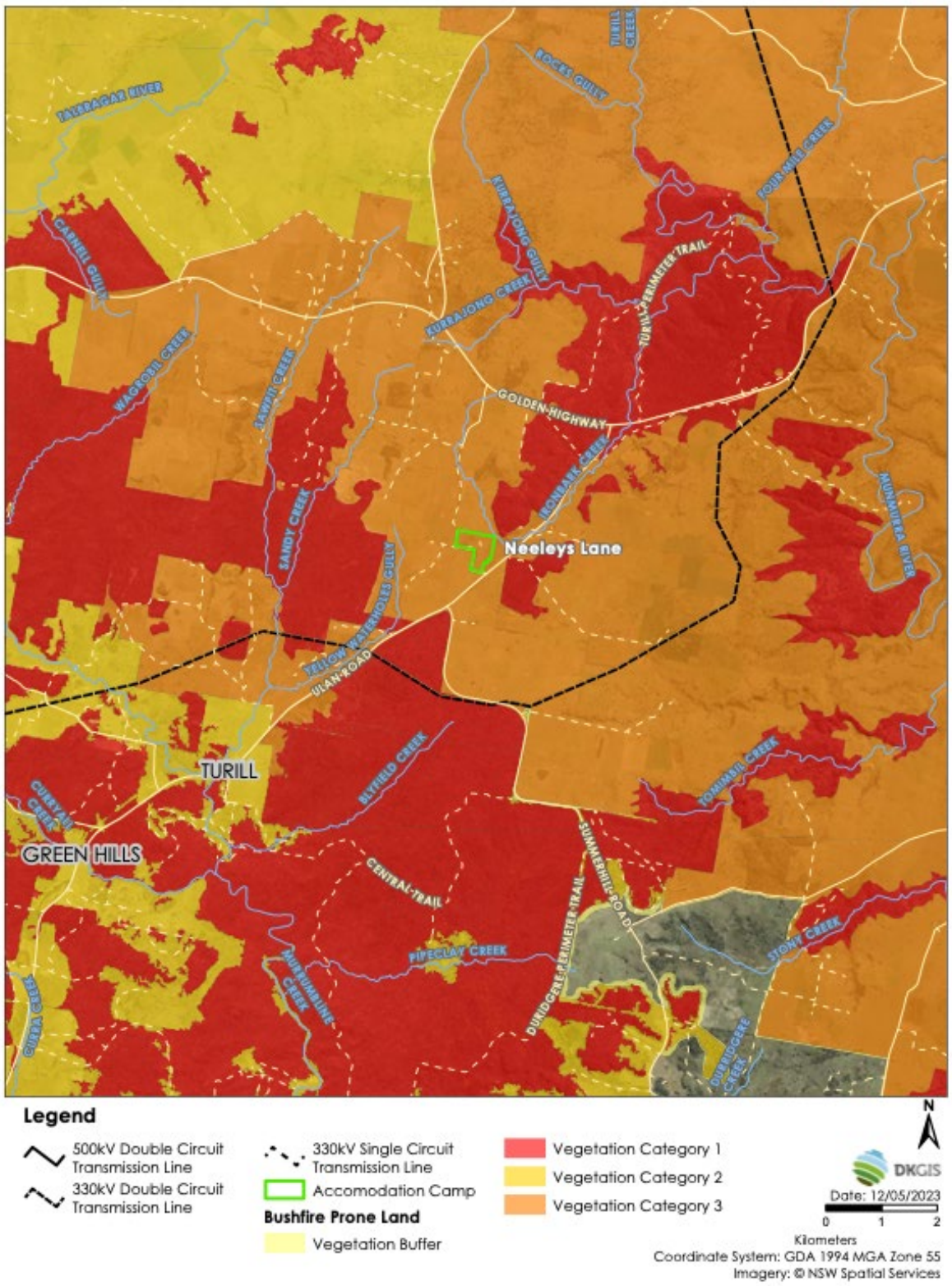
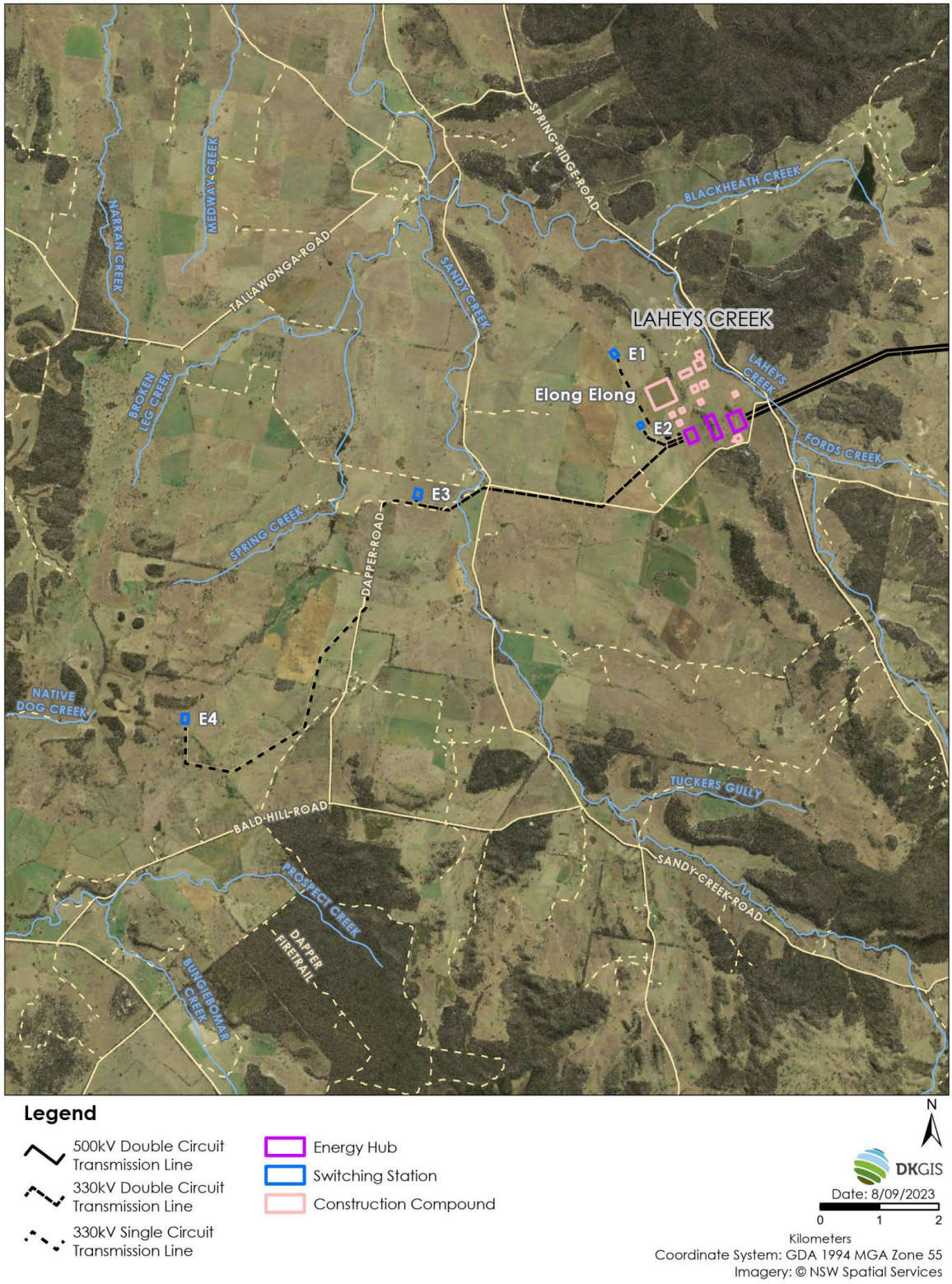


Bushfire Prone Land Map Wollar



Bushfire Prone Land Map Neeleys Lane

Appendix 2 - Bushfire History



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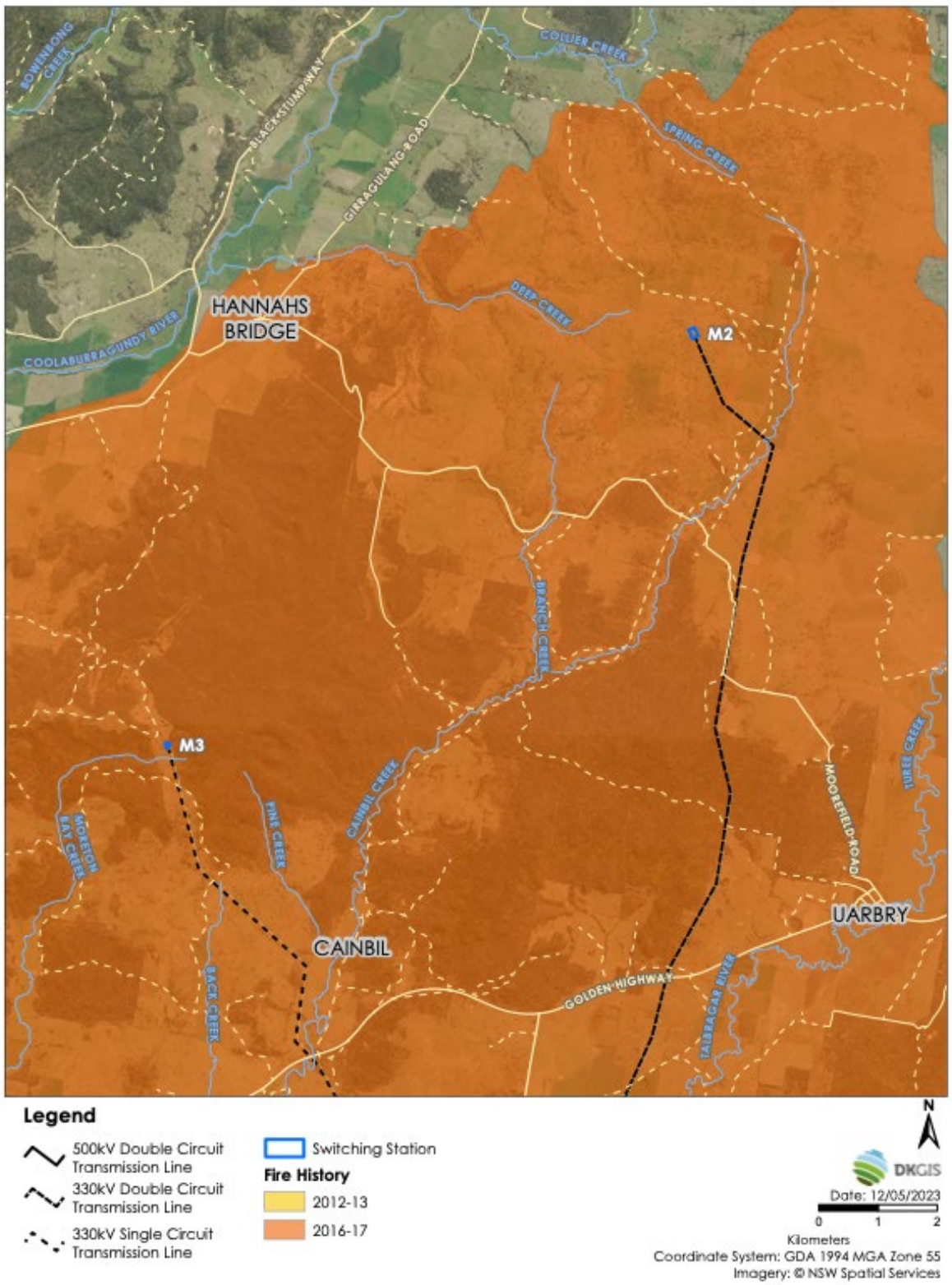
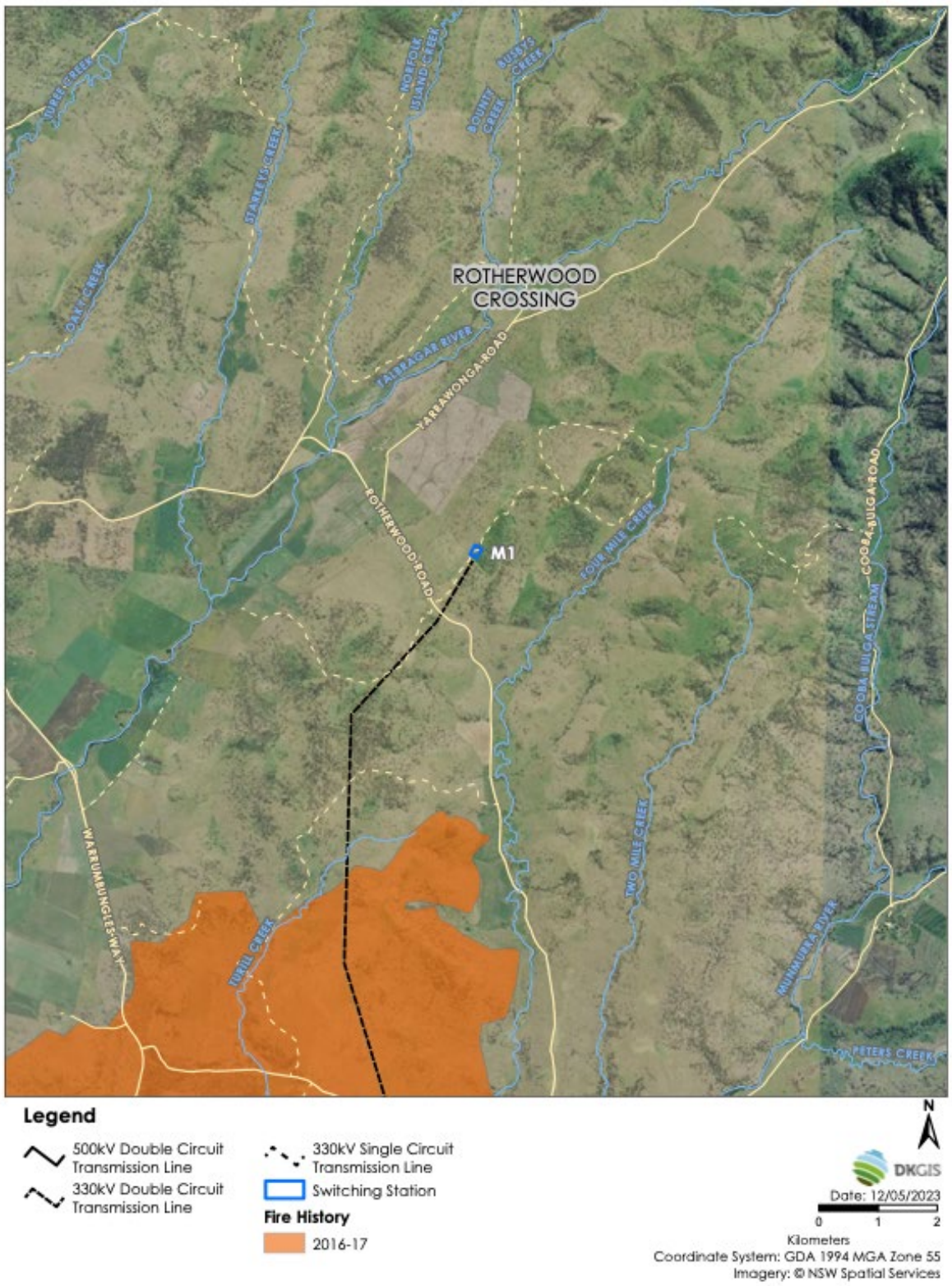
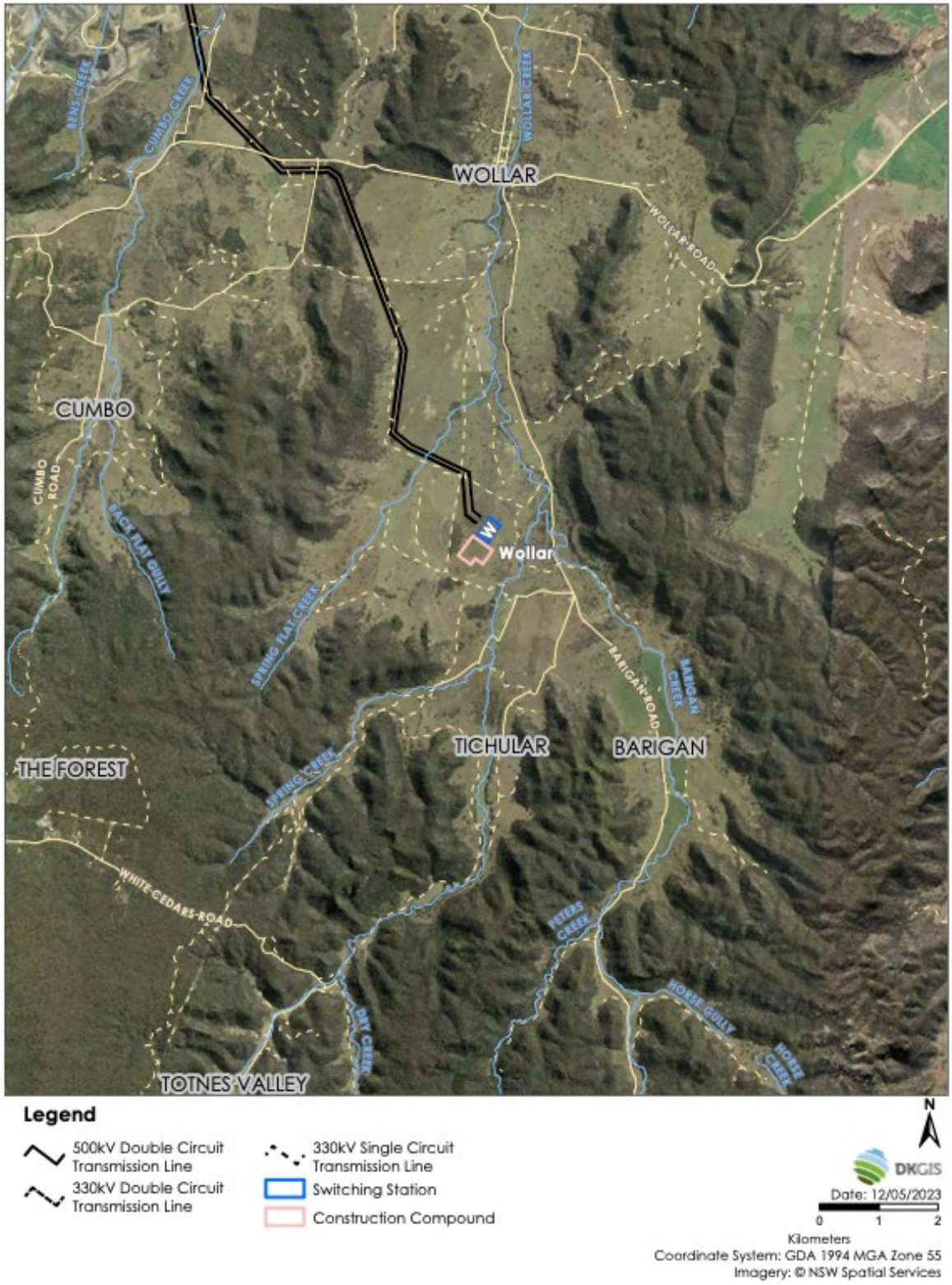


Bushfire History Hannahs Bridge



Bushfire History Rotherwood Crossing



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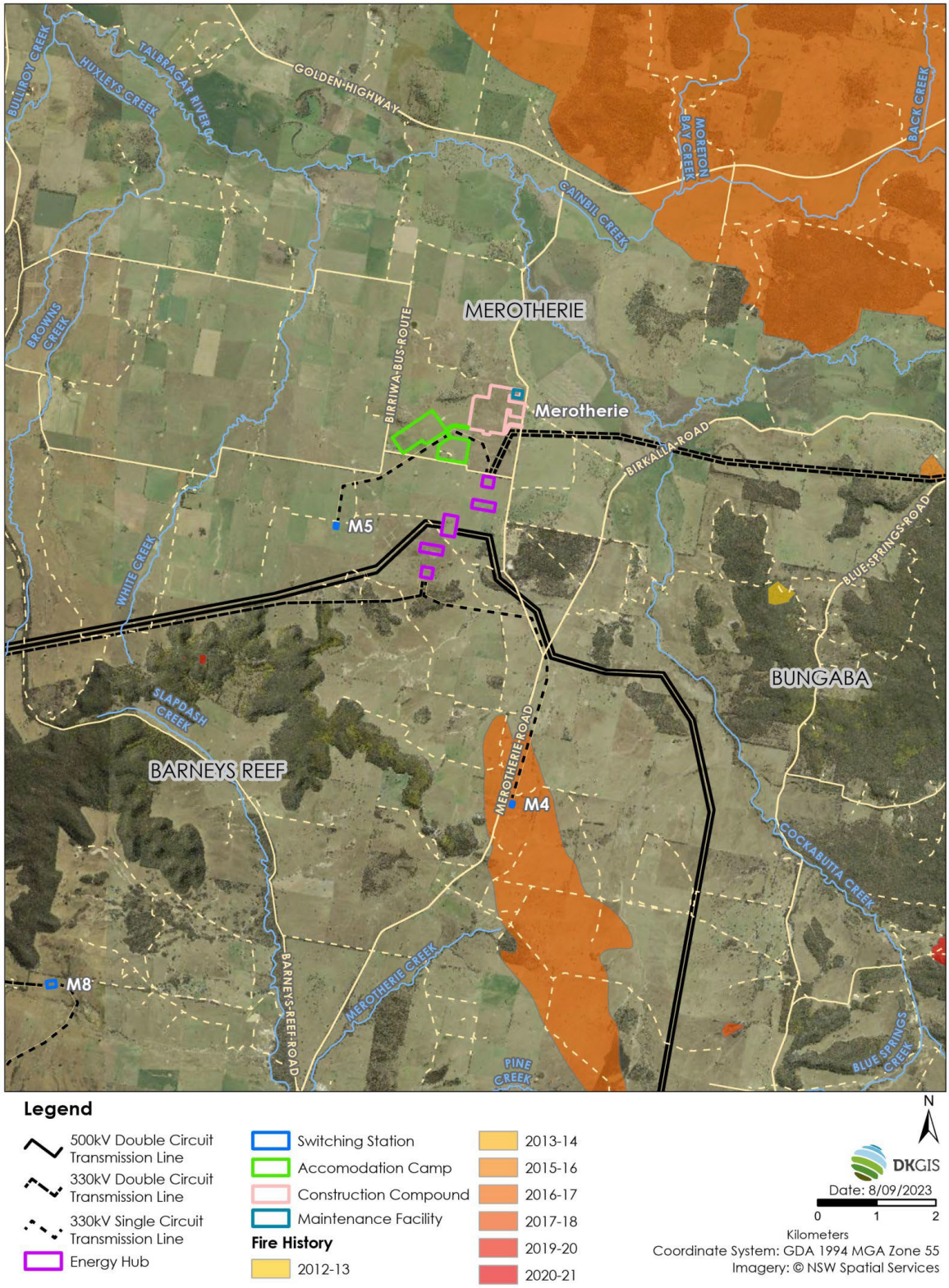

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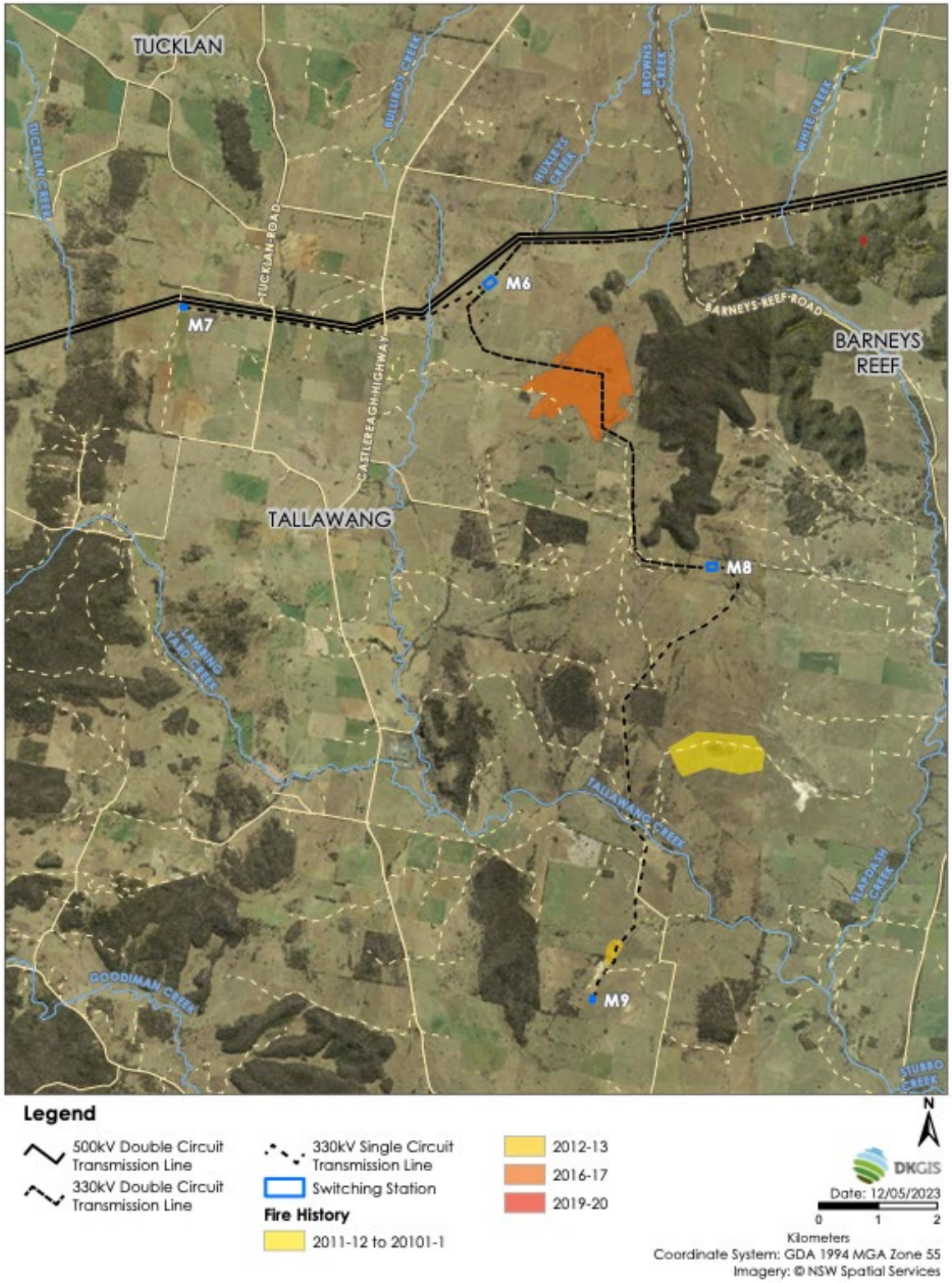

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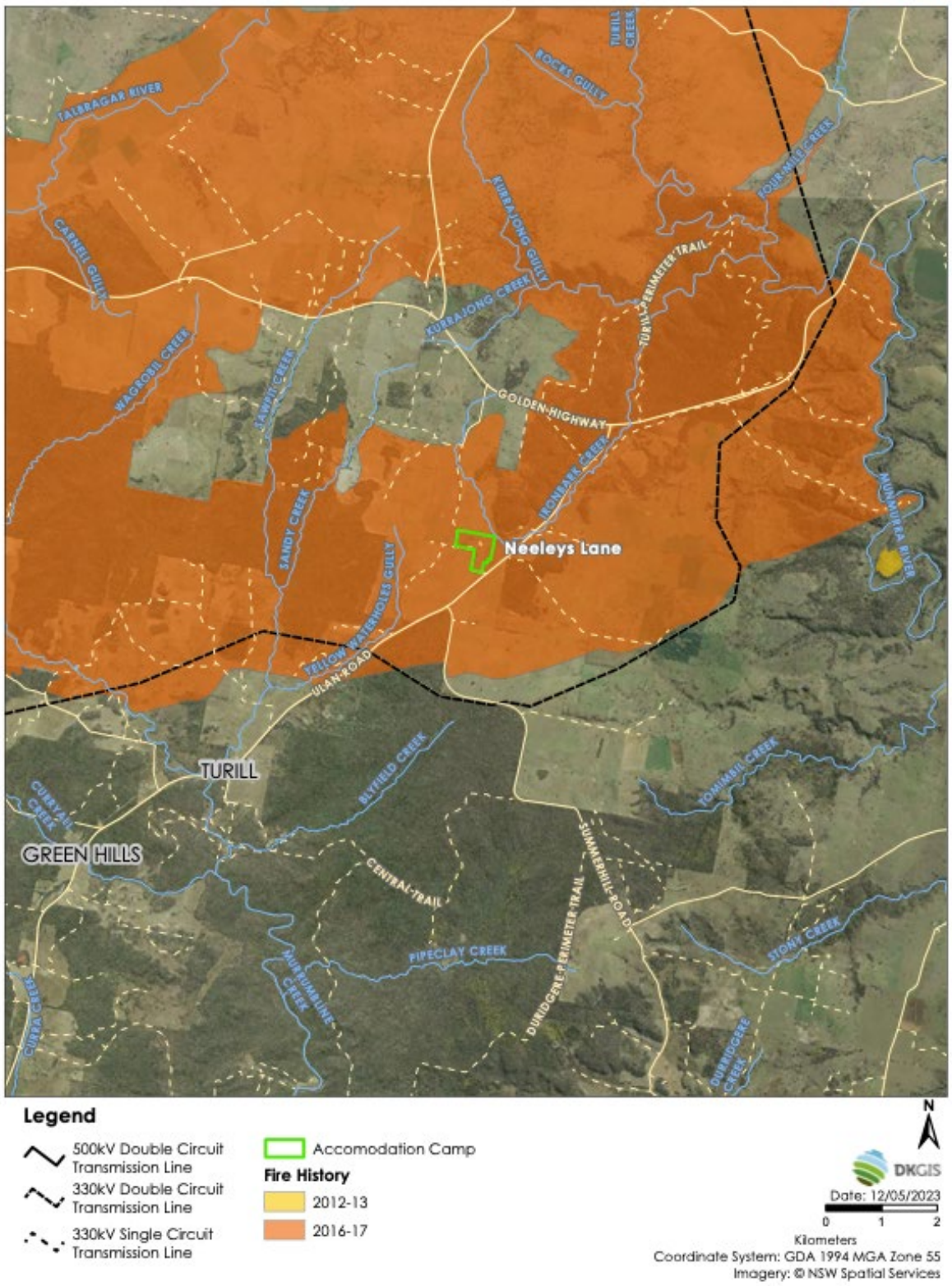
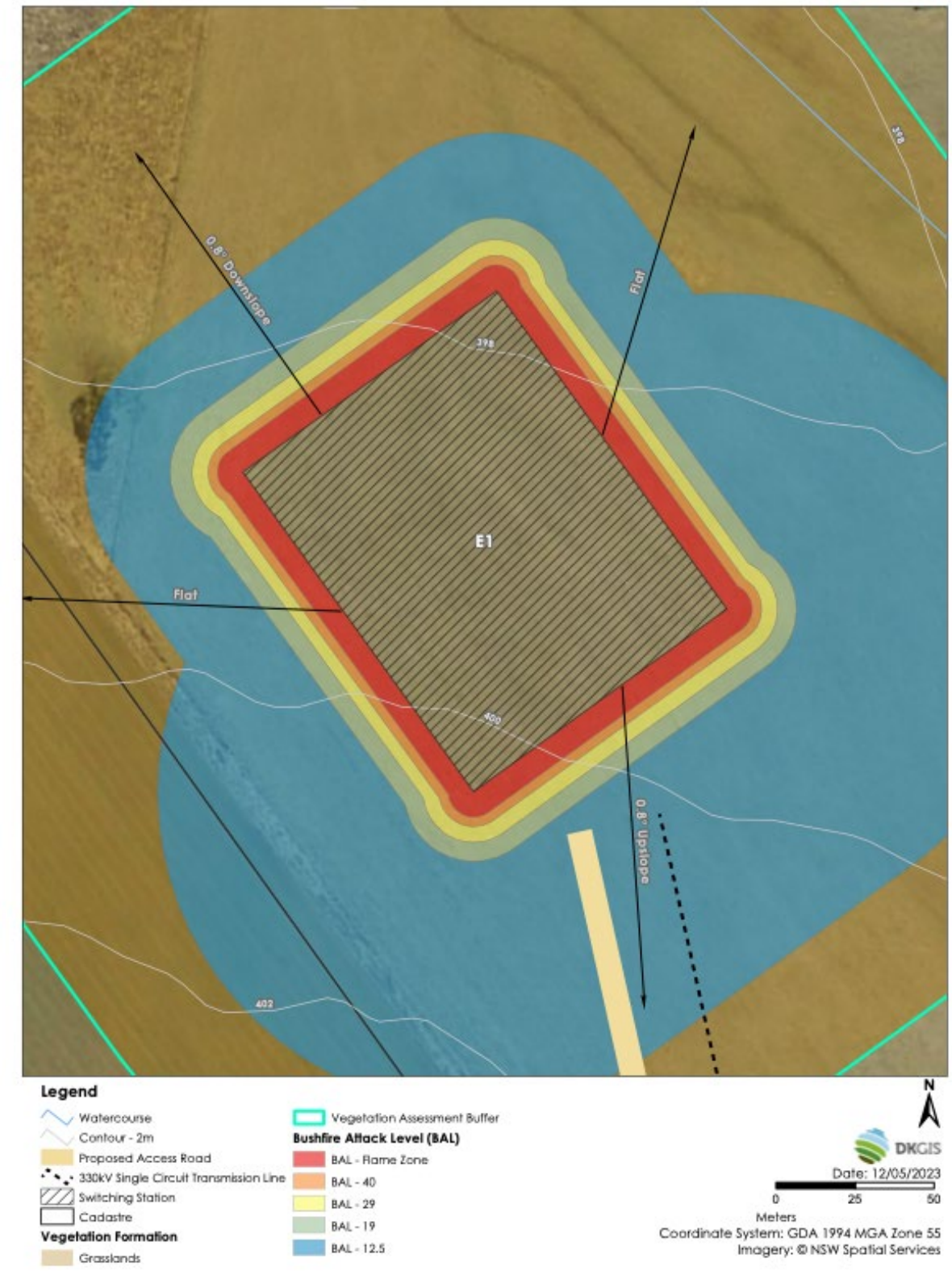


Bushfire History Neeleys Lane

Appendix 3 - Bushfire Attack Levels – Switching Stations



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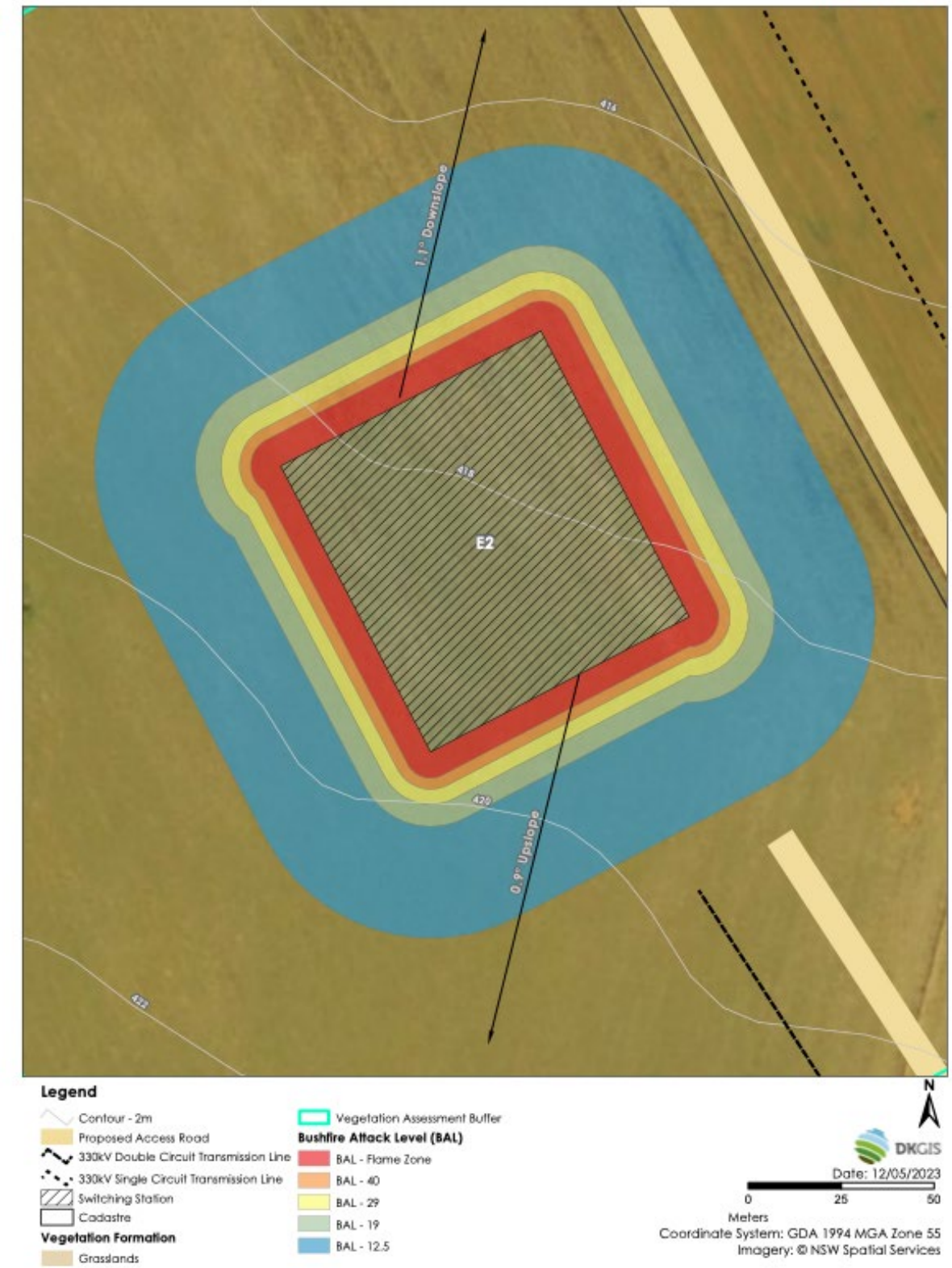

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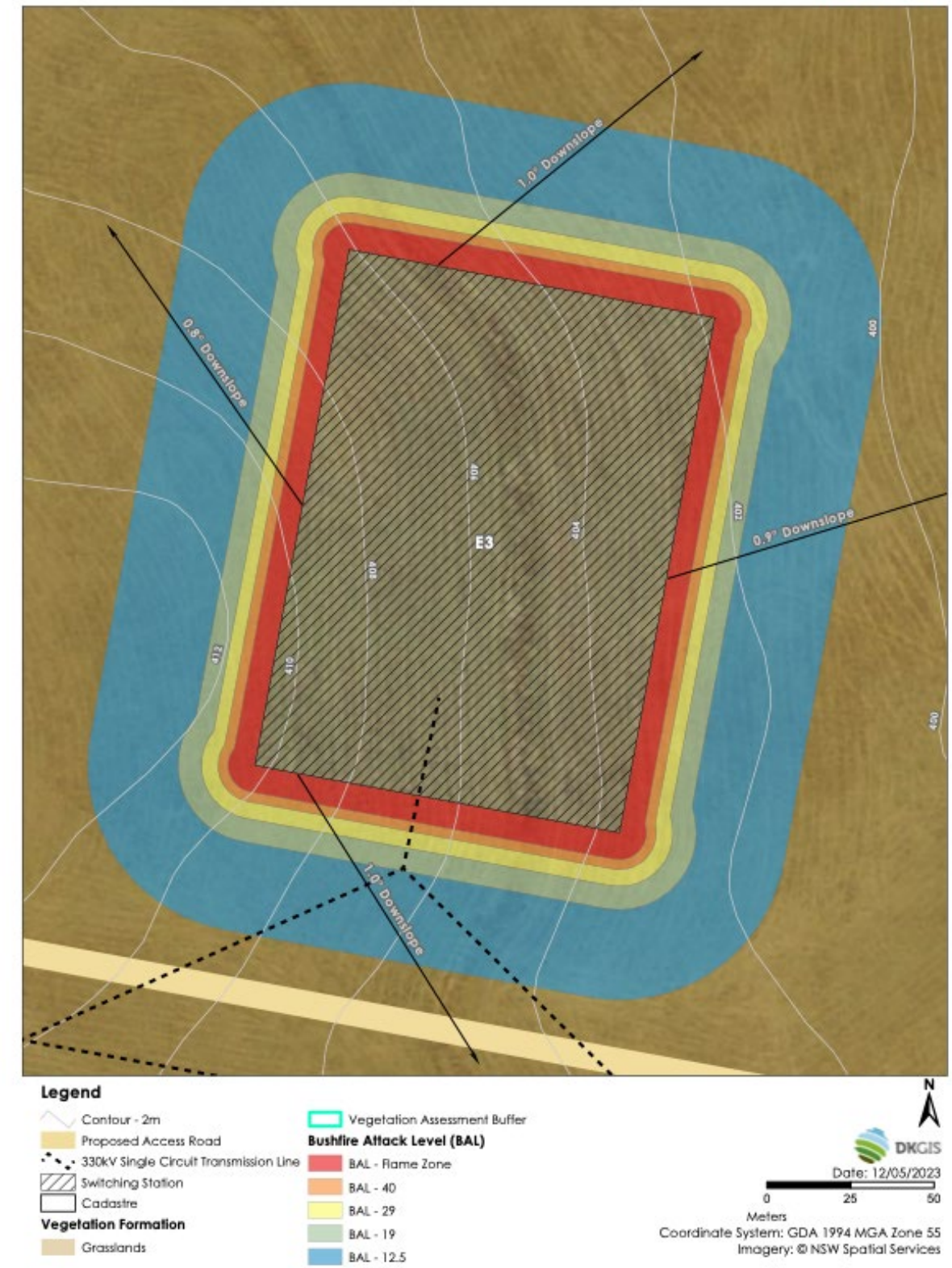

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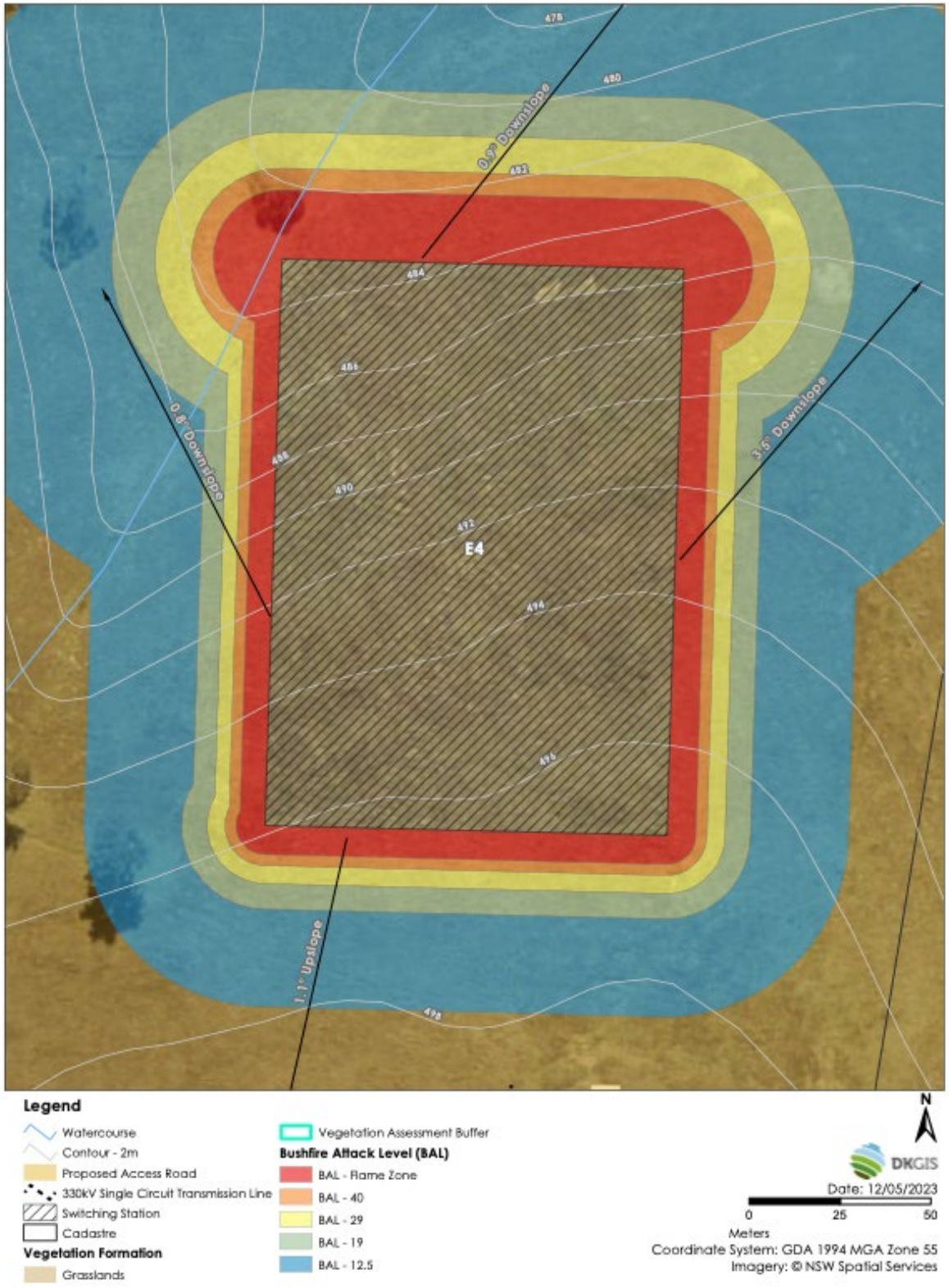

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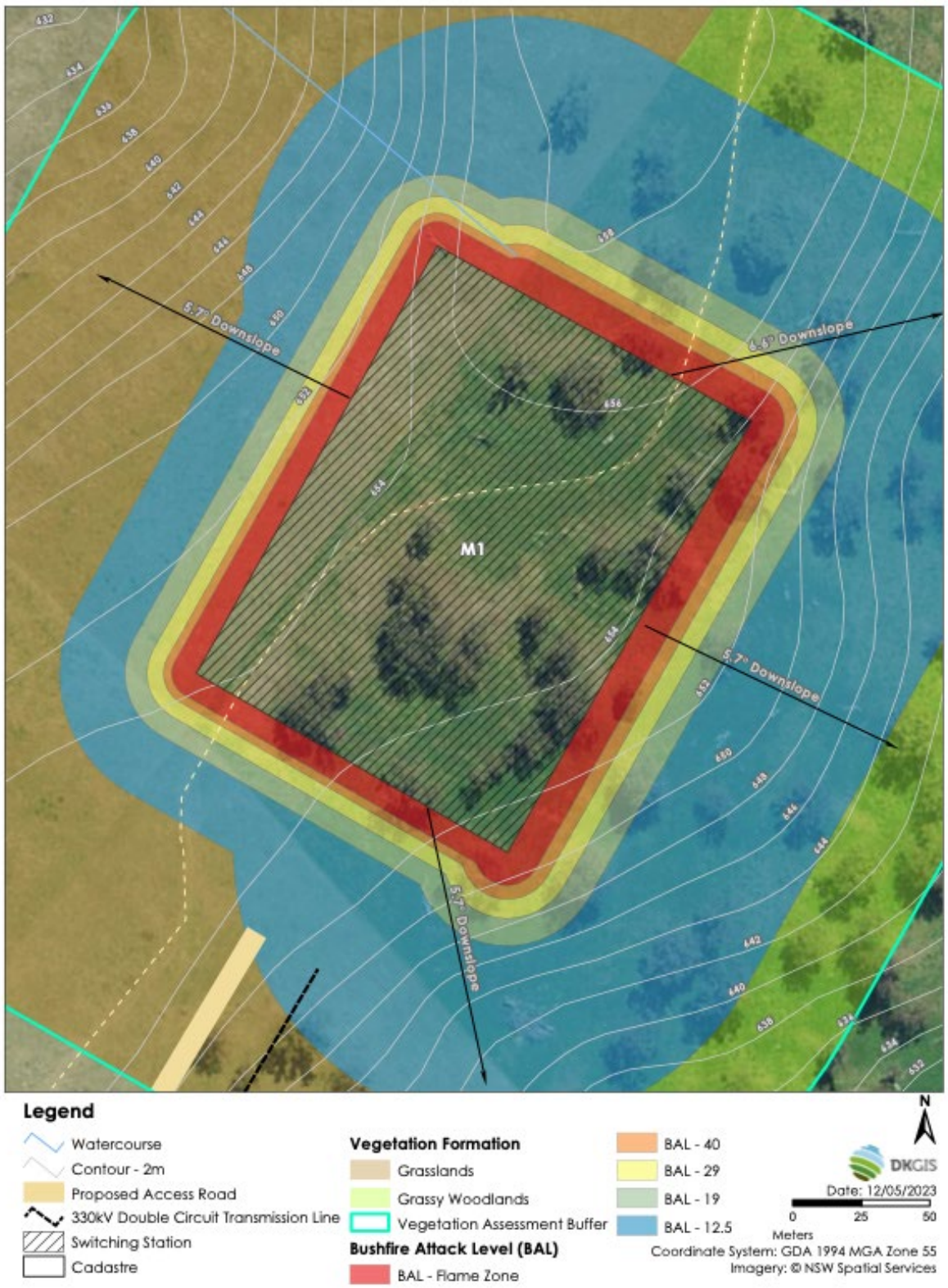

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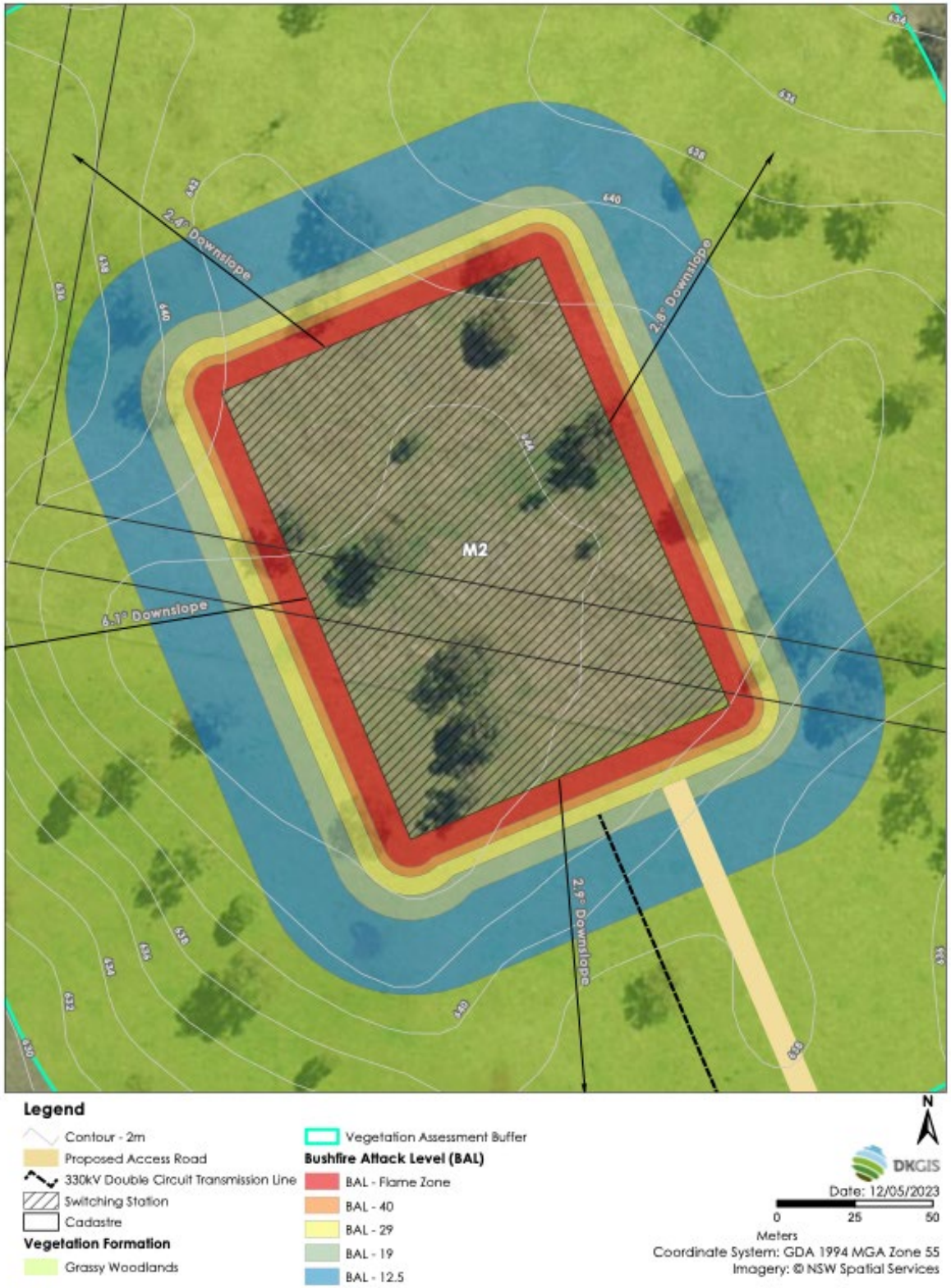

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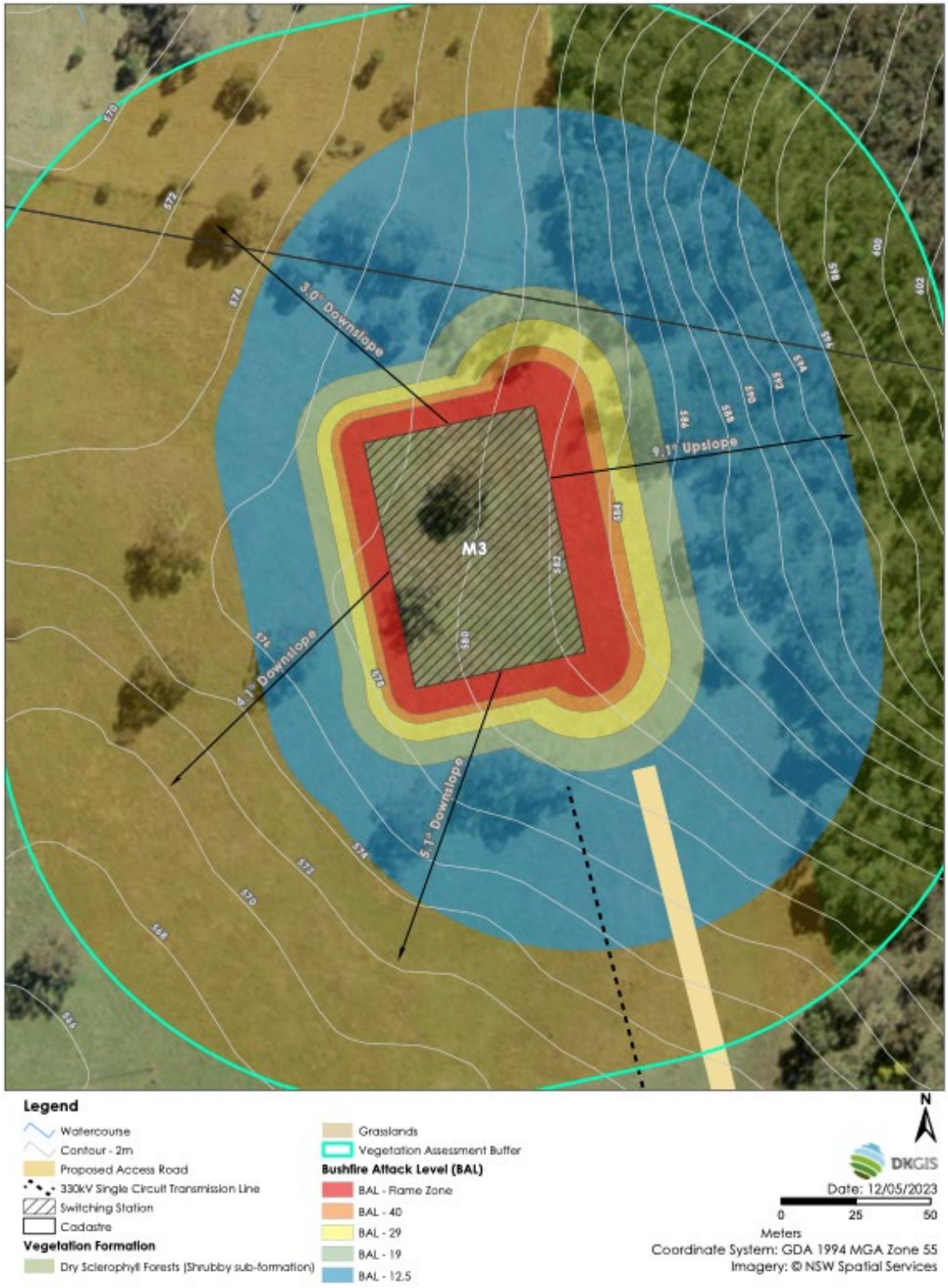

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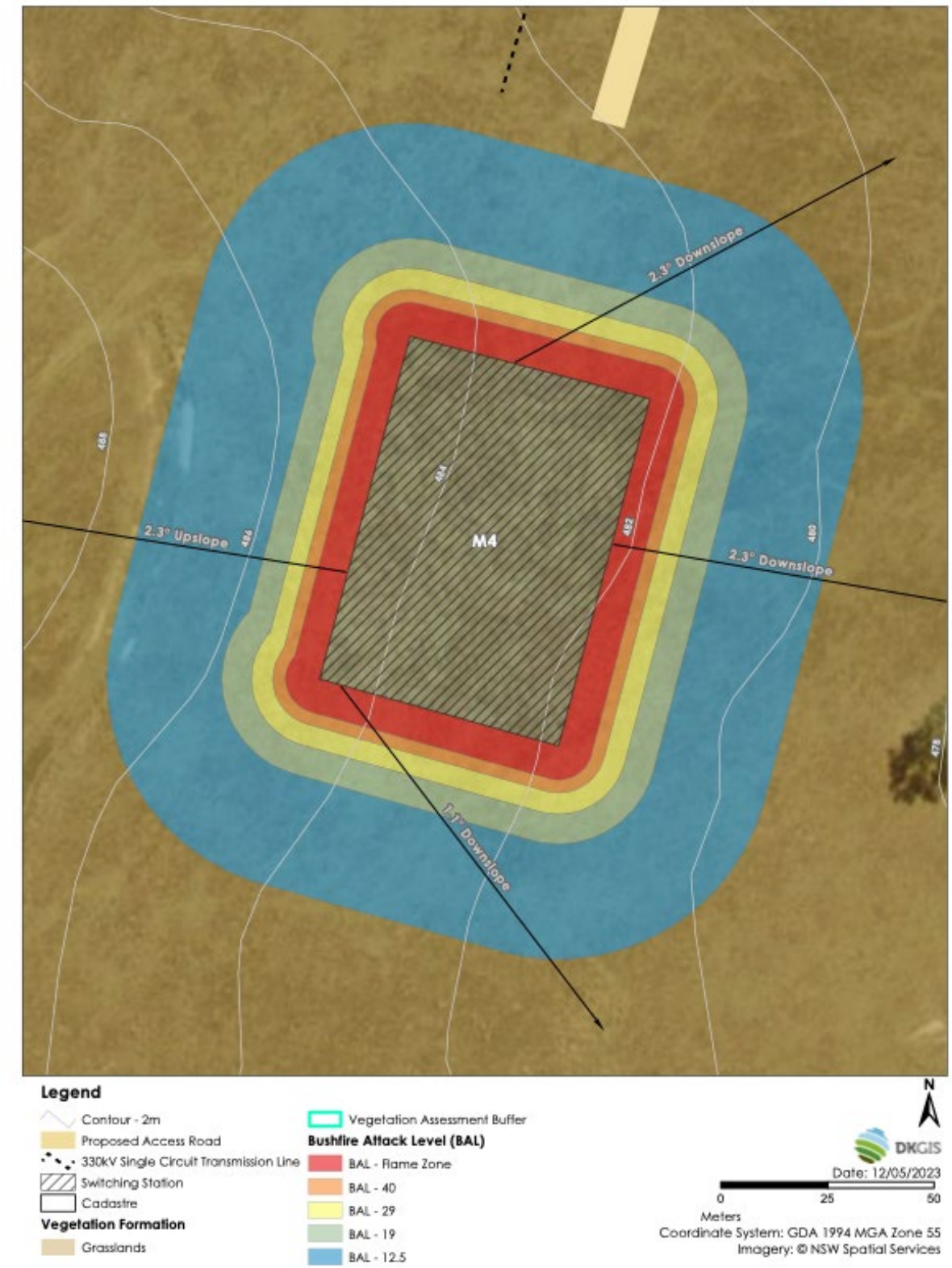

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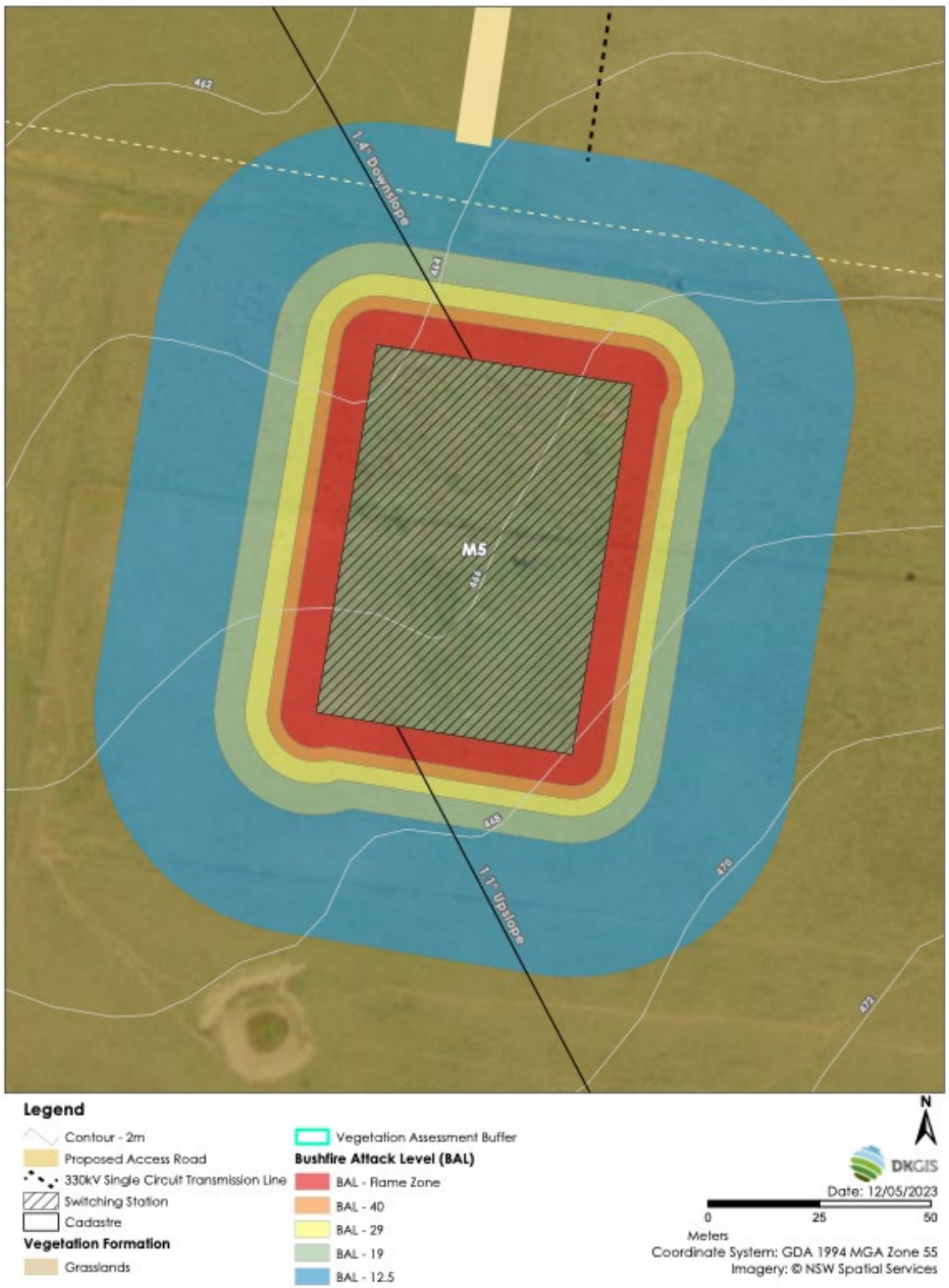

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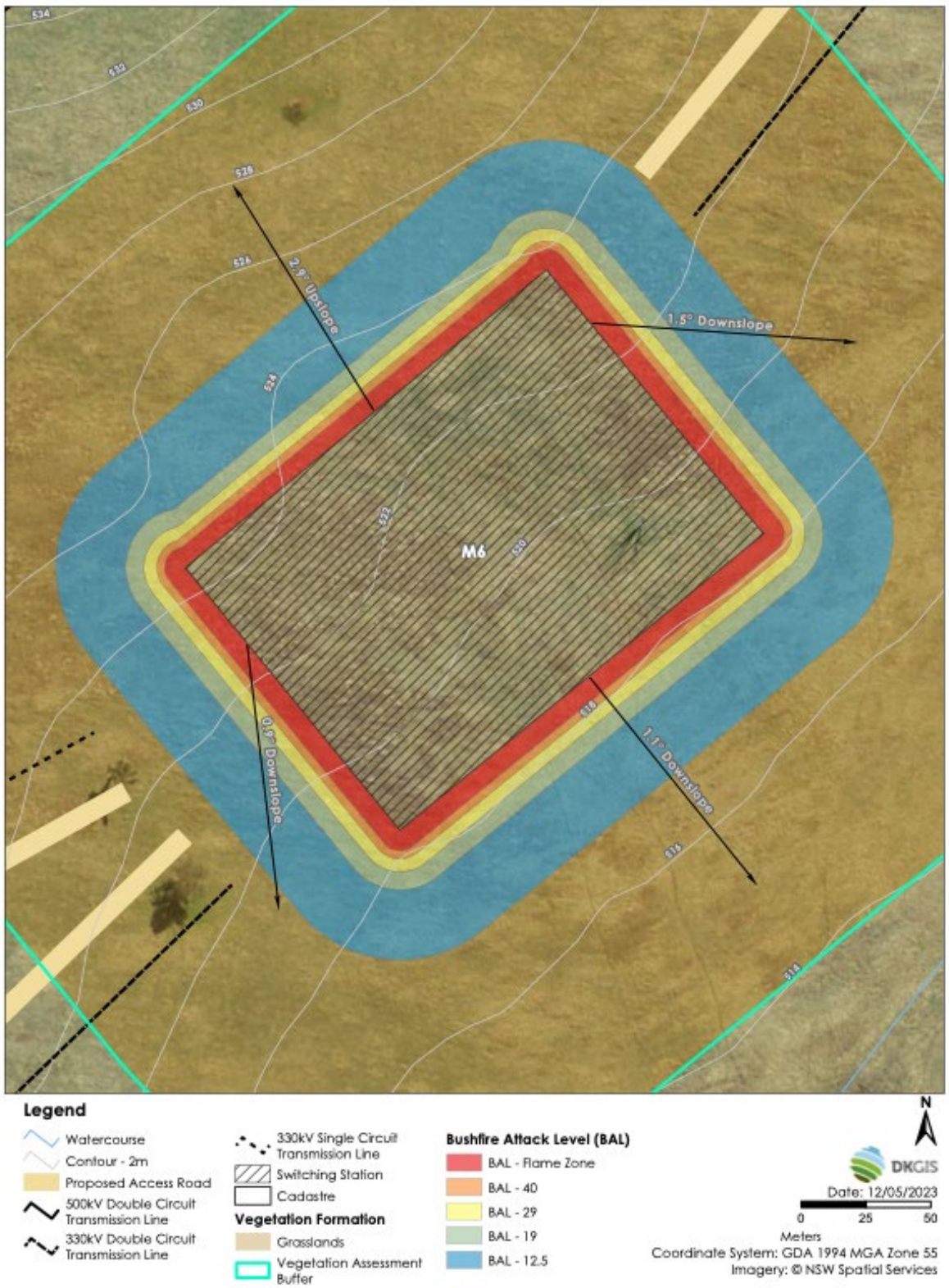

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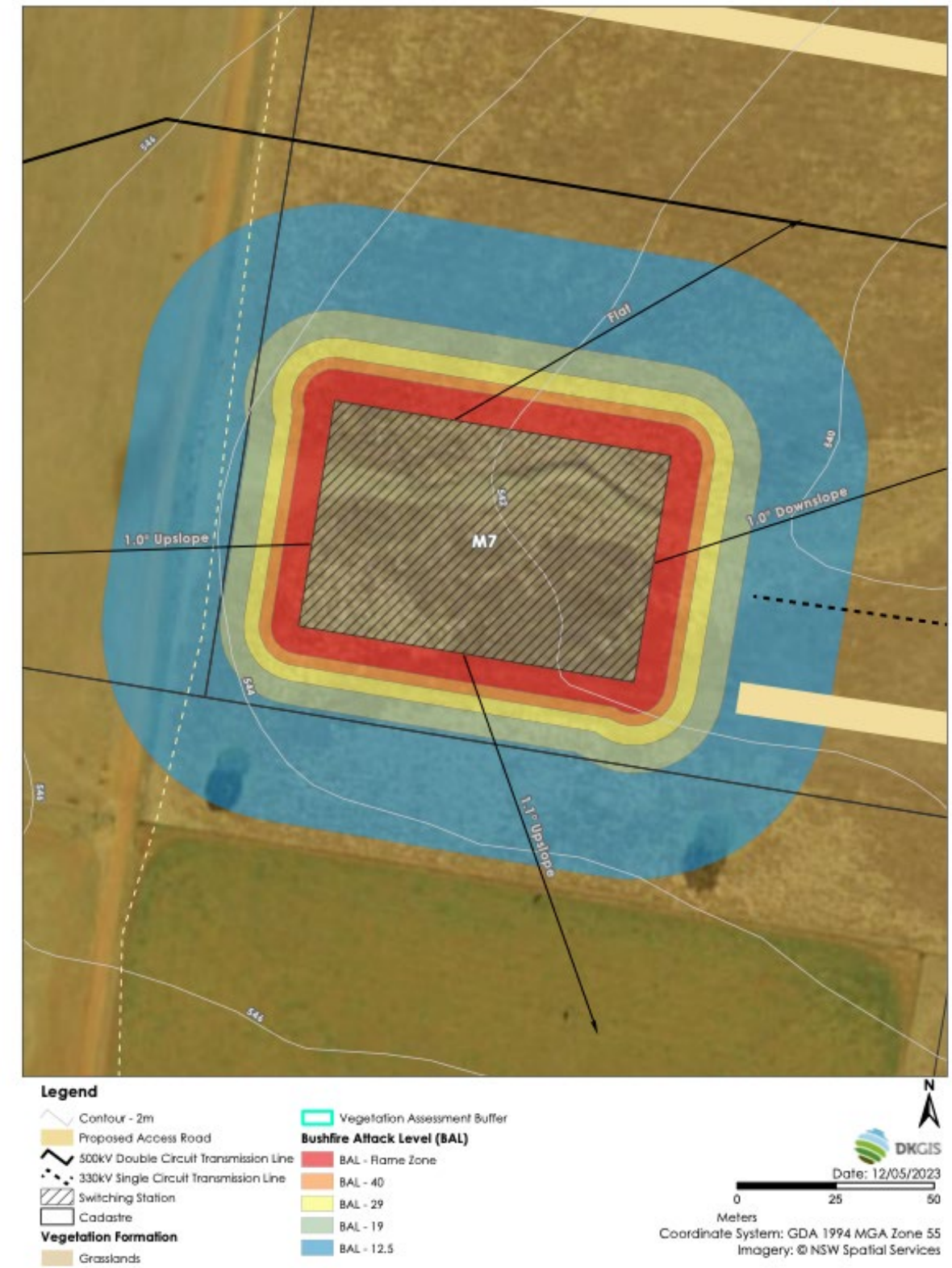

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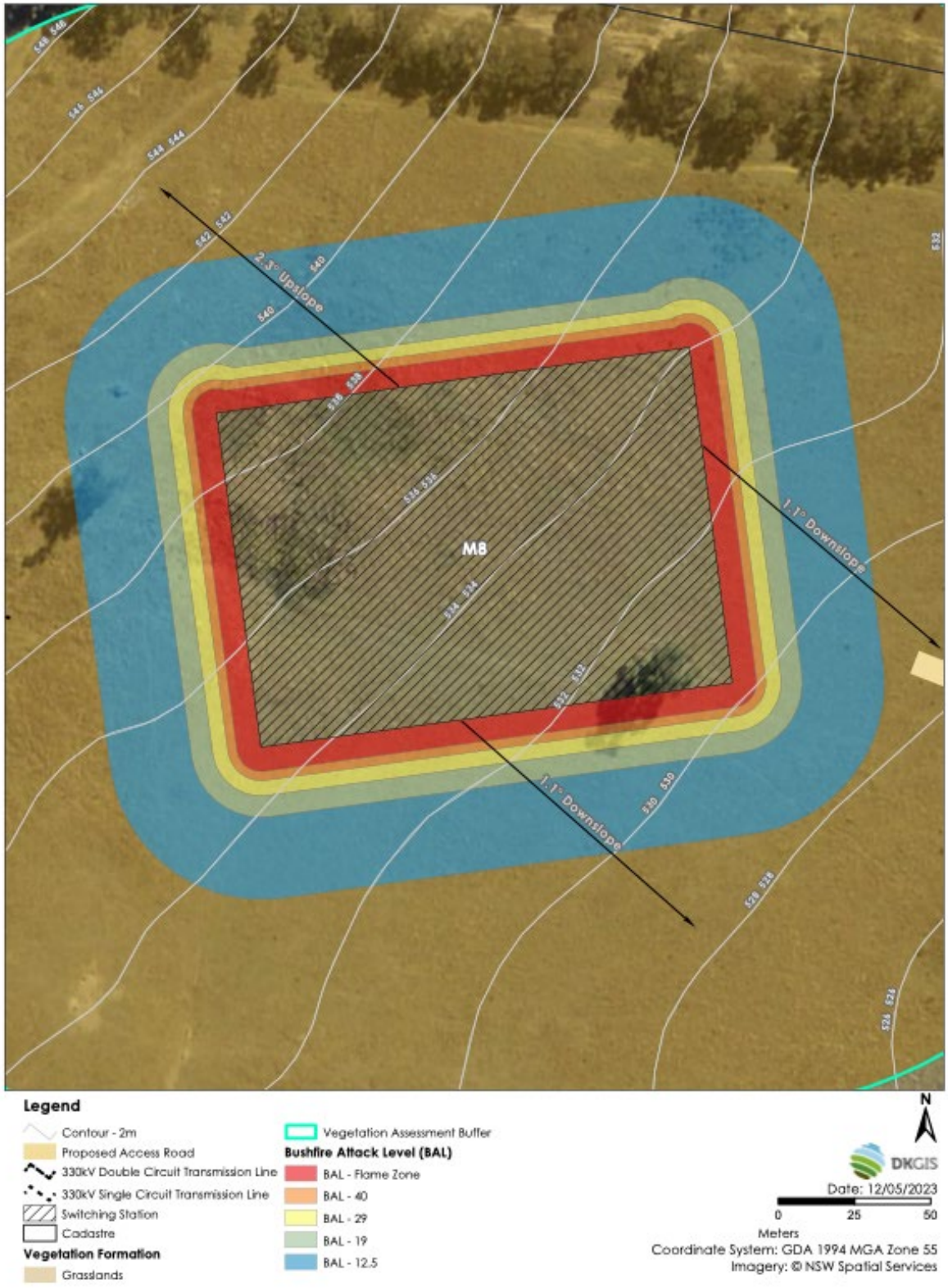

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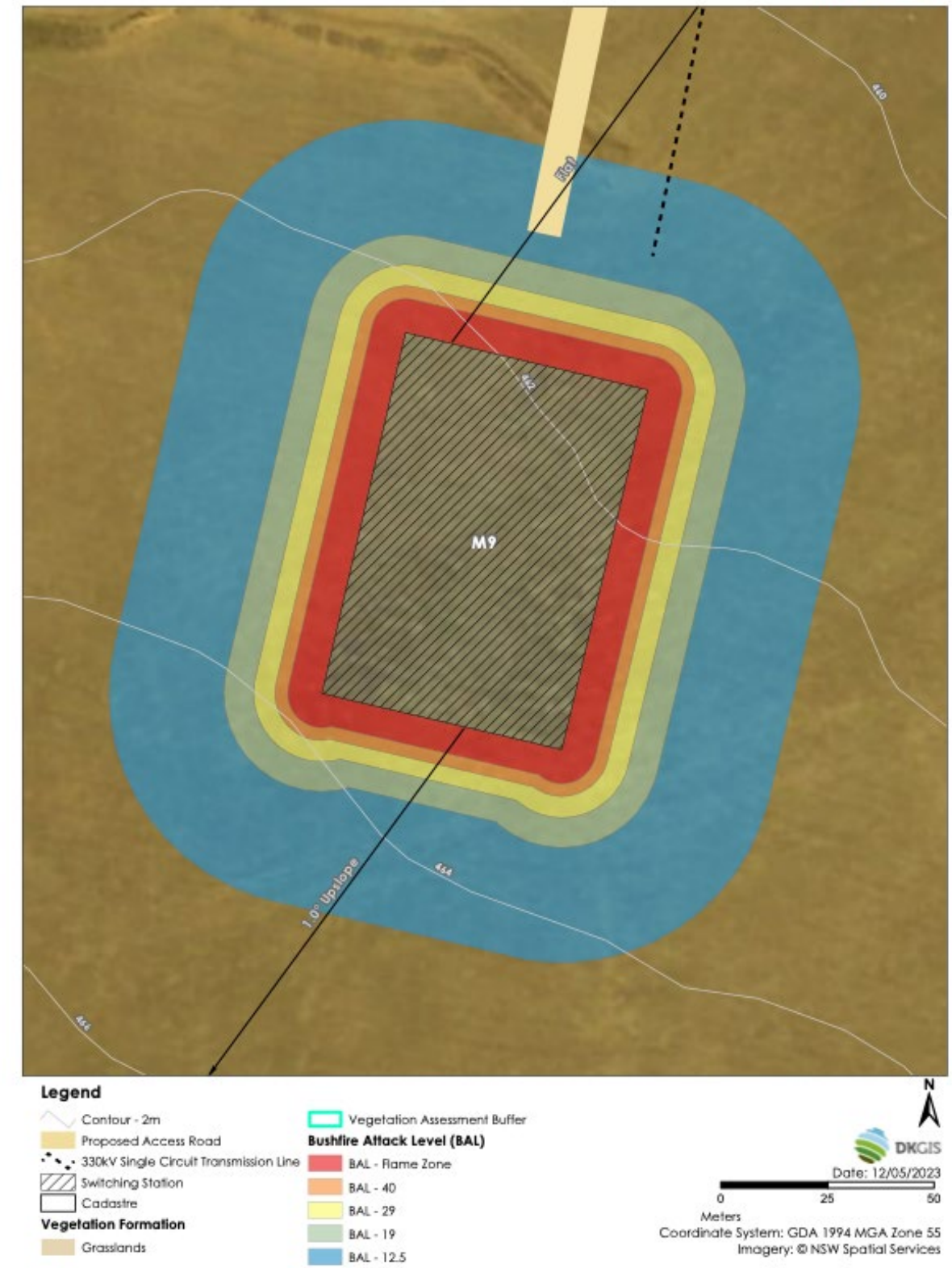

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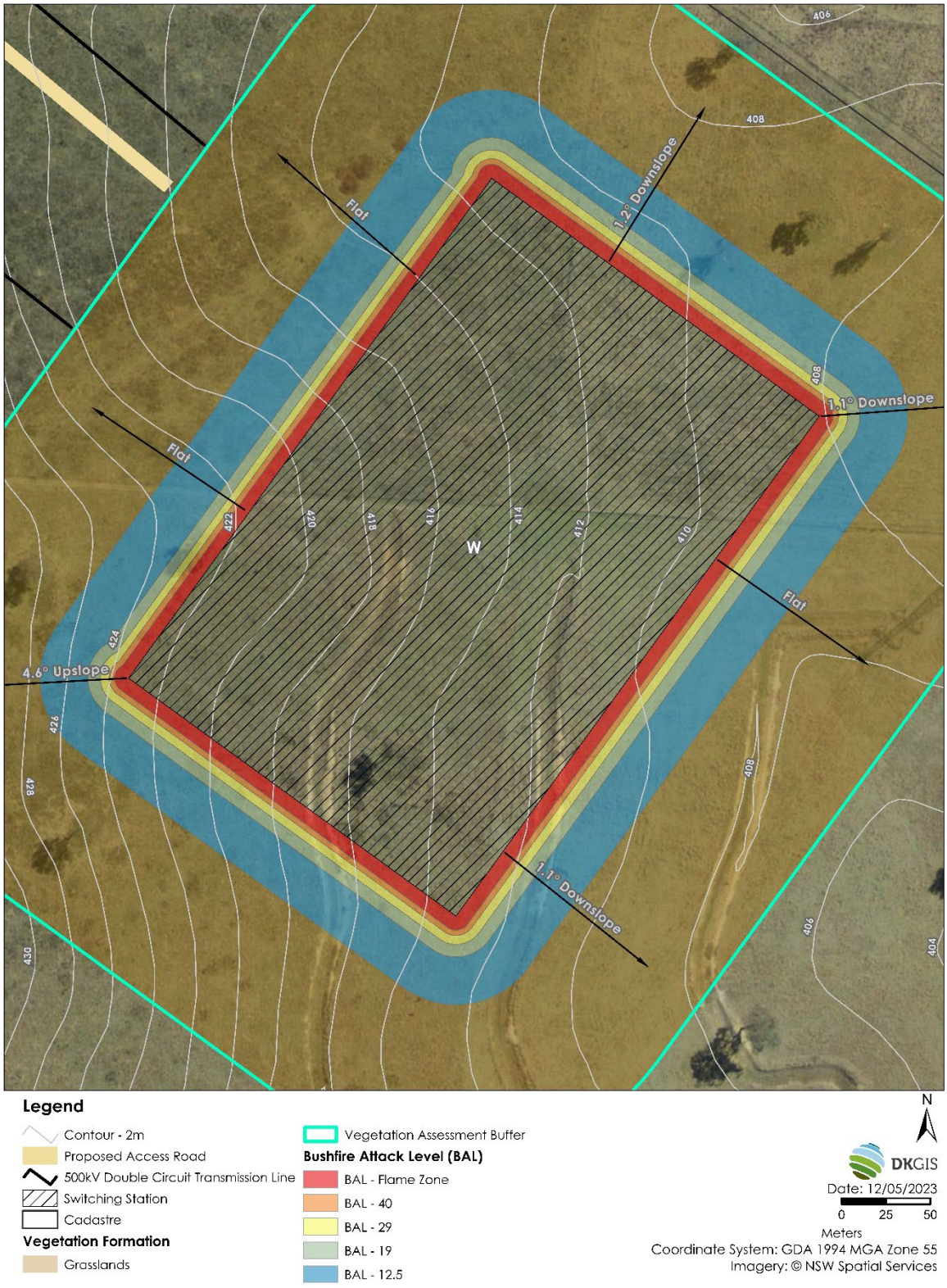
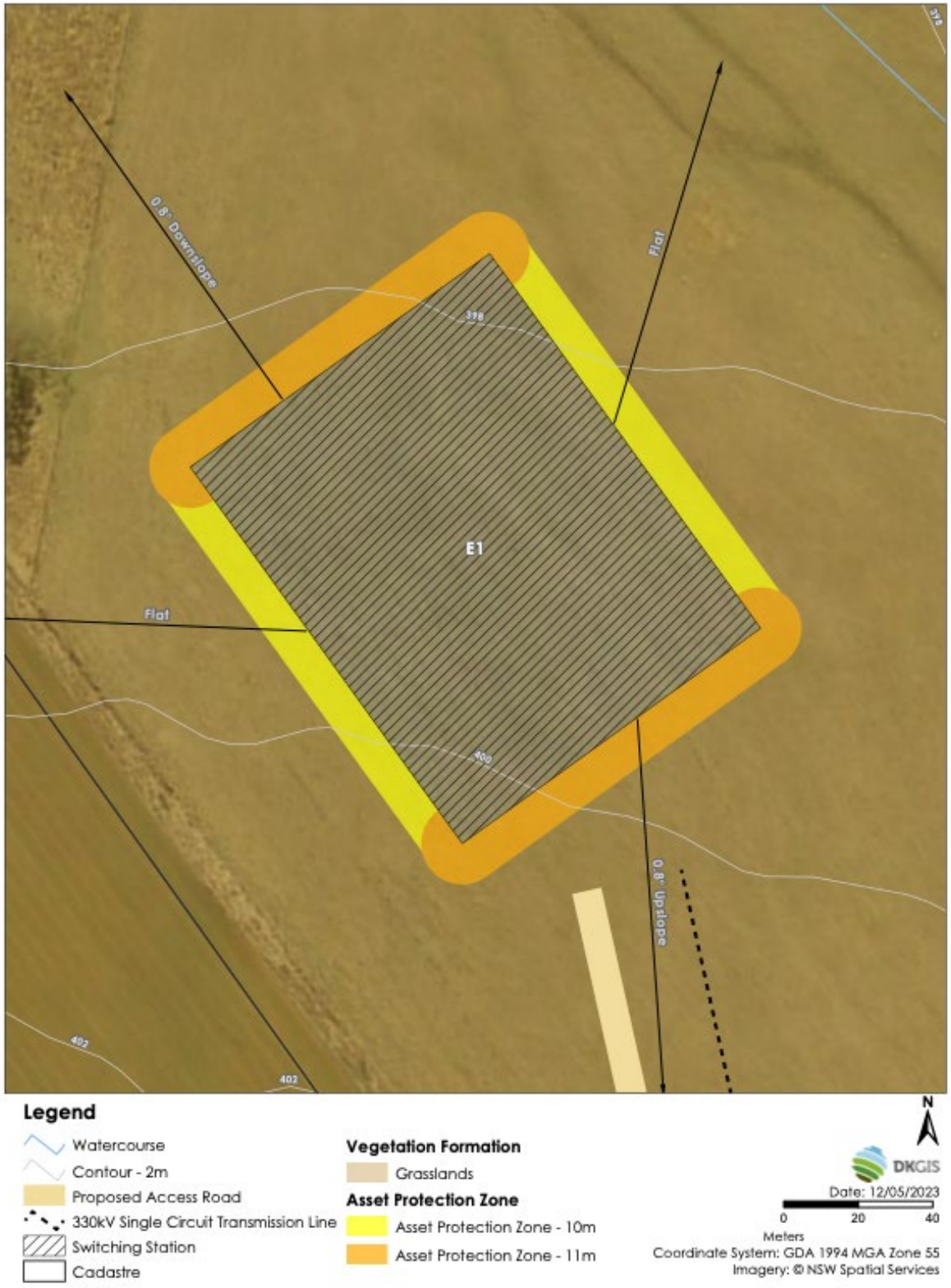


New Wollar Switching Station

Appendix 4 – Asset Protection Zones – Switching Stations



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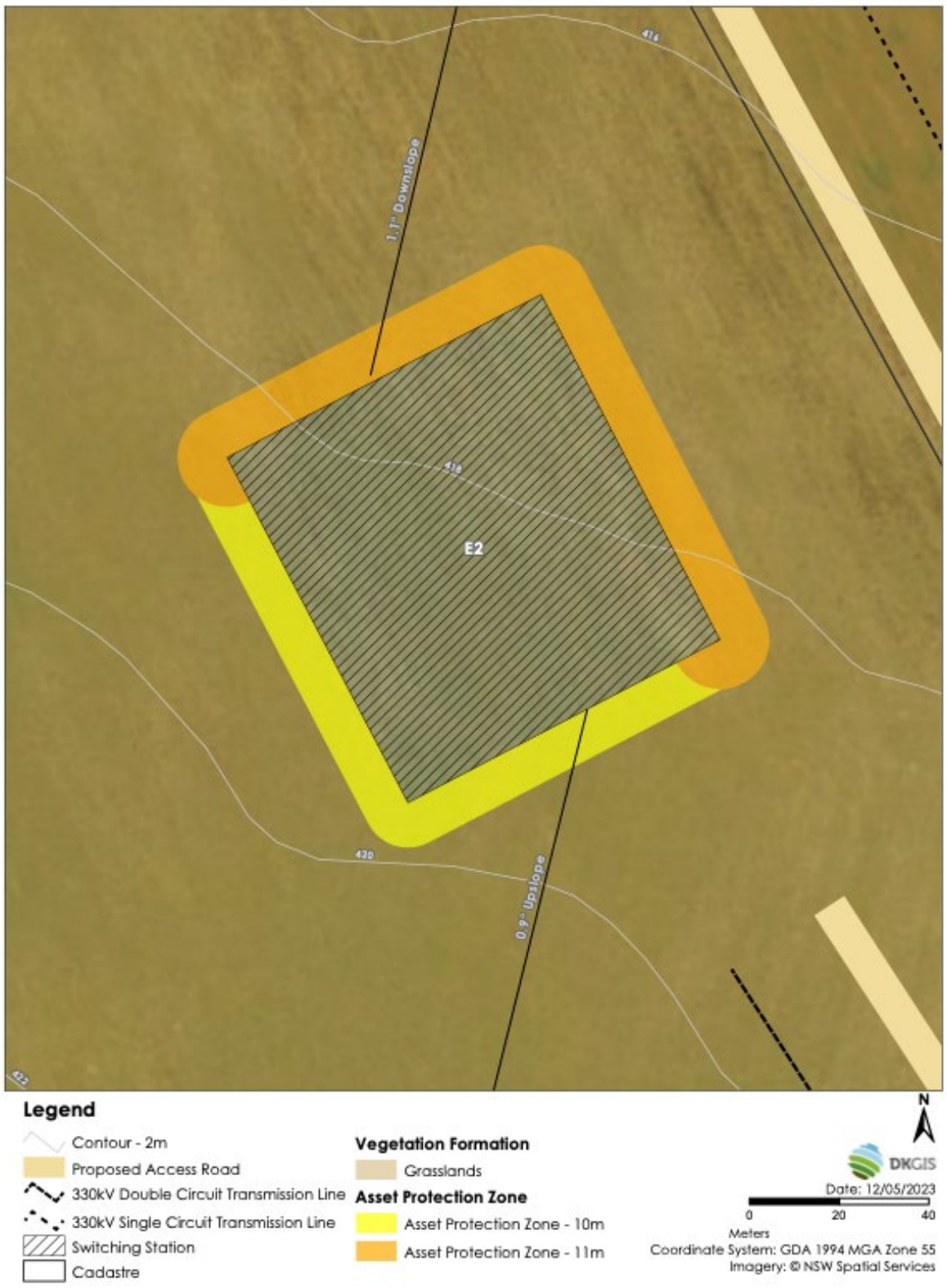

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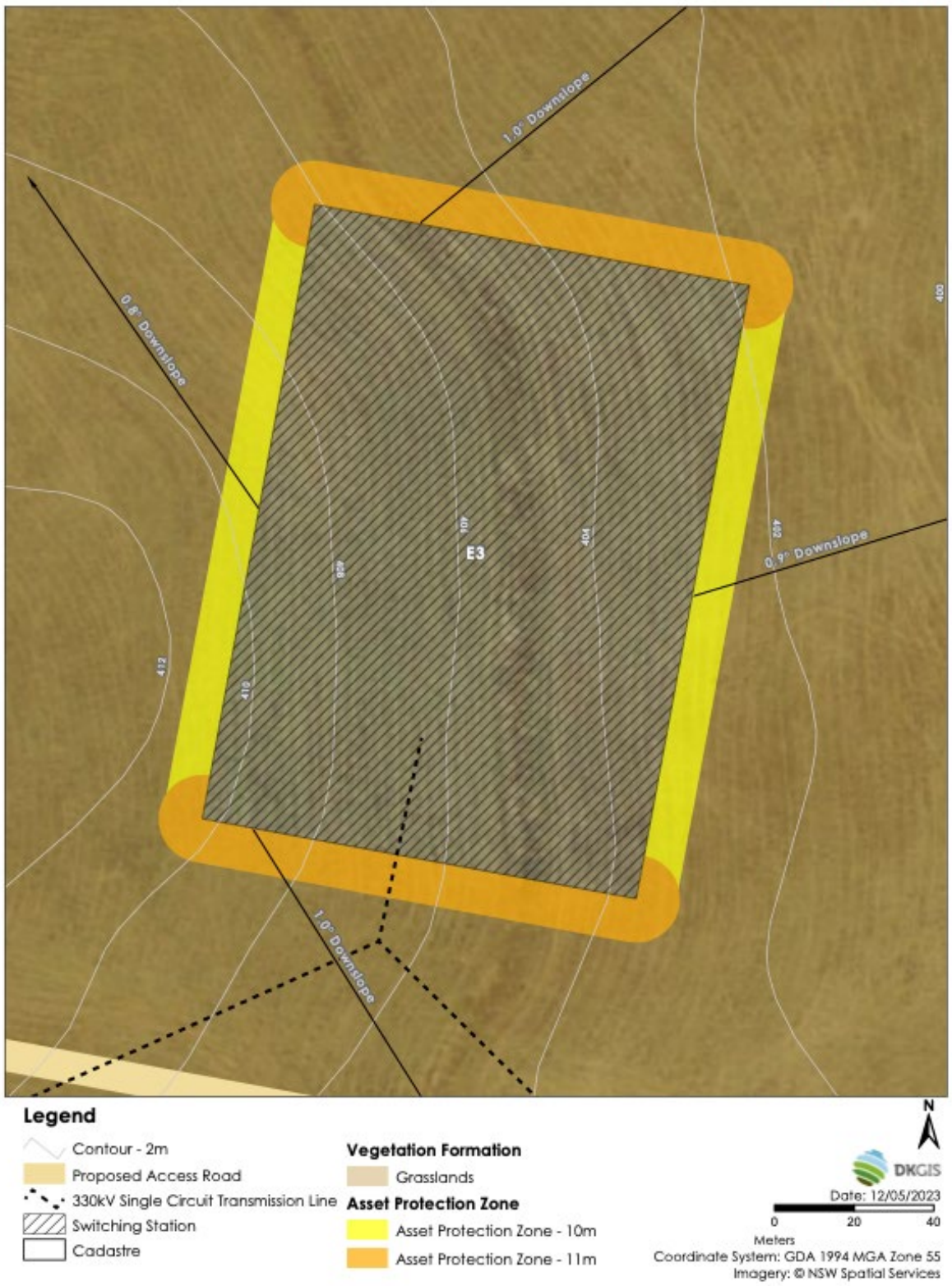
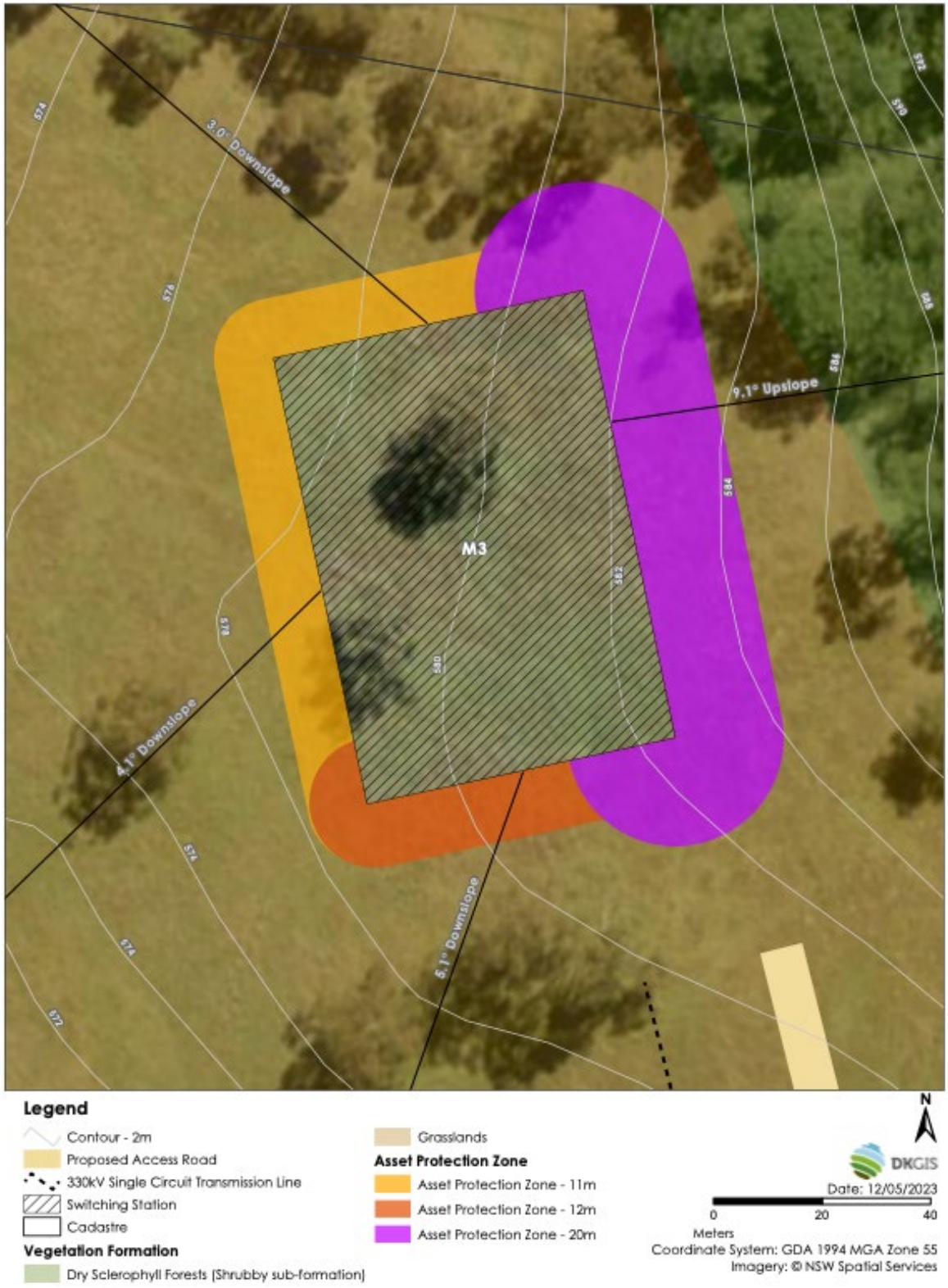


Switching Station E3

Switching Station E4

Switching Station M1

Switching Station M2



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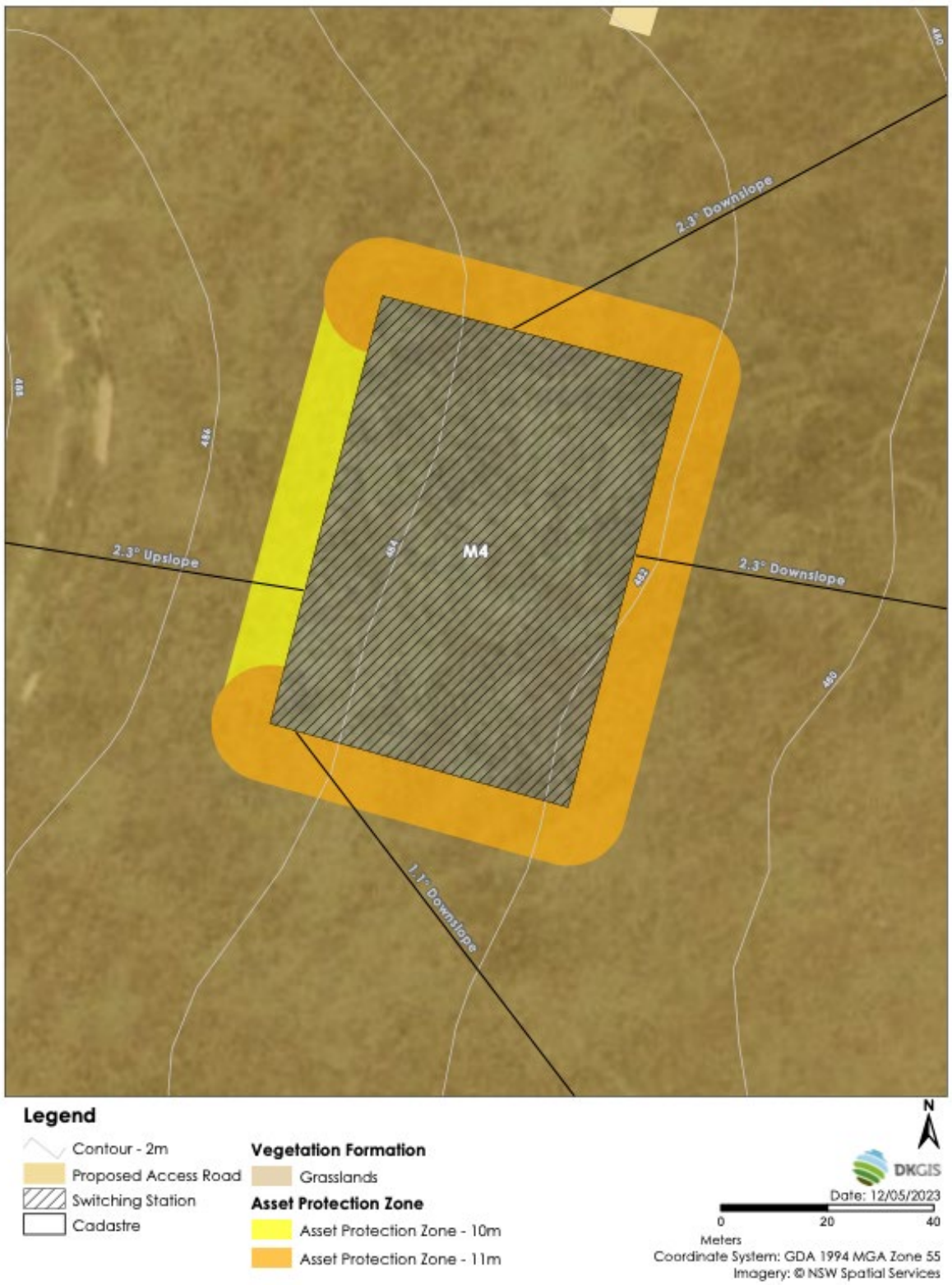
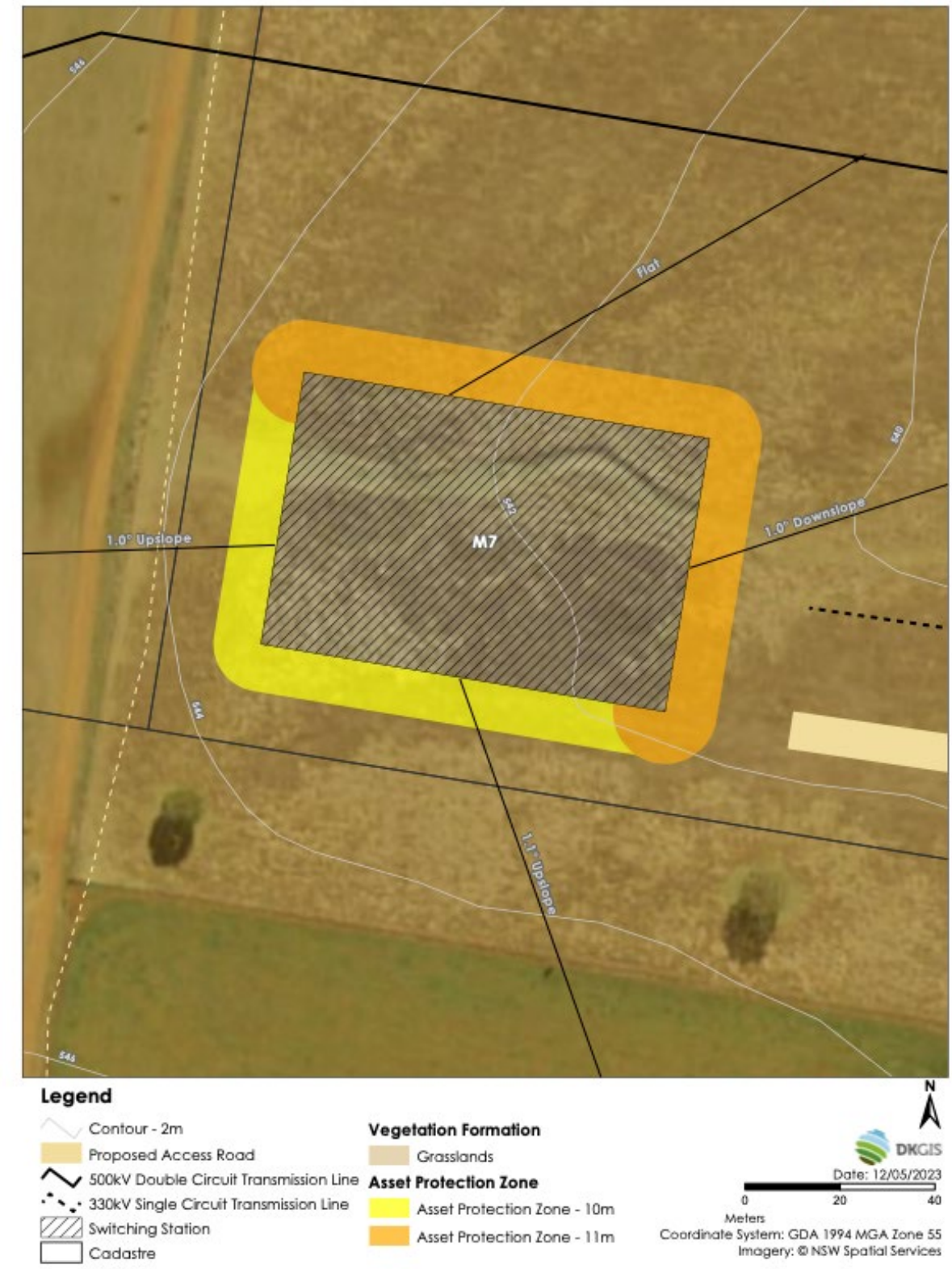


Switching Station M4

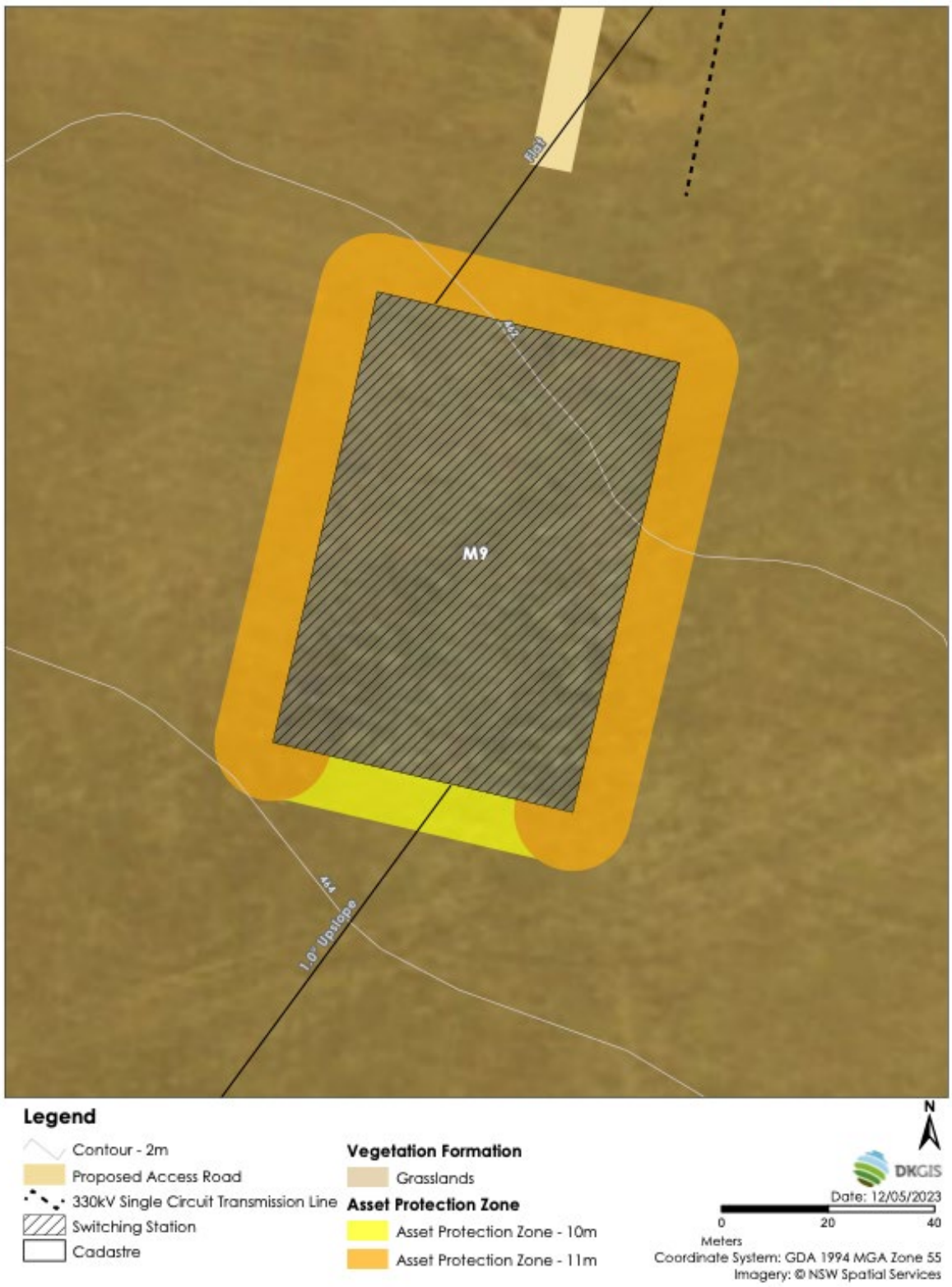
Switching Station M5

Switching Station M6



Switching Station M7

Switching Station M8



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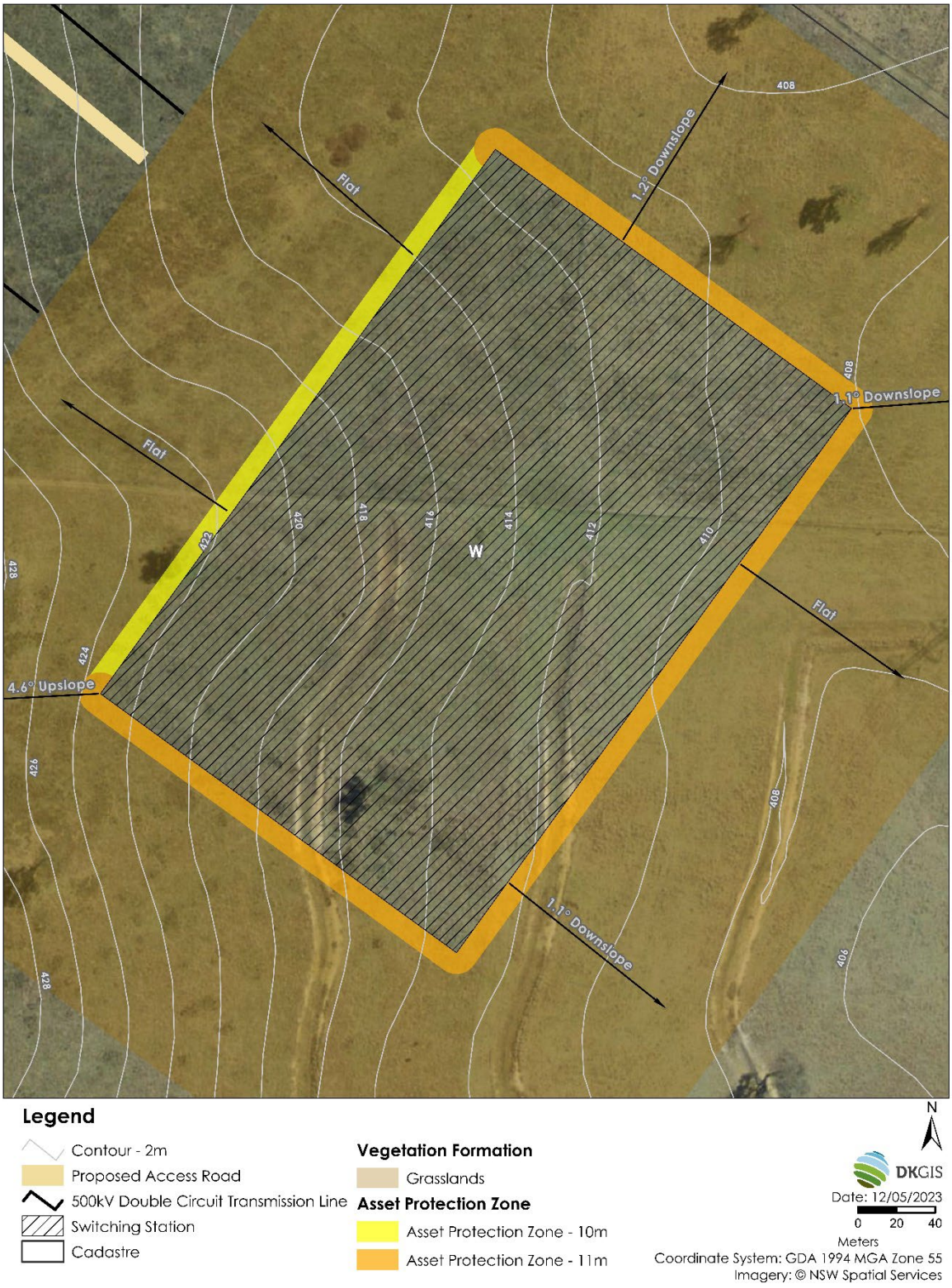
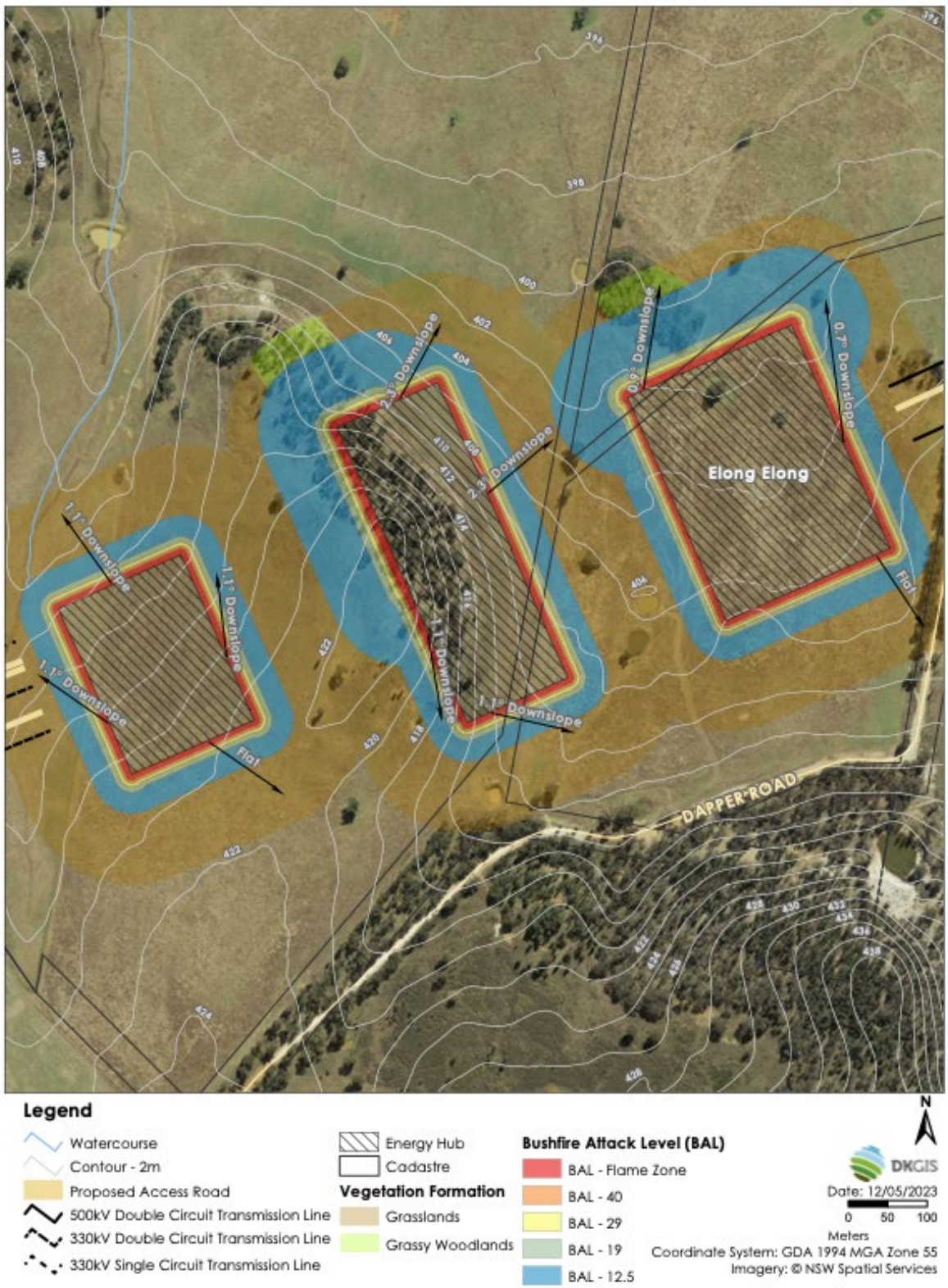


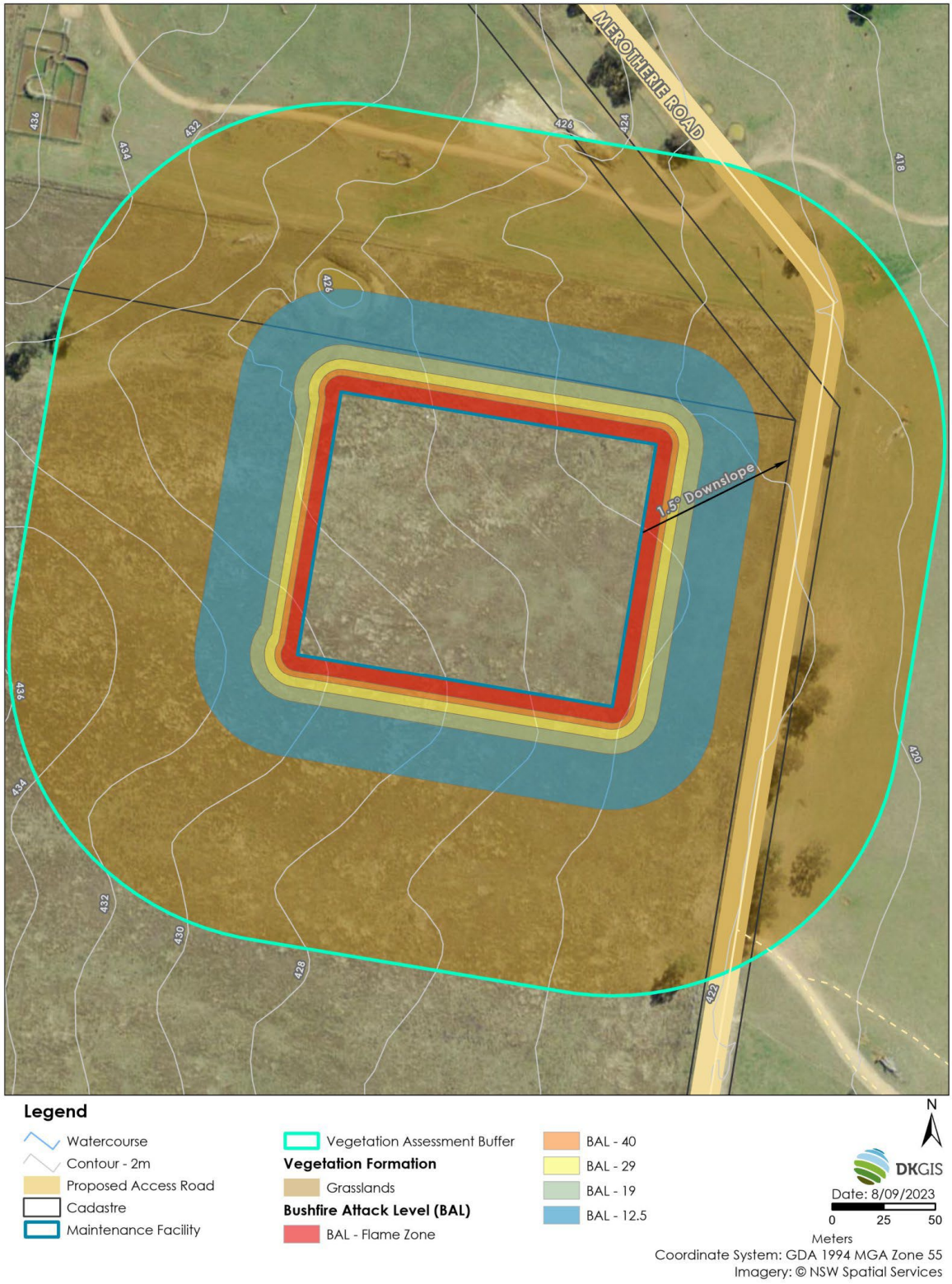
New Wollar Switching Station

Appendix 5 - Bushfire Attack Levels – Energy Hubs



Elong Elong Energy Hub

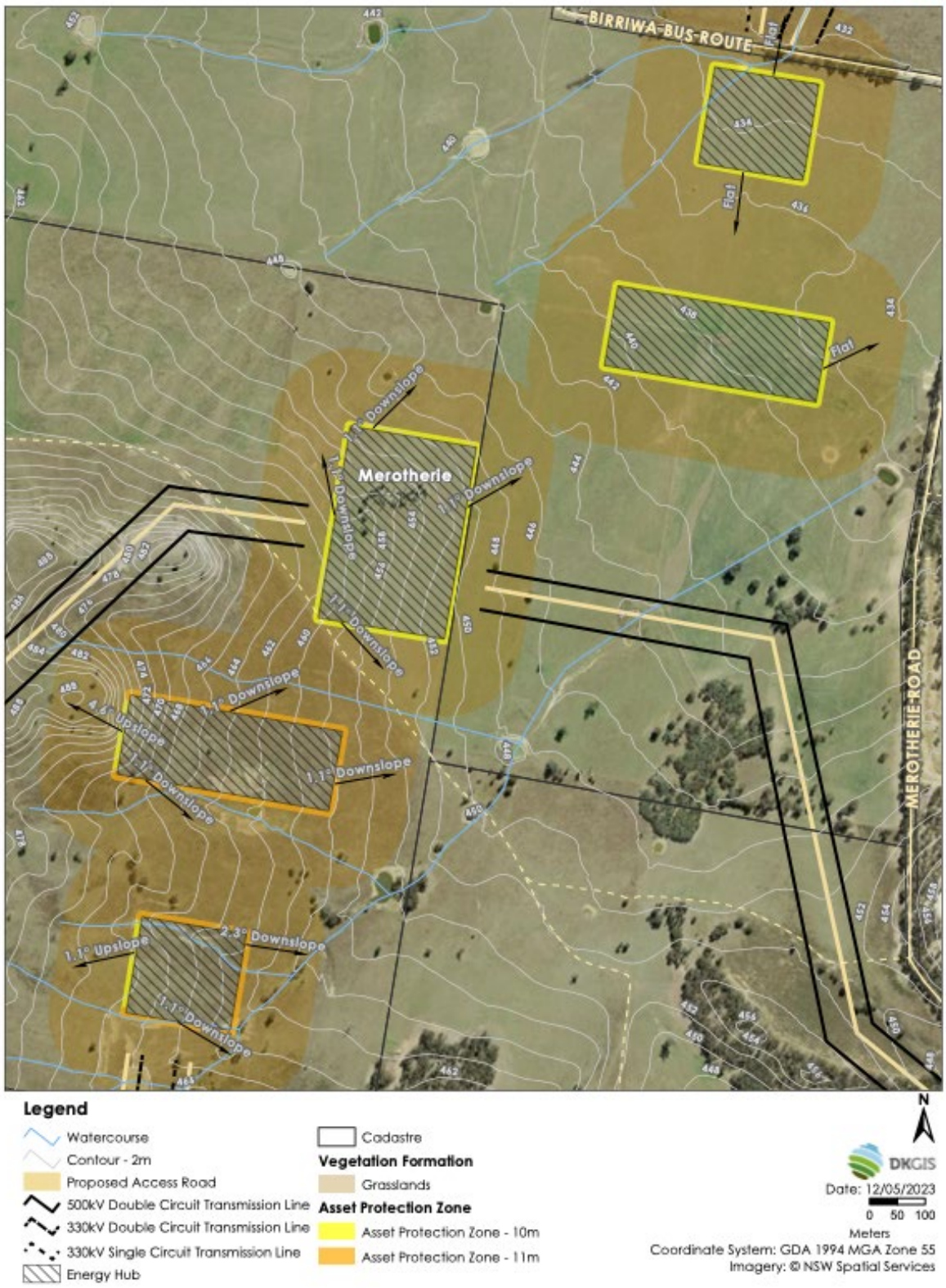
Merotherie Energy Hub



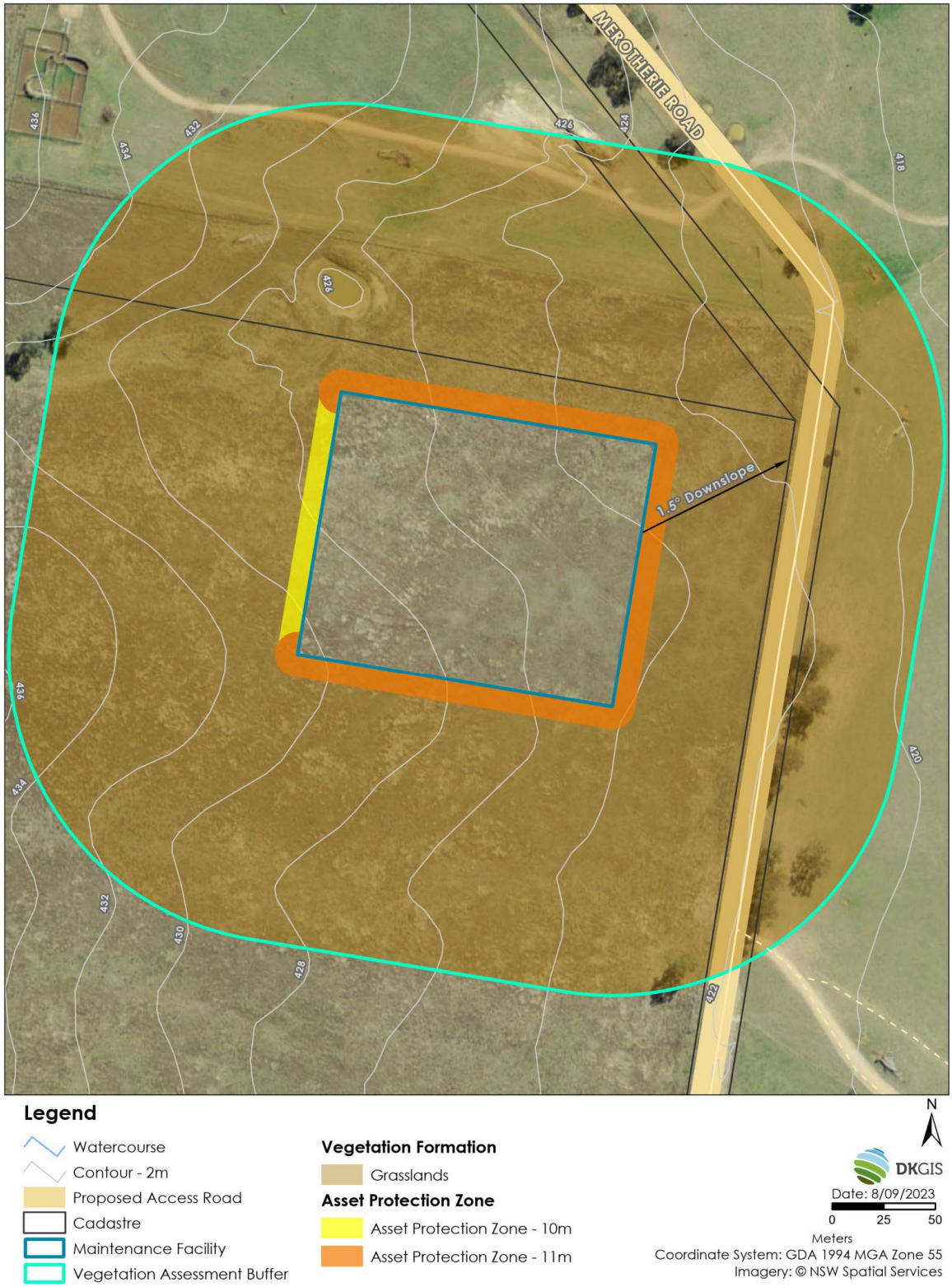
Merotherie Energy Hub – Maintenance facility

Appendix 6 – Asset Protection Zones – Energy Hubs

Elong Elong Energy Hub

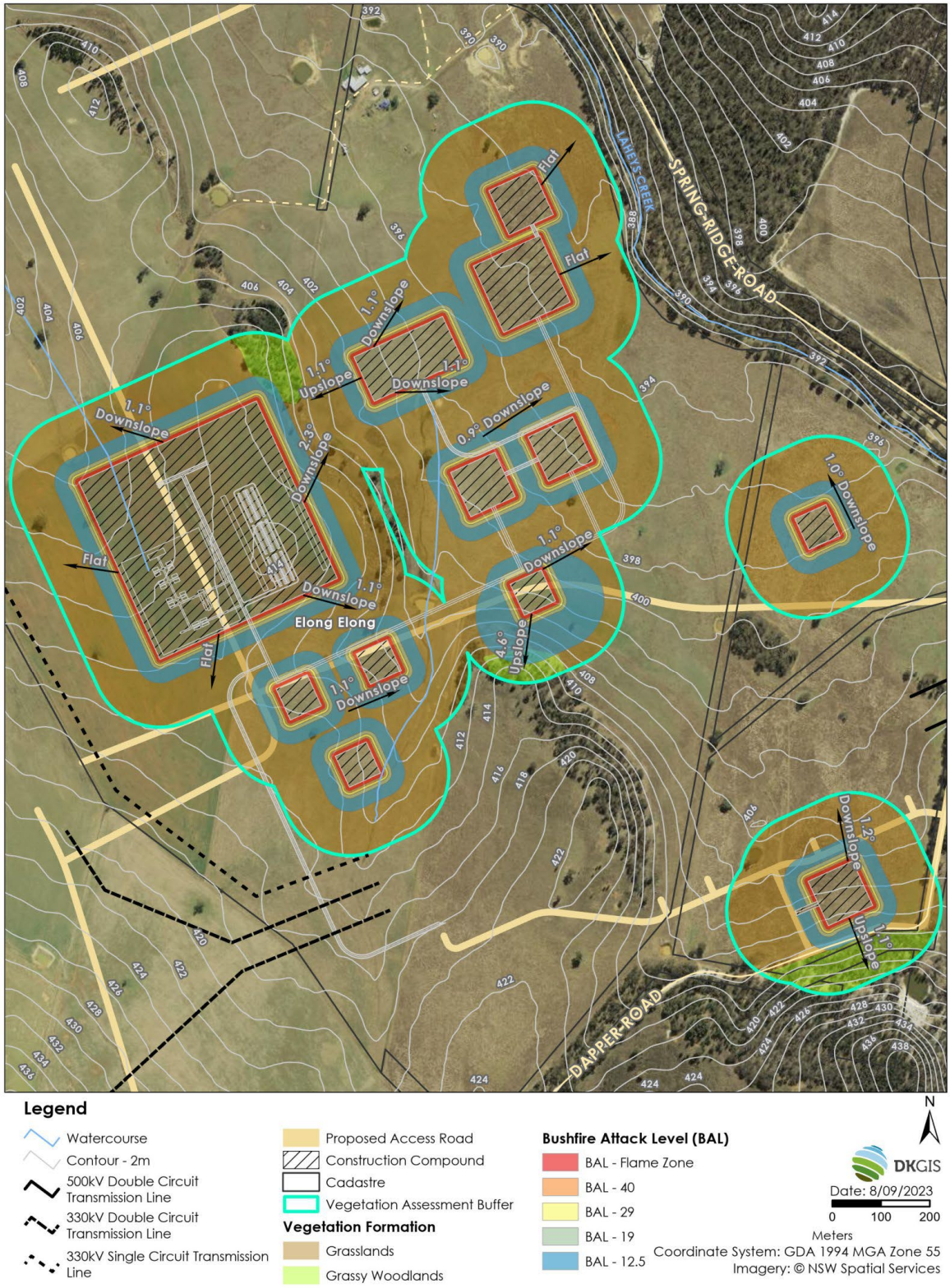


Merotherie Energy Hub

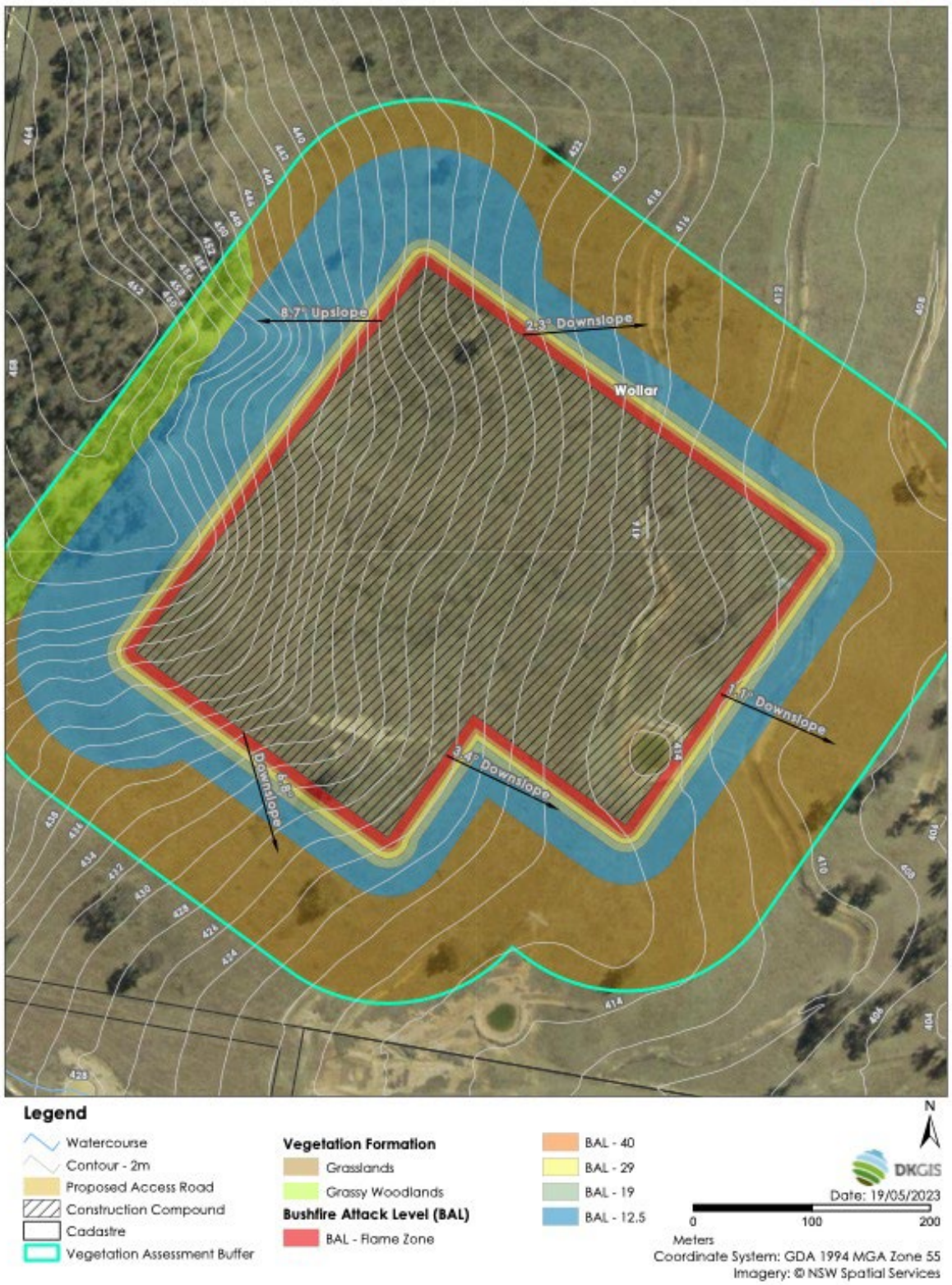


Merotherie Energy Hub – Maintenance facility

Appendix 7 - Bushfire Attack Levels – Construction Compounds

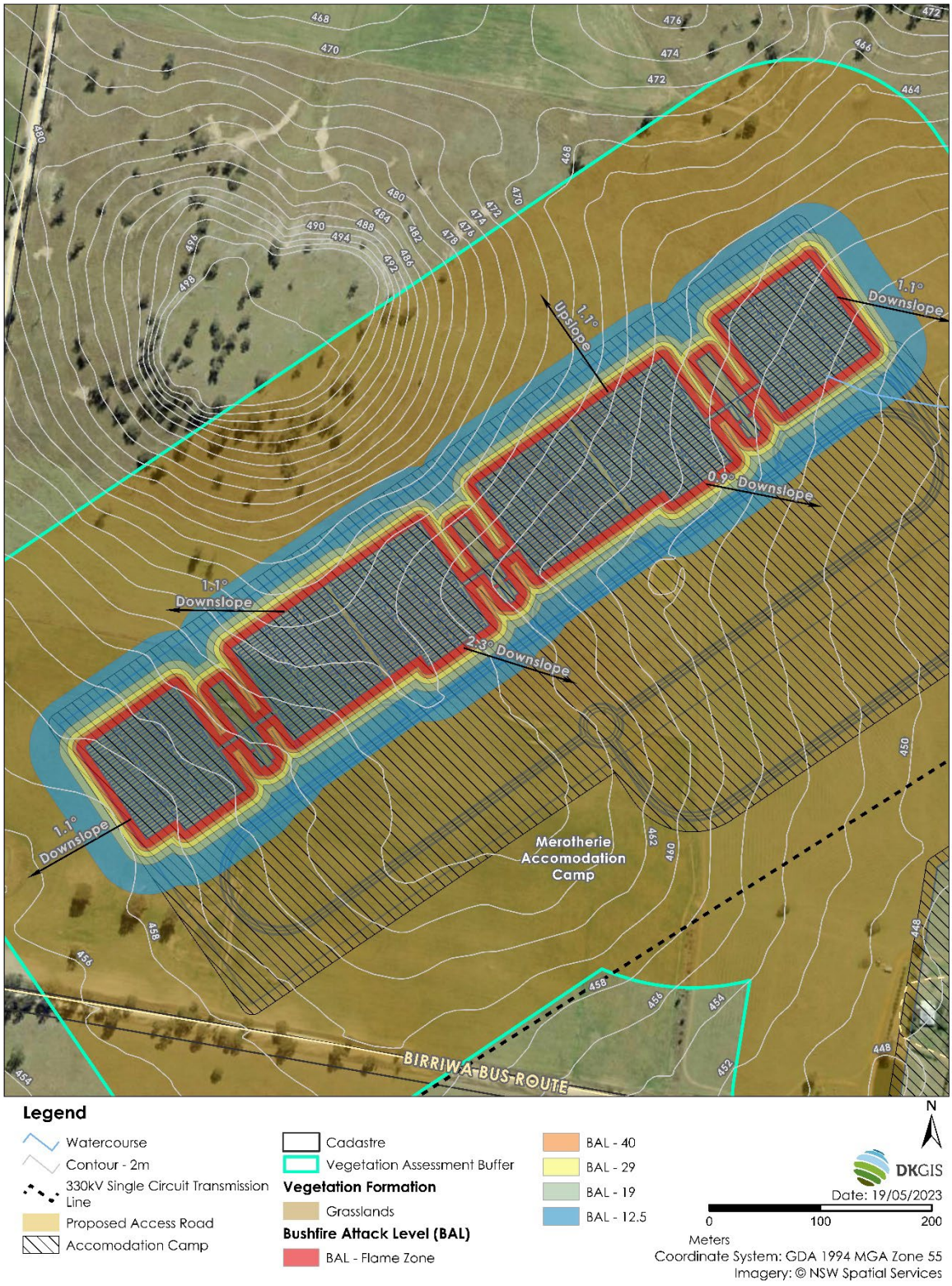


Construction Compound Elong Elong

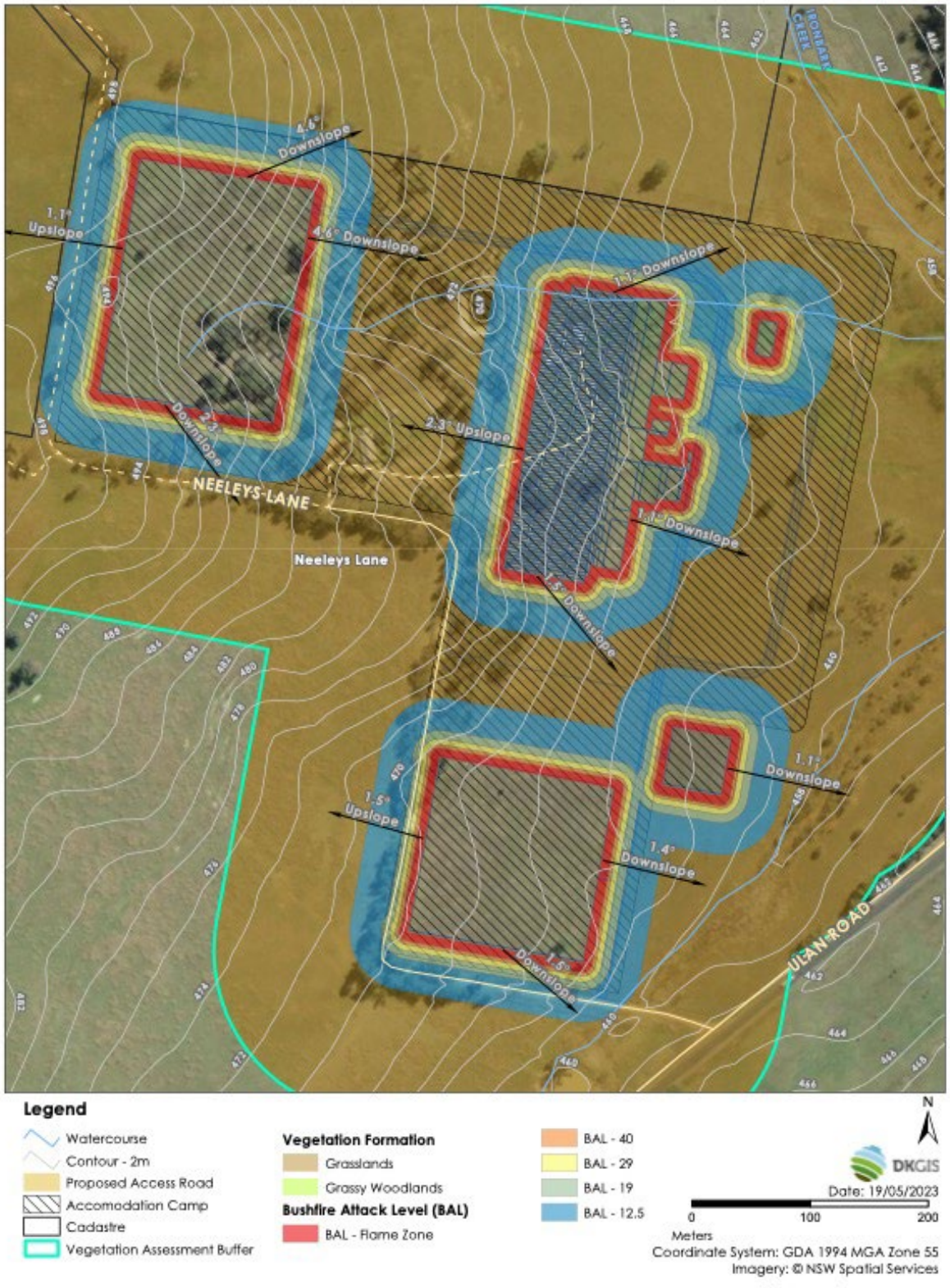


Construction Compound Wollar

Construction Compound Merotherie

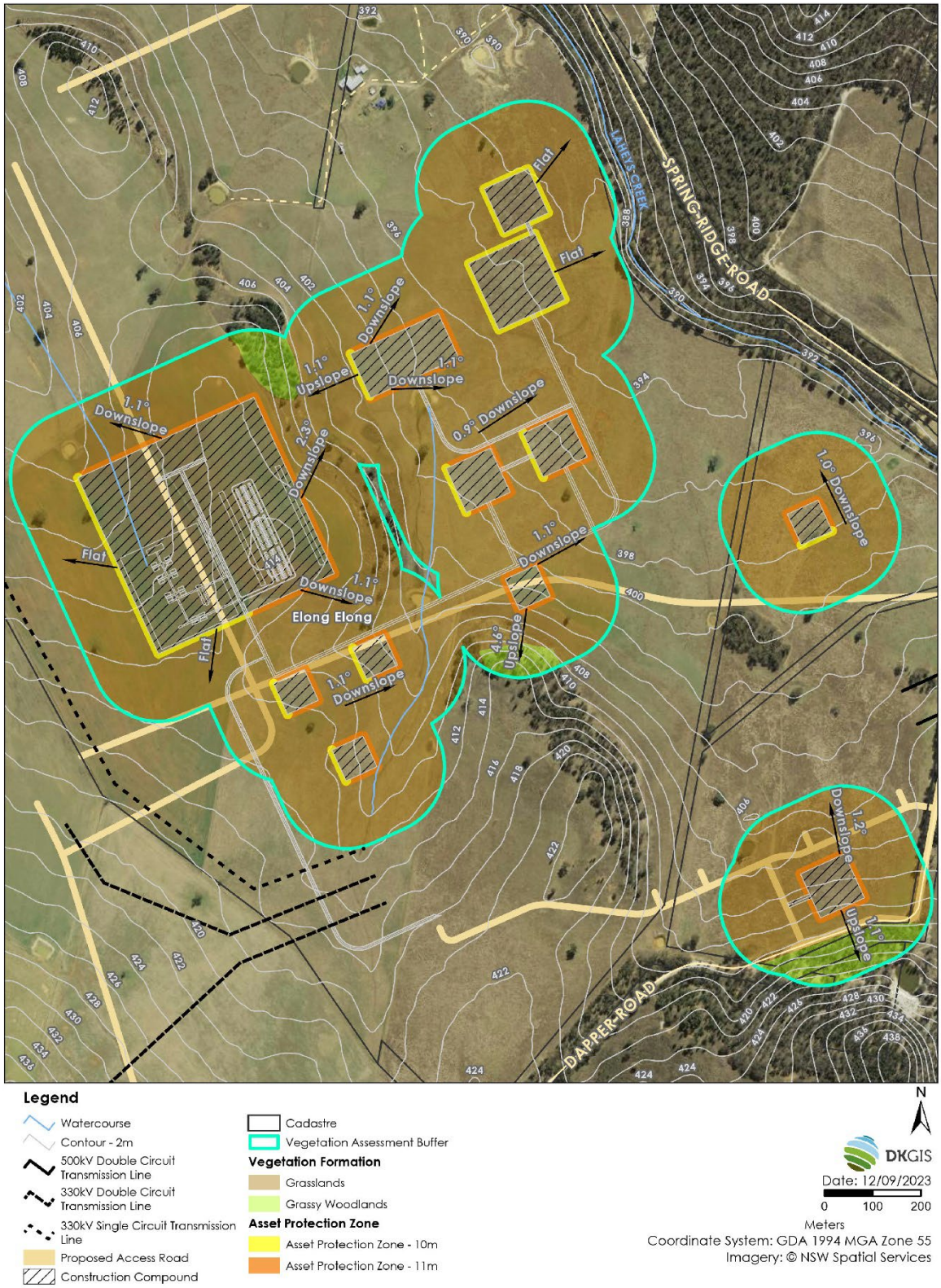


Merotherie Workforce Accommodation Camp



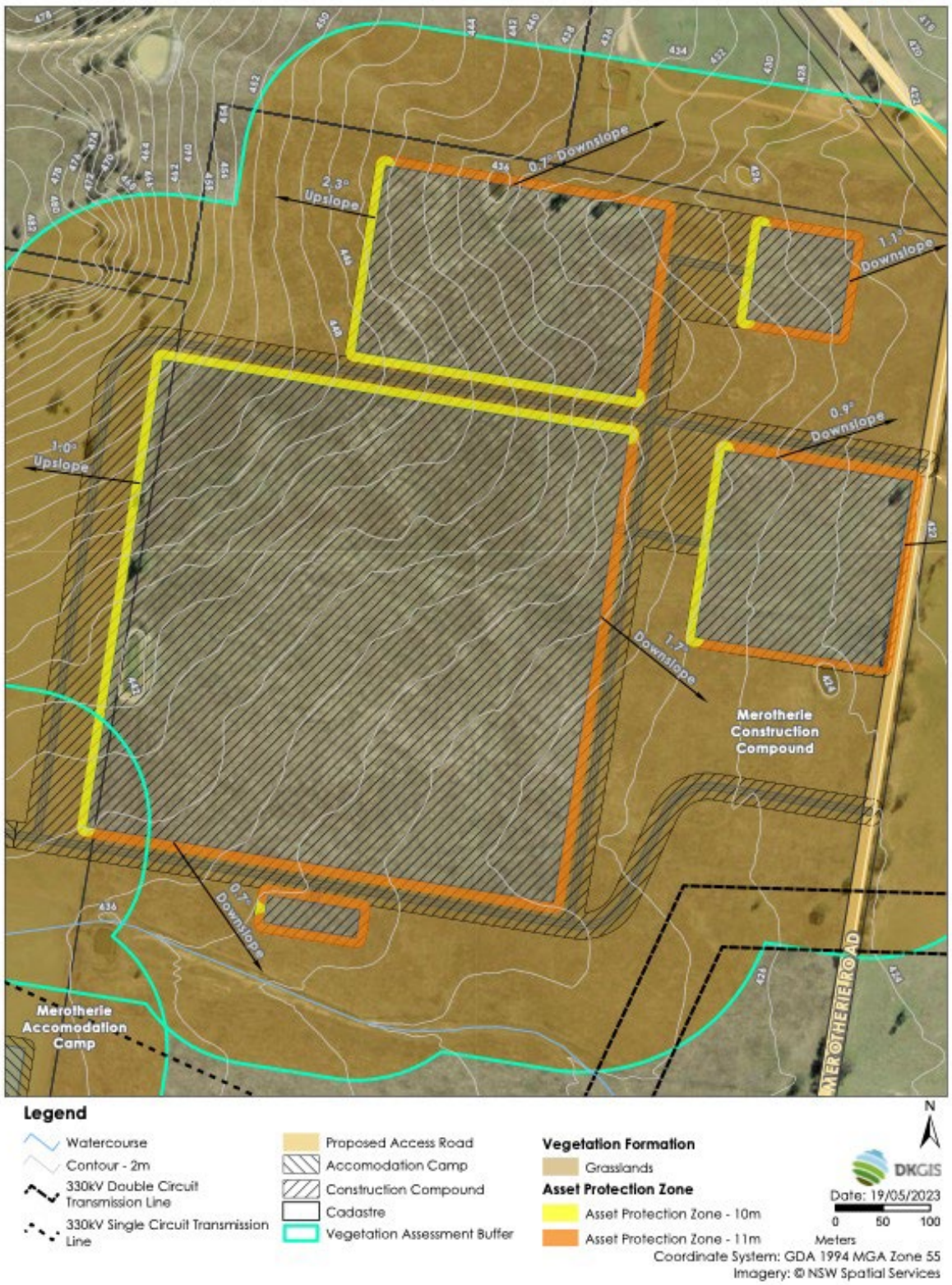
Neeleys Lane Workforce Accommodation Camp

Appendix 8 – Asset Protection Zones – Construction Compounds

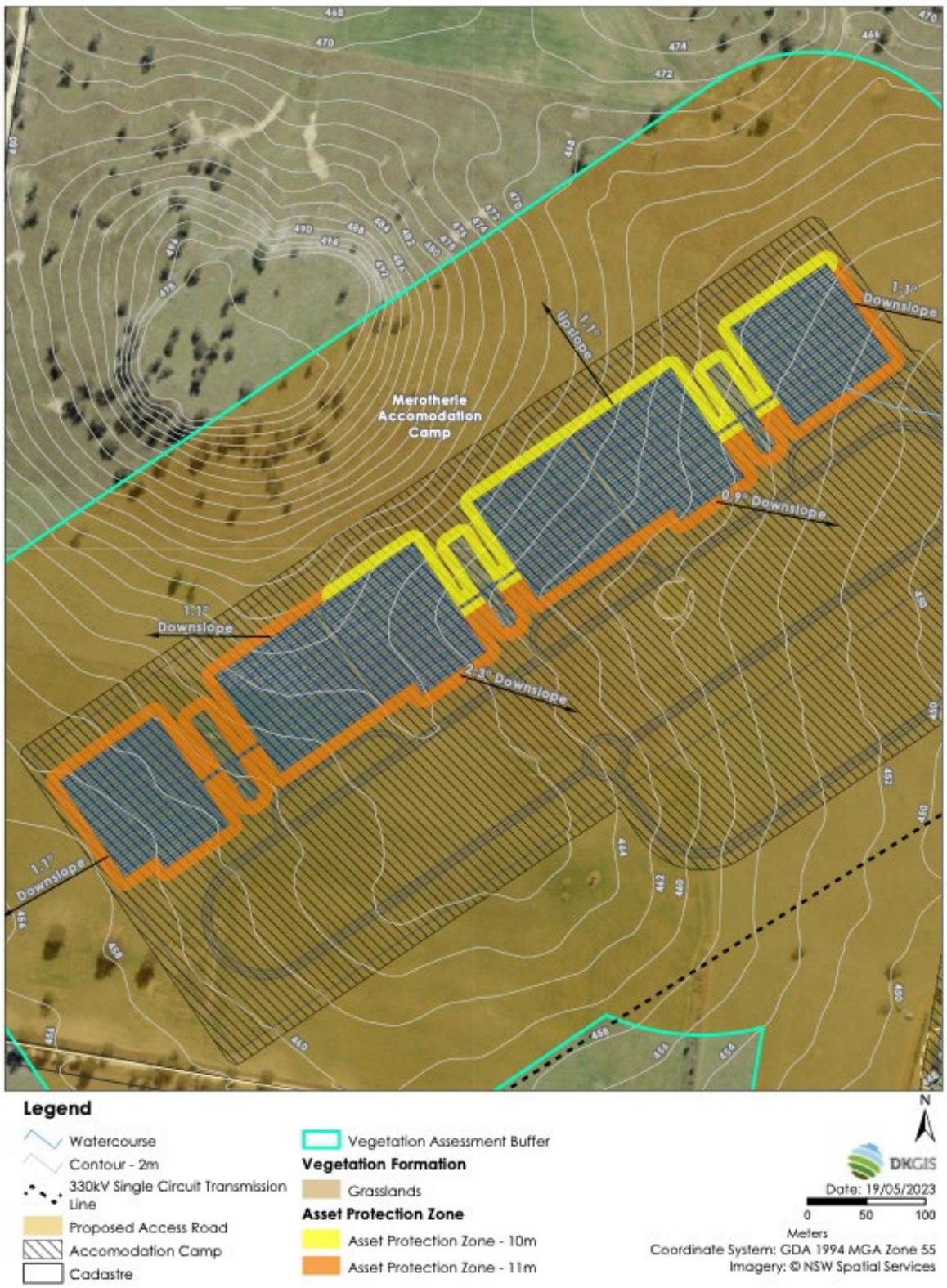


Construction Compound Elong Elong

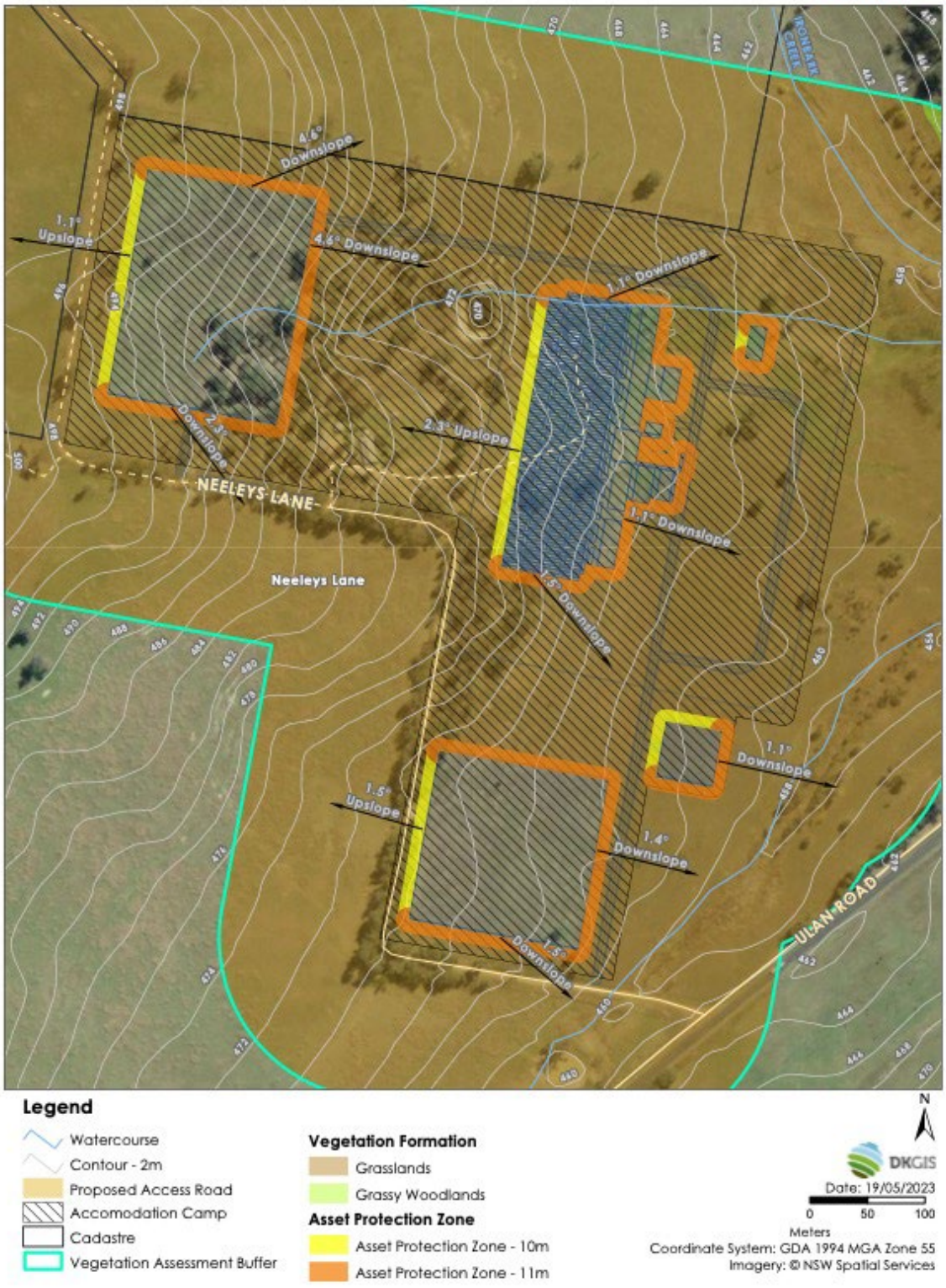
Construction Compound Wollar



Construction Compound Merotherie



Merotherie Workforce Accommodation Camp



Construction Compound Neeleys Lane

Appendix 9 - Inner Protection Area Requirements

APPENDIX 4

ASSET PROTECTION ZONE REQUIREMENTS

In combination with other BPMs, a bush fire hazard can be reduced by implementing simple steps to reduce vegetation levels. This can be done by designing and managing landscaping to implement an APZ around the property.

Careful attention should be paid to species selection, their location relative to their flammability, minimising continuity of vegetation (horizontally and vertically), and ongoing maintenance to remove flammable fuels (leaf litter, twigs and debris).

This Appendix sets the standards which need to be met within an APZ.

A4.1 Asset Protection Zones

An APZ is a fuel-reduced area surrounding a building or structure. It is located between the building or structure and the bush fire hazard.

For a complete guide to APZs and landscaping, download the NSW RFS document *Standards for Asset Protection Zones* at the NSW RFS Website www.rfs.nsw.gov.au.

An APZ provides:

- a buffer zone between a bush fire hazard and an asset;
- an area of reduced bush fire fuel that allows for suppression of fire;
- an area from which backburning or hazard reduction can be conducted; and
- an area which allows emergency services access and provides a relatively safe area for firefighters and home owners to defend their property.

Bush fire fuels should be minimised within an APZ. This is so that the vegetation within the zone does not provide a path for the spread of fire to the building, either from the ground level or through the tree canopy.

An APZ, if designed correctly and maintained regularly, will reduce the risk of:

- direct flame contact on the building;
- damage to the building asset from intense radiant heat; and
- ember attack.

The methodology for calculating the required APZ distance is contained within Appendix 1. The width of the APZ required will depend upon the development type and bush fire threat. APZs for new development are set out within Chapters 5, 6 and 7 of this document.

In forest vegetation, the APZ can be made up of an Inner Protection Area (IPA) and an Outer Protection Area (OPA).

A4.1.1 Inner Protection Areas (IPAs)

The IPA is the area closest to the building and creates a fuel-managed area which can minimise the impact of direct flame contact and radiant heat on the development and act as a defendable space. Vegetation within the IPA should be kept to a minimum level. Litter fuels within the IPA should be kept below 1cm in height and be discontinuous.

In practical terms the IPA is typically the curtilage around the building, consisting of a mown lawn and well maintained gardens.

When establishing and maintaining an IPA the following requirements apply:

Trees

- tree canopy cover should be less than 15% at maturity;
- trees at maturity should not touch or overhang the building;
- lower limbs should be removed up to a height of 2m above the ground;
- tree canopies should be separated by 2 to 5m; and
- preference should be given to smooth barked and evergreen trees.

Shrubs

- create large discontinuities or gaps in the vegetation to slow down or break the progress of fire towards buildings should be provided;
- shrubs should not be located under trees;
- shrubs should not form more than 10% ground cover; and
- clumps of shrubs should be separated from exposed windows and doors by a distance of at least twice the height of the vegetation.

Grass

- grass should be kept mown (as a guide grass should be kept to no more than 100mm in height); and
- leaves and vegetation debris should be removed.

A4.1.2 Outer Protection Areas (OPAs)

An OPA is located between the IPA and the unmanaged vegetation. It is an area where there is maintenance of the understorey and some separation in the canopy. The reduction of fuel in this area aims to decrease the intensity of an approaching fire and restricts the potential for fire spread from crowns; reducing the level of direct flame, radiant heat and ember attack on the IPA.

Because of the nature of an OPA, they are only applicable in forest vegetation.

When establishing and maintaining an OPA the following requirements apply:

Trees

- tree canopy cover should be less than 30%; and
- canopies should be separated by 2 to 5m.

Shrubs

- shrubs should not form a continuous canopy; and
- shrubs should form no more than 20% of ground cover.

Grass

- grass should be kept mown to a height of less than 100mm; and
- leaf and other debris should be removed.

An APZ should be maintained in perpetuity to ensure ongoing protection from the impact of bush fires. Maintenance of the IPA and OPA as described above should be undertaken regularly, particularly in advance of the bush fire season.