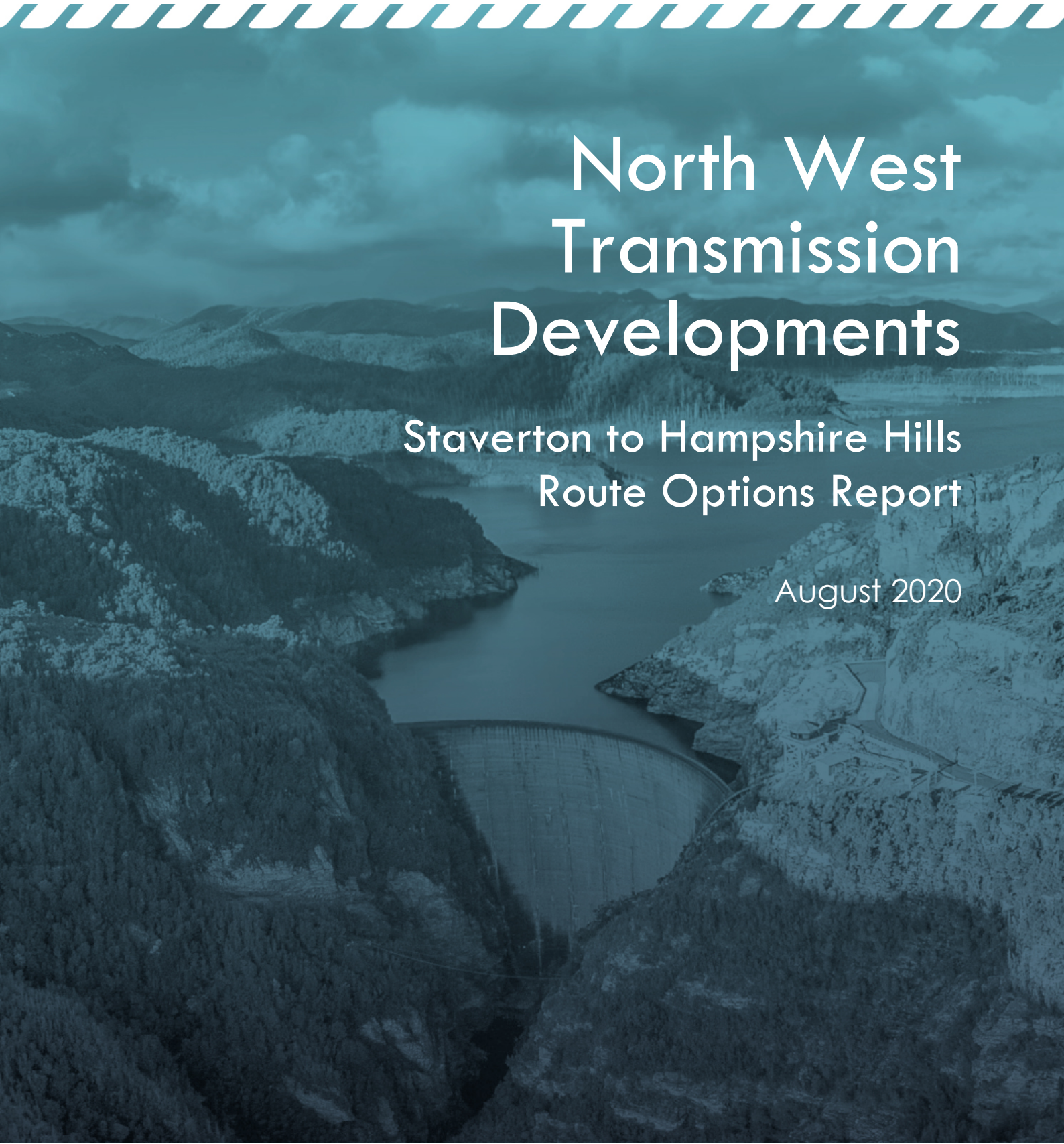
PROJECT MARINUS



North West Transmission Developments

Staverton to Hampshire Hills Route Options Report

August 2020

This document is the responsibility of Tasmanian Networks Pty Ltd, ABN 24 167 357 299 (hereafter referred to as "TasNetworks").

You can contact us with any questions about the proposed developments to the North West Tasmania transmission network via our project email and phone line. If you would like to find out more you can also visit the TasNetworks website, email us on projectmarinus@tasnetworks.com.au, or call us on 1300 127 777.

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Overview of Route Selection Process

(numbers relate to section numbers in this report)

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Executive Summary

Tasmanian Networks Pty Ltd (**TasNetworks**) owns, operates and maintains the electricity transmission and distribution networks in Tasmania. TasNetworks has responsibility for transmission system planning in Tasmania under the National Electricity Rules. The Australian Energy Market Operator (**AEMO**) is responsible for system security including transmission planning for the National Electricity Market (**NEM**). In Tasmania, TasNetworks is also responsible for system security including transmission planning.

In its capacity as jurisdictional planner, TasNetworks has prepared a strategic transmission plan for North West Tasmania. This plan sets out proposed transmission development for the region, to support energy flows to and from Marinus Link and efficiently unlock renewable energy and storage resources. As part of progressing the strategic transmission plan, TasNetworks is investigating the development of an overhead transmission line between Staverton and Hampshire Hills in North West Tasmania.

Project need

In its 2018 and 2020 Integrated System Plans (**ISPs**), AEMO has identified renewable energy zones and required transmission investment to efficiently unlock and transport energy in a rapidly transforming National Electricity Market. The *Integrated System Plan 2018 Plan 2018* (AEMO 2018) and *Integrated System Plan 2020* (AEMO 2020) identify three renewable energy zones (**REZs**) in Tasmania – one in North East Tasmania, one in North West Tasmania and one in the Tasmanian Midlands.

AEMO's 2018 ISP identified that Marinus Link, together with the supporting transmission developments in North West Tasmania, could play a key role in efficiently unlocking Tasmania's renewable energy and storage capacity, and that work should continue so that the project can be 'shovel ready' by 2023-24. The 2020 ISP also included Marinus Link as part of the future plan. The first 750 MW[1] of capacity including supporting transmission in North West Tasmania, should progress so it is able to be in service from 2028-29. The second 750 MW including supporting transmission in North West Tasmania, should be able to be in service from 2030-31.

The Tasmanian Government has announced proposals for Tasmania to reach 100 per cent self-sufficiency with renewable energy by 2022, and a doubling to 200 per cent renewable generation by 2040. The State has also released a Renewable Hydrogen Action Plan, aiming for Tasmania to be commercially exporting

1 This finding is based on the step change scenario outlined in the ISP. Link to 2020 ISP: https://aemo.com.au/energy-systems/major-publications/integrated-system-plan-isp/2020-integrated-system-plan-isp#:~:text=The%202020%20ISP%20provides%20an%20actionable%20roadmap%20for,a%20transition%20period%20of%20great%20complexity%20and%20uncertainty.

green hydrogen by 2030. Analysis undertaken by TasNetworks shows that the unlocking of Tasmania's renewable energy and storage resources supported by the Tasmanian Renewable Energy Target (**TRET**), a green hydrogen industry, and Marinus Link and supporting transmission developments, are complementary and provide significant benefits to electricity customers and to regional communities. The developments also support Australia's clean energy transition.

The Tasmanian electricity transmission network will require augmentation of existing transmission assets and development of new assets to enable proposed and anticipated renewable energy and storage projects to proceed.

Transmission network planning

TasNetworks developed conceptual plans for the North West region in response to identified connection enquiries and applications, forecast growth in renewable generation and storage projects in the region, the proposed connection of Marinus Link and system constraints. These were included in the 2019 Annual Planning Report (https://www.tasnetworks.com.au/Poles-and-wires/Planning-and-upgrades/Planning-our-network) published for consultation. TasNetworks also developed a strategic transmission plan for the North West Tasmanian transmission network.

Strategic planning recommends strengthening the North West Tasmania transmission network by creating a 220 kV 'rectangle' connecting the existing Sheffield and Burnie substations with two new switching stations. One new switching station is proposed at Hampshire Hills to facilitate forecast North West and Far North West wind development and West Coast wind and pumped hydroelectric storage projects. Another is proposed at Staverton to enable re-purposing of existing transmission lines between Staverton and Sheffield, and to facilitate forecast Mersey-Forth pumped hydroelectric storage projects.

Connecting Staverton and Hampshire Hills switching stations to Sheffield and Burnie substations to create a 'rectangle' (Figure E-1) provides significant system benefits. These include transmission route diversity and redundancy, reduced transmission losses, while maximising power transfer capability and system resilience.

The Staverton–Hampshire Hills connection augments the existing 220 kV transmission network by completing the first of two new 'sides' of the proposed 220 kV 'rectangle'. A new double circuit 220 kV overhead transmission line (**OHTL**) is proposed, with a new switching station at Staverton and plans for a future switching station at Hampshire Hills.

The Staverton to Hampshire Hills transmission route is proposed to connect Marinus Link, pumped hydro and other future renewable energy projects including the Robbins Island and Jim's Plain Renewable Energy Parks, currently being planned by a private energy developer called UPC Renewables. The UPC Renewables connection has prompted TasNetworks to bring forward the timing of development between Staverton and Hampshire Hills. TasNetworks' goal is to work with UPC Renewables and other generation and storage developers to achieve a coordinated and optimised transmission network that efficiently unlocks the renewable energy zone. The proposed transmission line between Staverton and Hampshire Hills is to be

built, owned and operated by TasNetworks. Under this arrangement, UPC Renewables will pay for the right to use the line.

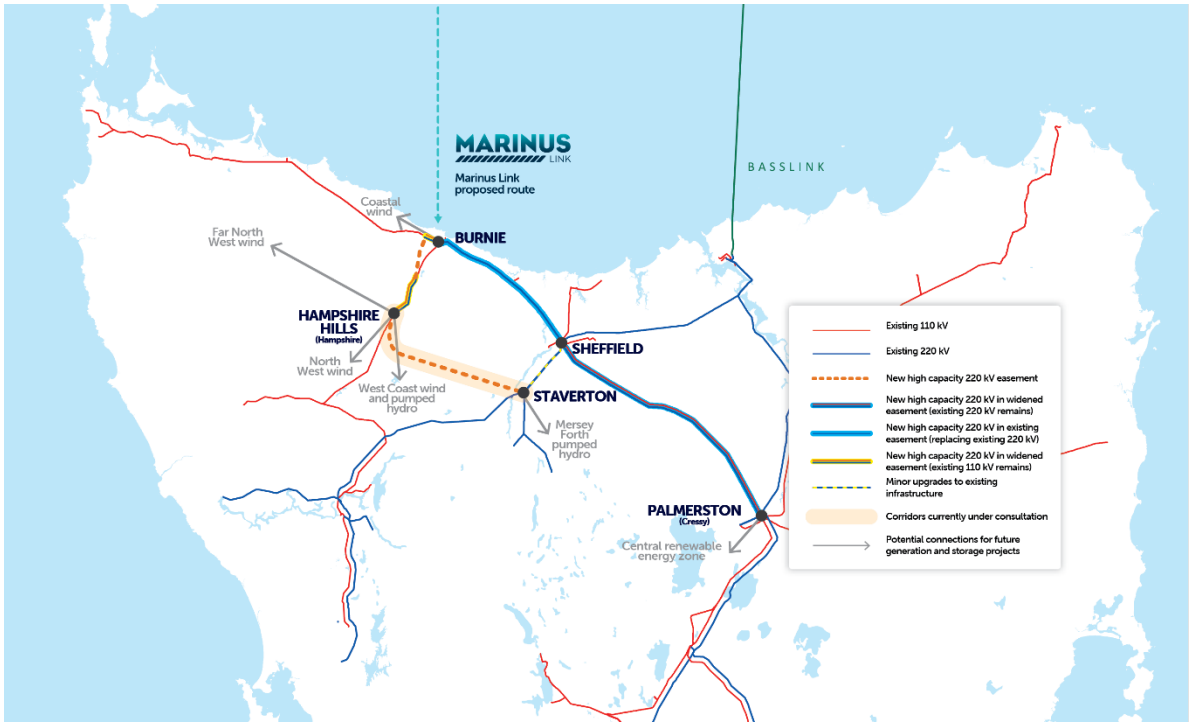


Figure E-1 North West Transmission Developments

Route selection

Route selection for the proposed Staverton–Hampshire Hills 220 kV OHTL involved collating all publicly available geospatial data and existing literature to identify constraints for the proposed OHTL route.

Constraints to route selection are considered in both ‘strategic’ and ‘tactical’ contexts. Strategic constraints inform corridor identification and tactical constraints inform identification of prudent and feasible routes within those corridors.

Significant strategic constraints, including Black Bluff Range, Cradle Mountain-Lake St Clair National Park, Leven Canyon, Loongana Range, Mt Everett, Mt Housetop, Native Track Tier and St Valentines Peak, informed three feasible corridors being identified:

- a northern corridor through South Nietta, South Preston, Gunns Plains, South Riana and Upper Natone to the north of Leven Canyon and Mt Housetop;
- a central corridor through the River Leven valley and Surrey Hills; and
- a southern corridor along the Sheffield–Farrell 220 kV OHTL and Burnie–Waratah 110 kV OHTL.

Prudent and feasible routes were identified in each corridor and evaluated against tactical technical, environmental and social route selection criteria.

Routes in the northern corridor were found to be highly constrained by geology (granite formations), rural settlements and intensive agriculture, particularly in Gunns Plains.

Routes in the southern corridor were significantly longer than routes in the other corridors. Routes in this corridor passed through the Vale of Belvoir conservation area and a conservation covenant with potential significant impacts on the subalpine grassland, sedgeland and rushland ecological communities and associated state and federally listed threatened species.

A route in the central corridor was found to be least constrained and nominated as the proposed route. This proposed route was released for public consultation in November 2019 (**2019 proposed route**).

Landowner and community feedback

Landowner/land manager and community feedback was sought on the 2019 proposed route, including through a survey and a series of workshops and meetings with individuals, groups, communities and organisations.

A number of individuals, groups, communities and organisations raised concerns about the proposed route and requested changes including proposals for alternative routes. A number of stakeholders raised broader concerns about new renewable energy projects in Tasmania and the corresponding need for any new transmission. The feedback relating to the proposed route and route change requests can be broadly grouped as follows:

- requests for an underground option;
- a strong preference for a route through the Vale of Belvoir; and
- requests for refinement of the proposed route.

Route change requests arising from community feedback are considered further where they introduce new material information, which was the case in several requests. In response, TasNetworks undertook a detailed review of the proposed route to identify possible realignments and the merits of the alternative routes. An end-to-end review (including assessment) was done to consider whether addressing one change request would adversely impact adjacent land, ecological and cultural heritage values or sections of the route.

Review of proposed route

Underground option

Transmission circuits can be constructed as OHTL or underground cables. A range of factors determine the feasibility of overhead or underground technologies. TasNetworks prefers to use OHTLs when progressing high voltage AC (**HVAC**) projects, as this allows for more efficient additional connections, reflects our existing transmission network assets, and is generally the least cost to deliver energy to customers, while still allowing land use and environmental impacts to be managed.

An underground option was discounted as the difficult terrain would increase the length of the route and environmental impacts would be greater. The environmental impacts reflect that the entire underground route would need to be cleared and trenched, except for major watercourse and road crossings which could be crossed using horizontal directional drilling if geotechnical conditions were suitable. Karst limestone and landslip hazard zones on the steep slopes of the major watercourses would expose the underground cable to risk of damage. These issues contribute to underground options costing significantly more than OHTLs.

The 2019 proposed route (and preferred route) is best constructed as an OHTL, as the route traverses deeply incised valleys, unstable geology including karst limestone and landslip hazard zones.

Sheffield to Farrell corridor

Despite routes along the Sheffield–Farrell 220 kV OHTL through the Vale of Belvoir having originally being discounted, routes through the conservation area and conservation covenant were revisited after numerous requests from affected communities. Overhead and underground options were reviewed. This review confirmed the earlier assessment that routes through the Vale of Belvoir would have significant environmental impacts on threatened ecological communities and species, would significantly increase the cost of the project. The cost differences change depending on the circumstances.

The Tasmanian Land Conservancy (**TLC**) actively manages the conservation area and conservation covenant and undertakes scientific research, ecological burns and conservation programs aimed at protecting and enhancing its values. The TLC expressed considerable concern at the prospect of routes through the Vale of Belvoir. Routes through the Vale of Belvoir were again discounted.

Refinement of 2019 proposed route

Review of route change requests and suggested alternative routes resulted in a number of route options being identified to refine the proposed route. No viable alternatives were identified between Staverton and Cethana and between Wey River and Hampshire Hills. The River Leven crossing is a '**pinch point**' with no viable alternatives. Alternative crossing points would significantly impact small private properties, conservation assets and covenants, and visual amenity.

Viable route change requests were grouped into sections to aid review and evaluation.

The sections were:

- Cethana to River Leven (eastern section)
- River Leven to Blythe Road (central section)
- Blythe Road to Wey River (western section)

For the eastern section of the route there were two alternatives identified (north and south of Bell Mount); for the central section of the route, there was one alternative (north of Loongana); and for the western section of the route, there was one alternative (south through Rabbit Plain).

In assessing these alternatives, detailed ecology, cultural heritage and geomorphology desktop studies and an eagle nest survey were undertaken to ensure the evaluation process was based on an equivalent level of data to that used for the originally proposed route.

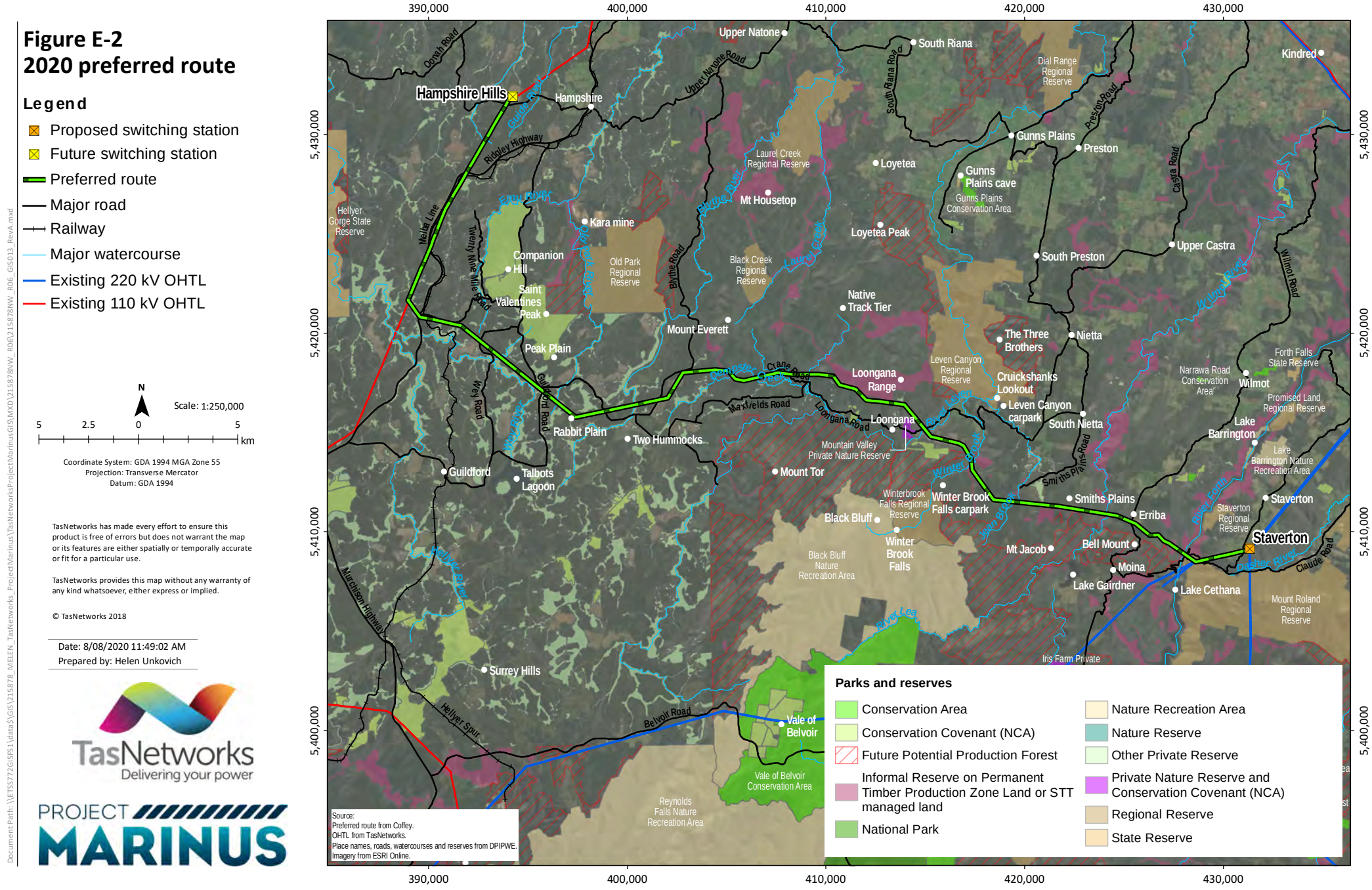
The alternative routes were evaluated against the proposed route for key route selection criteria including technical, environmental and social aspects. Findings from the desktop studies and the experience of TasNetworks' subject matter experts were key inputs to the evaluation. The alternative routes for each section were evaluated as to whether they were an improvement on the proposed route or a detriment.

Preferred route

Evaluation of the alternative routes against the proposed route for the three sections resulted in a preferred route that is a combination of the 2019 proposed route and alternate routes identified. This outcome was found to address a number of landholder and community concerns and route change requests, while also considering other variables such as constructability and environmental impacts. The preferred route (Figure E-2) was identified as:

- Staverton to Cethana – 2019 proposed route;
- Cethana to River Leven (eastern section) – north of Bell Mount alternative route;
- River Leven crossing – 2019 proposed route;
- River Leven to Blythe Road (central section) – north of Loongana alternative route;
- Blythe Road to Wey River (western section) – Rabbit Plain alternative route; and
- Wey River to Hampshire Hills – 2019 proposed route.

Figure E-2
2020 preferred route



Next steps

TasNetworks will use the preferred route to progress further planning and engagement activities. Landowners, communities and stakeholders will have multiple opportunities to comment on the preferred route and its impacts. Formal opportunities to make submissions are provided through comprehensive and robust environmental, planning and heritage assessment processes, and informal opportunities are available through planned engagement activities.

Identification of the preferred route will enable:

- Tower positions to be confirmed, which will inform environmental, planning and heritage assessments and land access negotiations.
- Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 referral application.
- Land access negotiations to be completed to enable field surveys.
- Detailed terrestrial ecology, cultural heritage and geomorphology field surveys to accurately map existing conditions for environmental impact assessment purposes.
- Landscape and visual impact assessment to understand how the preferred route addresses community concerns about views from their properties and key tourist viewpoints. Community input on views and landscapes will inform this assessment and the development of appropriate mitigation.
- Preliminary geotechnical and constructability investigation (walk-through) to identify features and site conditions that require detailed investigation to inform detailed design.
- Environmental, cultural heritage and socioeconomic technical studies to inform environmental impact assessment and cultural heritage and planning approvals. The outcomes of these studies may require route refinement to address site-specific constraints and manage impacts.
- Landowner negotiations for the required easement, valuations and compensation agreements.
- Detailed design of the proposed double circuit 220 kV OHTL and Staverton Switching Station having regard to the environmental impact assessment including cultural heritage and socioeconomic studies and proposed mitigation measures.
- Submission of environment, land use planning and heritage applications for approval.
- Environment, land use planning and heritage approval decisions determines the final design of the OHTL and Staverton Switching Station.

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1 Report purpose and structure

This report has been prepared to document for landowners, the community and other stakeholders, the route selection process used to identify a preferred route for the proposed Staverton–Hampshire Hills overhead transmission line in North West Tasmania. The preferred route will support progress of environmental and social impact assessment, detailed transmission line design, environmental and planning approvals, and land access negotiations.

The route selection process presented in this report is summarised below and shown in Figure 1-1, which includes key milestones. Numbers in Figure 1-1 relate to the section numbers in this report.

National Electricity Rules (**NER**) require identification of a route that is a prudent and efficient. Environmental, planning and cultural heritage legislation and guidelines require prudent and feasible alternatives to be identified and assessed that factor in additional values and constraints. This process is used to identify a preferred transmission route.

Route selection involves trade-offs between a variety of factors. Prudent and feasible routes balance societal expectations with environmental impacts, cultural heritage considerations, constructability, current and future land use, project costs (construction, operation and maintenance) and technical and operational requirements.

Route selection starts by considering strategic transmission network planning requirements to identify what augmentation or new transmission infrastructure is required, and where it is to be located, i.e. the start and end points for route selection.

The existing physical, biological and socioeconomic environments provide context and assist in identifying constraints and opportunities for prudent and feasible routes. Environmental, planning and heritage legislation and guidelines are used to define constraints to route selection. Some existing linear infrastructure provides opportunities for co-location. Strategic constraints such as mountain ranges inform the identification of least constrained corridors within which prudent and feasible routes are identified having regard to tactical constraints such as houses and threatened species habitat.

The technical specification, opportunities and constraints are captured in route selection criteria that comprise technical, environmental and social aspects. Technical criteria include project objectives, and engineering and configuration considerations described in the technical specification. Environmental and social criteria include values important to people, communities and government.

Potential routes are identified using, and evaluated against, the route selection criteria. Options are progressively discounted or refined as more detailed information becomes available and is analysed. Desktop information is used to identify all prudent and feasible routes, with preliminary baseline studies and ‘ground-truthing’ used to evaluate shortlisted options to determine a proposed route. Landowner, community

and other stakeholder feedback on the proposed route and preliminary design inform the decision on preferred route.

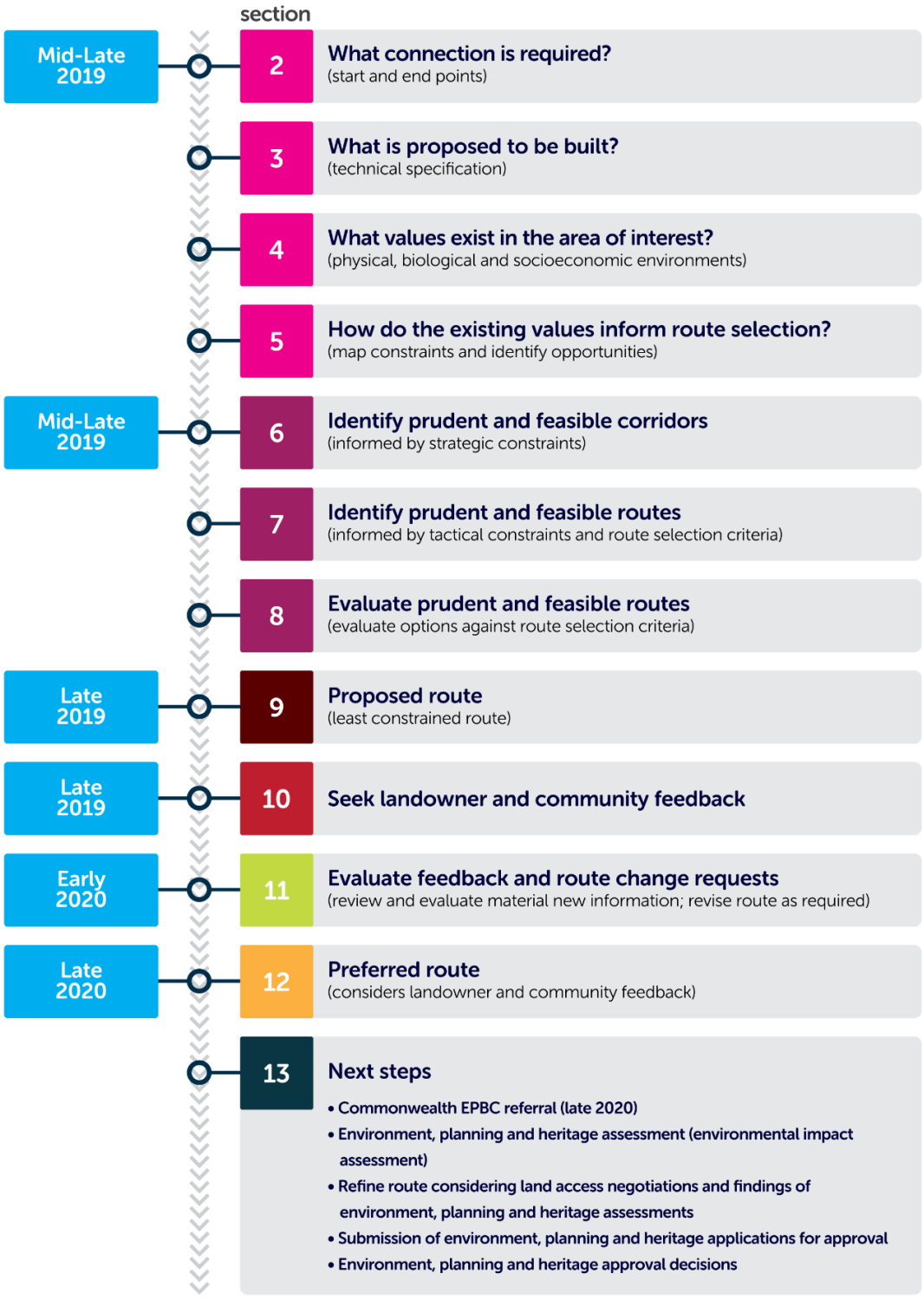


Figure 1-1 Route selection process

2 What connection is required?

Tasmanian Networks Pty Ltd (**TasNetworks**) owns, operates and maintains the electricity transmission and distribution networks in Tasmania. TasNetworks has responsibility for transmission system planning in Tasmania under NER. The Australian Energy Market Operator (**AEMO**) is responsible for system security including transmission planning for the National Electricity Market (**NEM**). In Tasmania, TasNetworks is also responsible for system security including transmission planning.

In its capacity as jurisdictional planner, TasNetworks has prepared a strategic transmission plan for North West Tasmania. This plan sets out proposed transmission development for the region, to support energy flows to and from Marinus Link and efficiently unlock renewable energy and storage resources. As part of implementing the strategic transmission plan, TasNetworks is investigating the development of an overhead transmission line between Staverton and Hampshire Hills in North West Tasmania.

2.1 Background

Developed in collaboration with jurisdictional planners or transmission network service providers, AEMO publishes two reports – *Electricity Statement of Opportunities* annually and *Integrated System Plan* every two years – that inform electricity market participants and prospective participants of forecast demand, generation, constraints and opportunities. The *Integrated System Plan*, first published in 2018 and most recently in 2020, responds to the market transitioning from coal-fired generation to renewable generation and decentralised energy resources. The plan identifies renewable energy zones and required transmission investment to efficiently unlock and transport energy in a rapidly transforming NEM.

The *Integrated System Plan 2018* (AEMO 2018) and *Integrated System Plan 2020* (AEMO 2020) identify three renewable energy zones (**REZs**) in Tasmania – one in North East Tasmania, one in North West Tasmania and one in the Tasmanian Midlands.

AEMO's 2018 Integrated System Plan (**ISP)** identified that Marinus Link, together with the supporting transmission developments in North West Tasmania, could play a key role in efficiently unlocking Tasmania's renewable energy and storage capacity, and that work should continue so that Project Marinus can be '**shovel ready**' by 2023-24. The 2020 ISP included Marinus Link as part of the future plan. The first 750 megawatt (**MW**) of capacity, including supporting transmission in North West Tasmania, should progress so

it is able to be in service from 2028-29[2]. The second 750 MW, including supporting transmission in North West Tasmania, should be able to be in service from 2030-31.

The Tasmanian Government's *Draft Tasmanian Renewable Energy Action Plan 2020* (State of Tasmania 2020) confirms the government's commitment to 100 per cent renewable energy by 2022 and proposes a Tasmanian Renewable Energy Target (**TRET**) of 200 per cent renewable generation by 2040, establishing Tasmania as a net exporter of clean energy. The Tasmanian Government has also released the *Draft Tasmanian Renewable Hydrogen Action Plan* (State of Tasmania 2019) with a vision that Tasmania will be commercially exporting hydrogen by 2030. Analysis undertaken by TasNetworks shows that unlocking Tasmania's renewable energy and storage resources supported by the TRET, a green hydrogen industry, and Marinus Link and supporting transmission developments, are complementary and provide benefits to electricity customers and to regional communities. The developments also support Australia's clean energy transition.

Tasmania has world-class wind resources that are being developed. Granville Harbour and Cattle Hill wind farms are nearing full commercial operation and will contribute to Tasmania's 2022 target of 100 per cent renewable energy. A number of other wind and solar projects are in various stages of development around Tasmania including UPC Renewables' Robbins Island and Jim's Plain Renewable Energy Parks. UPC Renewables plans to progress the first stage of its projects regardless of the timing of Marinus Link. UPC Renewables has indicated that Marinus Link is required to enable the full development of Robbins Island Renewable Energy Park.

The Tasmanian electricity transmission network will require augmentation of existing transmission assets and development of new assets to enable proposed and anticipated renewable energy and storage projects across Tasmania to proceed.

2.2 North West Tasmania Strategic Transmission Plan

TasNetworks, in its capacity as Tasmanian jurisdictional planner, is required to plan and consult on proposed transmission network augmentation. The augmentation plans consider the configuration and performance of the existing network, respond to forecast changes in generation and customer load including as a result of

2 This finding is based on the step change scenario outlined in the ISP. Link to 2020 ISP: https://aemo.com.au/energy-systems/major-publications/integrated-system-plan-isp/2020-integrated-system-plan-isp#:~:text=The%202020%20ISP%20provides%20an%20actionable%20roadmap%20for,a%20transition%20period%20of%20great%20complexity%20and%20uncertainty.

connection enquiries and applications, and address anticipated constraints in the network. Transmission planners are also required to consider AEMO's ISP.

The regulatory framework for network planning requires TasNetworks to provide efficient solutions in the long-term interests of users and producers of electricity. The framework is intended to support planning, consultation and development of a shared transmission network (the transmission lines, substations, switching stations and associated infrastructure constructed and managed for the benefit of all customers) that efficiently transports energy from where it is being generated to where customers are using it. The approach adopts a least regrets approach (that is, development of the transmission network will not result in under-utilised or stranded assets) that sees development staged where practical.

TasNetworks has developed a strategic transmission plan for the North West Tasmanian transmission network which considers:

- Future load and generation connection requirements. This takes into account connection enquiries and applications received, and REZs identified in AEMO's ISP. Approximately 5000 MW of renewable generation and storage is forecast in the North West Tasmania by AEMO's ISP.
- A second Bass Strait interconnector (Marinus Link). In its role as Tasmanian jurisdictional planner, TasNetworks has identified favourable sites near Burnie for connecting the proposed 1500 MW high voltage direct current (**HVDC**) interconnector to the Tasmanian alternating current (**AC**) transmission network.
- Existing and forecast transmission network constraints. Parts of the North West Tasmania transmission network, including the Palmerston–Sheffield 220 kilovolt (**kV**) circuit and Sheffield–Burnie 220 kV circuit, are constrained or will become constrained in the coming years.

The strategic plan recommends strengthening the North West Tasmania transmission network by creating a 220 kV 'rectangle' connecting the existing Sheffield and Burnie substations with two new switching stations. One new switching station is proposed at Hampshire Hills to facilitate forecast North West and Far North West wind development and West Coast wind and pumped hydroelectric storage projects. Another is proposed at Staverton to enable re-purposing of existing transmission lines between Staverton and Sheffield, and to facilitate forecast Mersey-Forth pumped hydroelectric storage projects.

Connecting Staverton and Hampshire Hills switching stations to Sheffield and Burnie substations to create a 'rectangle' provides significant system benefits including:

- Diversifying transmission circuits to avoid power system events or faults resulting in system collapse (redundancy).
- Reducing resistance in transmission circuits resulting in higher transmission capacity.
- Reducing transmission losses (maximising power transfer capability).
- Strengthening the system's ability to manage fault conditions.

The strategic plan is proposed to be implemented as staged development of the 'rectangle', together with a further transmission line alongside the existing Palmerston–Sheffield 220 kV overhead transmission line **(OHTL).** The projects collectively known as the North West Transmission Developments are shown in Figure 2-1.

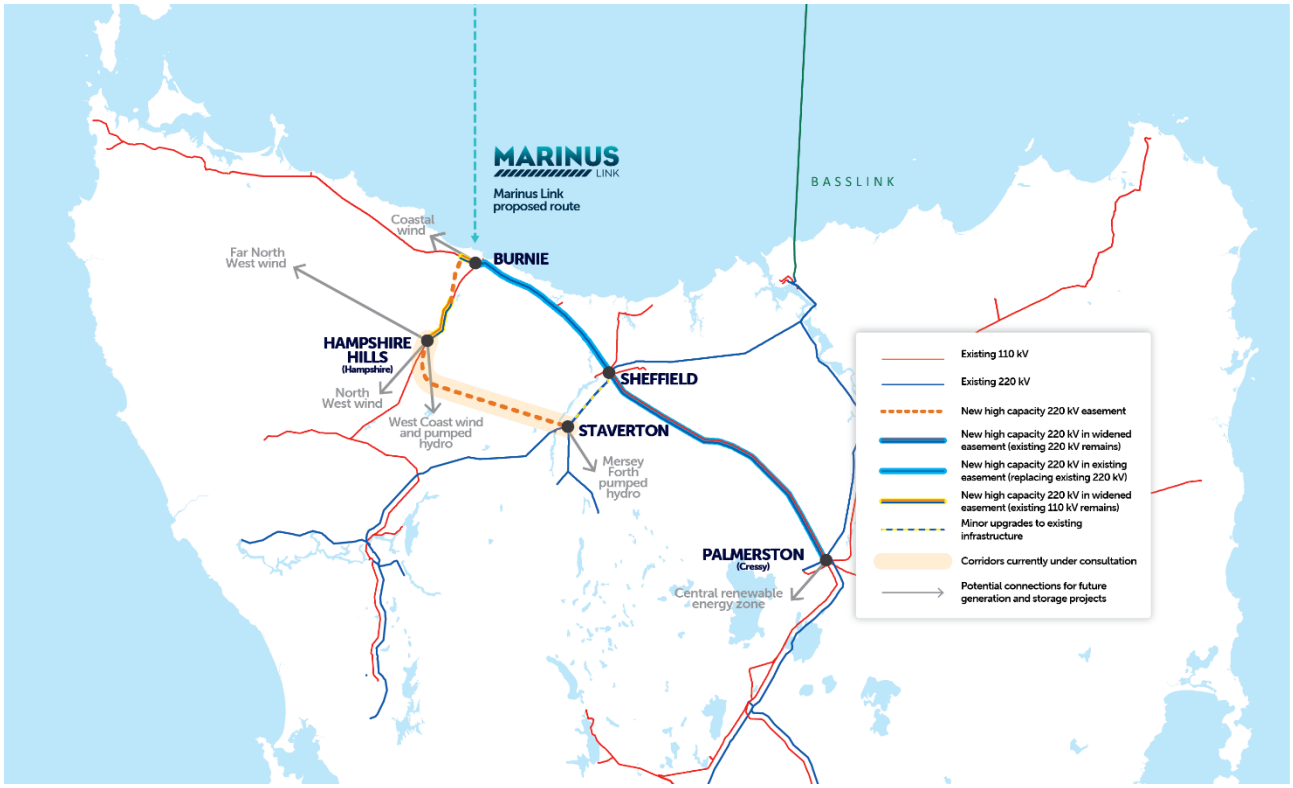


Figure 2-1 North West Transmission Developments

2.3 Staverton to Hampshire Hills transmission line

The Staverton to Hampshire Hills transmission route is proposed to connect Marinus Link, pumped hydro and other future renewable energy projects including the Robbins Island and Jim's Plain Renewable Energy Parks, currently being planned by a private energy developer called UPC Renewables. The UPC Renewables connection has prompted TasNetworks to bring forward the timing of development between Staverton and Hampshire Hills. TasNetworks' goal is to work with UPC Renewables and other generation and storage developers to achieve a coordinated and optimised transmission network that efficiently unlocks the renewable energy zone. The proposed transmission line between Staverton and Hampshire Hills is to be built, owned and operated by TasNetworks. Under this arrangement, UPC Renewables will pay for the right to use the line.

3 What is proposed to be built?

Route selection requires an understanding of what is proposed to be built, i.e., the technical specifications for the transmission infrastructure. The technical specifications adopted for the Staverton–Hampshire Hills OHTL route selection are set out in Table 3-1.

Table 3-1 Technical specifications for Staverton – Hampshire Hills OHTL

Component	Specification
Nominal voltage	220 kV
Minimum design ground clearance	8.5 metre (**m**) (from lowest conductor to ground)
Proposed configuration	Double circuit steel lattice towers, twin phosphorous phase conductors and dual optical ground wires
Proposed tower types	Strain towers at deviation points and to break up long sections; suspension towers in straight sections
Nominal tower height	42 m with some extensions up to 56 m; 38 m in some situations
Nominal tower footprint	10 m by 10 m
Nominal area required to construct tower	50 m by 50 m
Nominal strategic easement width	90 metre wide strategic easement to allow for future network development or asset replacement, except in some instances where existing easements are widened to accommodate the new OHTL.
Nominal transmission line operational area width	60 m
Nominal switching station plot size	260 m by 120 m (assuming air-insulated switchgear and excluding associated infrastructure, e.g., sediment retention pond)
Nominal access track width	6 m (excluding batters and cut-off drains)

The proposed Staverton–Hampshire Hills OHTL will be built and operated in accordance with the technical requirements set out in relevant Australian standards. TasNetworks applies a 60-metre wide operational area to its 220 kV OHTLs to protect the assets and meet electrical safety requirements.

TasNetworks locates and operates the electricity network to ensure electric and magnetic field (**EMF**) levels comply with the recommendations of the Australian Radiation Protection and Nuclear Safety Agency and the EMF limits of exposure recommended by the International Commission on Non-Ionizing Radiation Protection. Energy Networks Australia is working on behalf of the industry to monitor and gauge responses to scientific developments.

An example of a double circuit transmission tower is shown in Plate 3-1. The conceptual arrangement of the proposed easement and transmission line operational area are shown in Figure 3-1, Figure 3-2 and Figure 3-3.

The proposed towers are higher than existing towers due to the higher required power transfer capacity of the OHTL, which requires greater ground clearance.

Plate 3-1 Typical double circuit 220 kV transmission tower adjacent to typical double circuit 110 kV transmission tower

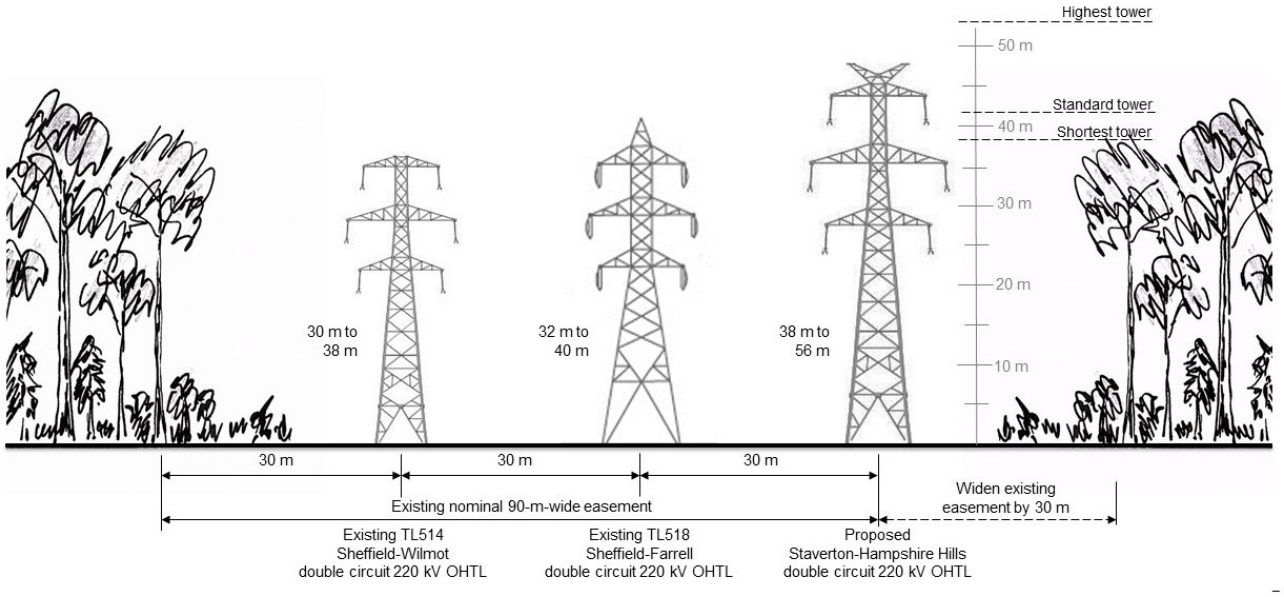


Figure 3-1 Conceptual arrangement of Staverton – Hampshire Hills easement and transmission line operational area from proposed Staverton Switching Station to Cethana (looking south from Staverton)

Note: The standard separation between transmission lines is 30 m. The standard transmission line operational area width for 220 kV transmission lines is 60 m. Figure 3-1 shows location of the proposed OHTL 30 m from the existing OHTLs, requiring an additional 30 m to obtain the required 60 m transmission line operational area width. This section is an example of where it is not proposed to obtain the strategic 90-metre wide easement. The final easement width in this location has been narrowed to 60 m.

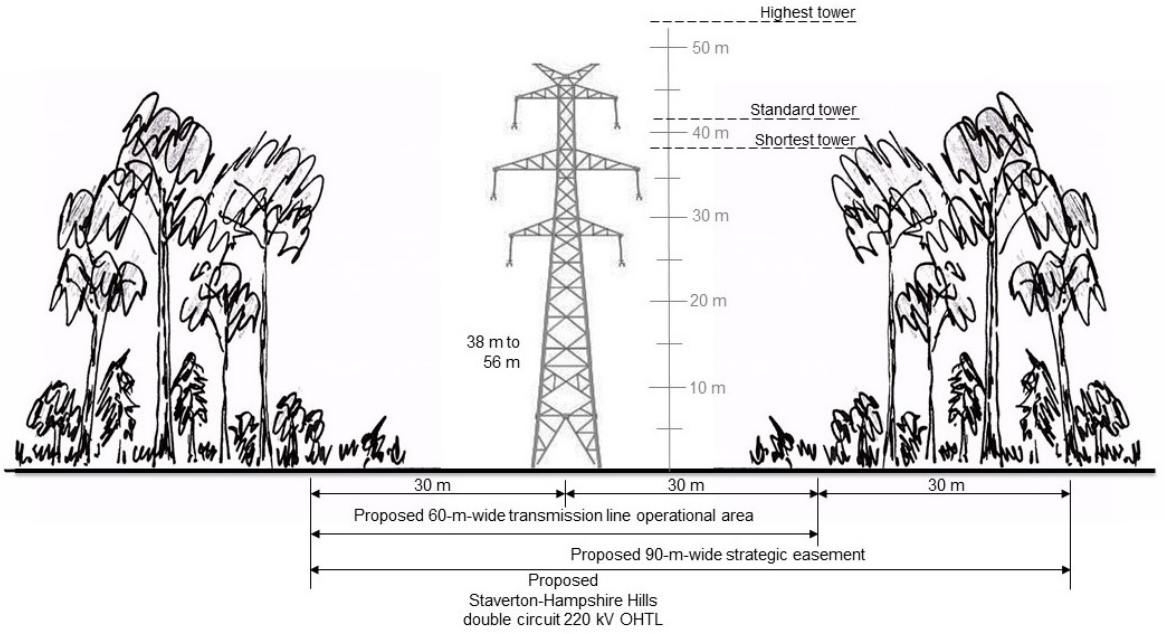


Figure 3-2 Conceptual arrangement of Staverton – Hampshire Hills easement and transmission line operational area from Cethana to Wey River (looking west from Cethana)

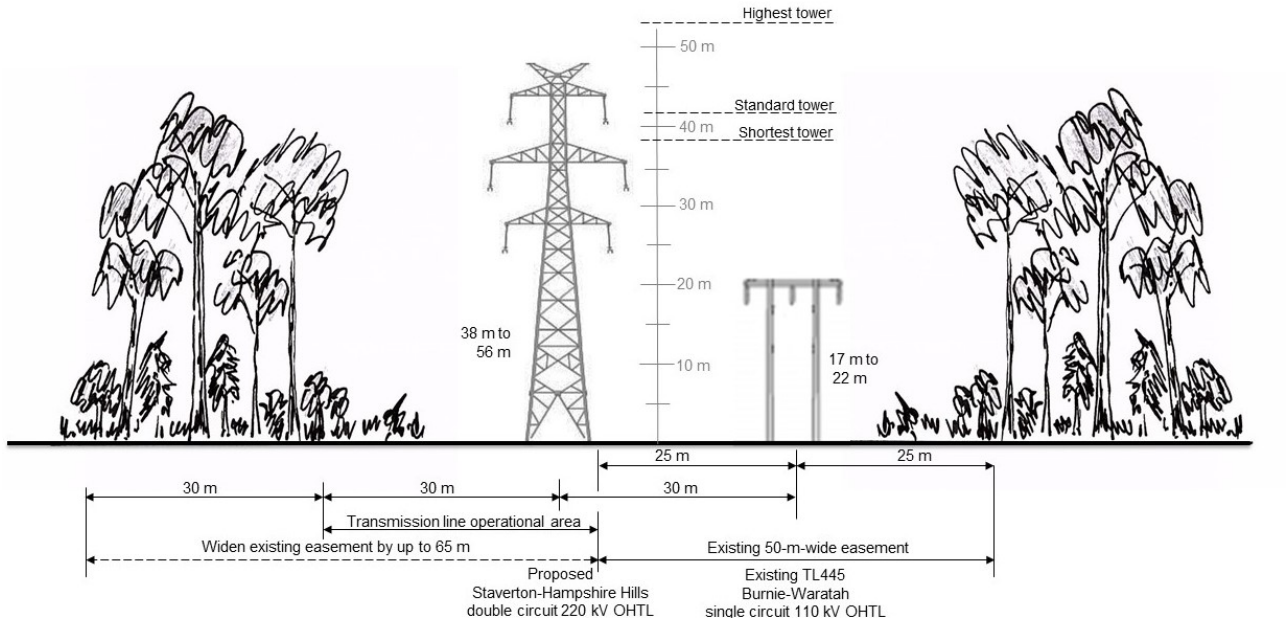


Figure 3-3 Conceptual arrangement of Staverton – Hampshire Hills easement and transmission line operational area from Wey River to Hampshire Hills (looking north from Wey River)

4 What values exist in the area of interest?

The project is in North West Tasmania, with the area of interest extending from Staverton to Hampshire and Cradle Mountain to Gunns Plains. The area of interest is described below with respect to the physical, biological and socioeconomic environments; the latter encompassing social, cultural and economic aspects including landscape and scenic values.

4.1 Physical environment

The area of interest is characterised by mountain ranges and undulating plateaus dissected by deeply incised rivers and creeks (Figure 4-1). Watercourses are north flowing and discharge to Bass Strait. Their sources are in the central highlands of Tasmania. Major watercourses are River Forth, Wilmot River, Winter Brook, River Leven, Blythe River, Old Park River, Wey River and Emu River. Tributaries of the River Leven include Winter Brook, Olivers Creek and Dempster Creek.

The plateaus comprise weathered basalt overlying sedimentary rocks, with igneous (granite) rock outcropping, volcanic intrusions, alluvial deposits, talus slopes and karst limestone. Karst limestone is a feature of the River Leven valley with elaborate cave systems found at Loogana and Gunns Plains. Faulting is generally perpendicular to the major watercourses. The interface between the weathered basalt and sedimentary rock creates a zone of instability, particularly on the steep slopes of the watercourse valleys. Historic landslides are evidence of the risk this geological feature poses, with the risk increased by land clearing activities.

Prominent mountains and mountain ranges in the area of interest are Bell Mount, Cradle Mountain, Black Bluff Range, Loongana Range, Native Track Tier, Mt Everett, Mt Housetop and St Valentines Peak. The Surrey Hills west of River Leven comprise an undulating plateau with small hills and rocky outcrops.

The weathered basalt supports deep, highly fertile soils. This has resulted in native vegetation being cleared for agriculture and plantation forestry in much of the area of interest.

The area of interest includes temperate and subalpine environments. Climate statistics for Bureau of Meteorology (**BOM**) weather stations in the area of interest are presented in Table 4-1.

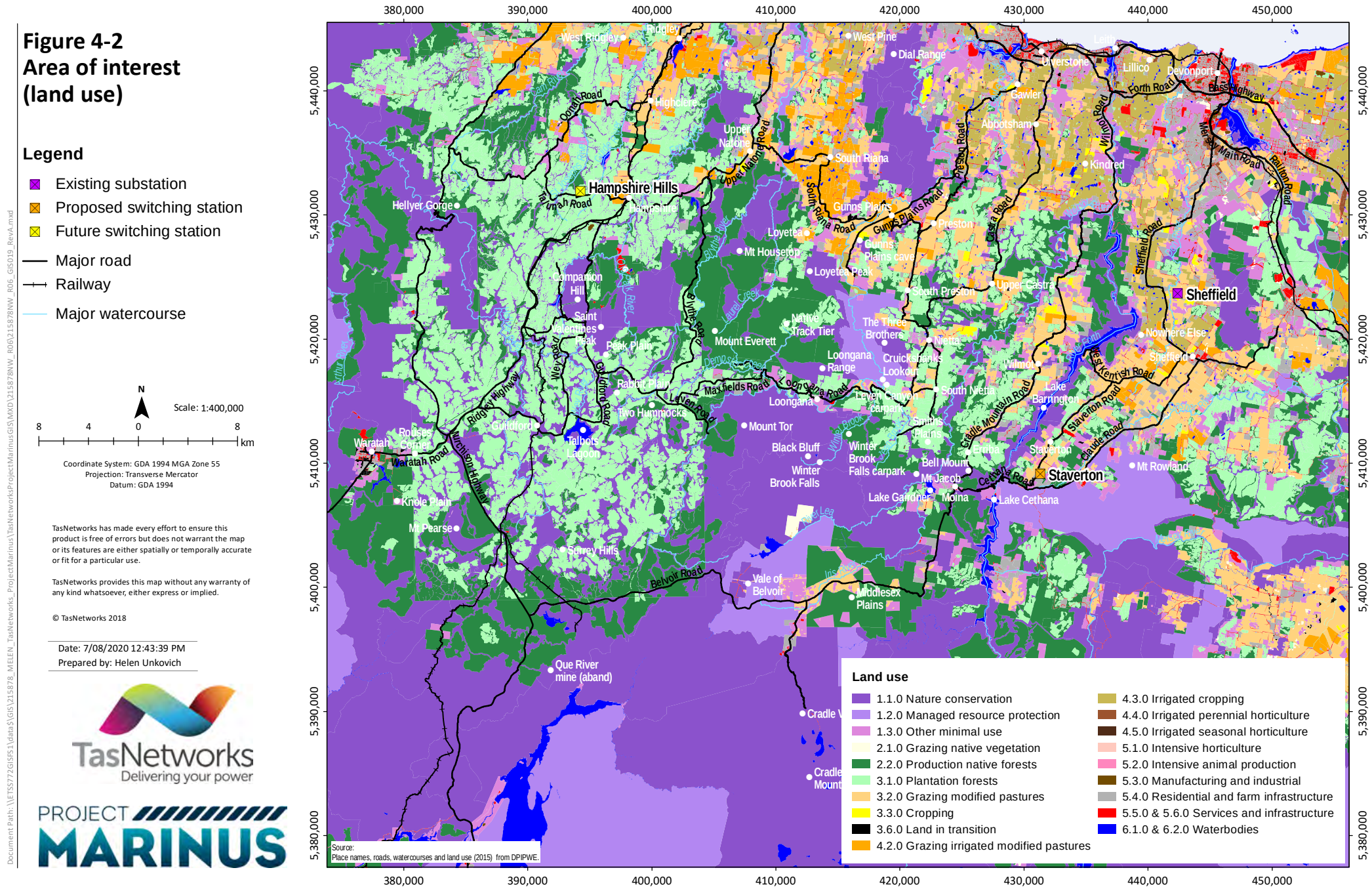
Table 4-1 Climate statistics for area of interest

BOM weather station	Elevation	Mean minimum temperature	Mean maximum temperate	Mean rainfall
091091 Sheffield	280 m AHD	6.2°C	15.8°C	1179 mm
091119 Erriba	590 m AHD	4.7°C	13.1°C	1602 mm
097014 Waratah	609 m AHD	3.6°C	12.3°C	2180 mm

Prevailing winds are predominantly northwesterly, westerly and southwesterly with a northerly and southeasterly component at Sheffield and a northeasterly component at Erriba.

Figure 4-1
Area of interest (terrain)

Figure 4-2
Area of interest (land use)



4.2 Biological environment

Remnant vegetation remains in the area of interest (Figure 4-2) in conservation reserves and informal and private reserves in forestry estates managed for conservation purposes. Extensive areas of native vegetation are reserved as future potential production forest.

Native vegetation has been cleared for agriculture and plantation forestry with hardwood and softwood plantations covering large parts of the area of interest. Hardwood plantations extend over most of the Surrey Hills, Rabbit Plain, Peak Plain and Loongana area. Hardwood and softwood plantations occur in Smiths Plains and near Staverton. Production native forestry occurs in the Laurel Creek and Old Park River catchments on and north of Native Track Tier; east of St Valentines Peak; around Mt Housetop and south of Upper Natone.

The area of interest comprises a mosaic of wet eucalypt forest and woodland, rainforest and related scrub and dry eucalypt forest and woodland. Native vegetation transitions from wet eucalypt forest and woodland and rainforest and related scrub to dry eucalypt forest in the northern part of the area of interest. Small patches of lowland *Poa* grassland occur in the River Leven valley with more expansive patches of highland *Poa* grassland occurring in Rabbit Plain, Peak Plain and the Vale of Belvoir.

Threatened ecological communities occur throughout the native vegetation including:

- *Eucalyptus viminalis* wet forest
- *Eucalyptus amygdalina* forest and woodland on sandstone
- *Eucalyptus brookeriana* wet forest
- Lowland *Poa labillardierei* grassland
- Highland *Poa* grassland
- Subalpine *Diplarrena latifolia* rushland
- *Sphagnum* peatland
- Riparian scrub.

Numerous threatened flora species are associated with the above communities, with highest diversity and numbers occurring in the grasslands, rushlands and peatlands.

Threatened fauna species occurring throughout the area of interest include:

- Tasmanian wedge-tailed eagle (*Aquila audax subsp. fleayi*)
- Grey goshawk (*Accipiter novaehollandiae*)

- Masked owl (*Tyto novaehollandiae subsp. castanops*)
- Swift parrot (*Lathamus discolor*)
- Tasmanian devil (*Sarcophilus harrisii*)
- Spotted-tail quoll (*Dasyurus maculatus subsp. maculatus*)
- Eastern quoll (*Dasyurus viverrinusl*)
- Giant freshwater crayfish (*Astacopsis gouldi*)
- Ptunarra brown butterfly (*Oreixenica ptunarra*).

Threatened vegetation, flora and fauna are, in some places, protected by conservation reserves and covenants (Figure 4-3), most notably:

- Gunns Plains Conservation Area.
- Conservation covenants on private properties in Loogana and Taylors Flats.
- Mountain Valley Private Nature Reserve and conservation covenant.
- Iris Farm Private Nature Reserve and conservation covenant.
- Vale of Belvoir Conservation Area.
- Vale of Belvoir Reserve conservation covenant.
- Black Bluff Nature Recreation Area.
- Romney Marsh conservation covenant.
- Hatfield Plain conservation covenant.

4.3 Socioeconomic environment

Aboriginal people have lived in and passed through the area of interest, with recent evidence suggesting a much different landscape to what exists today (ACM 2020). ACM (2020) reports University of Melbourne researchers finding evidence of Aboriginal (palawa people) land management practices that maintained a woodland and grassland landscape in the Surrey Hills area. The researchers believe rainforest took over the open landscape when Aboriginal occupation ceased. Caves, rock shelters and stone and ochre quarries occur in the region and are the likely sources of artefacts scattered throughout the area of interest. Story lines and walking trails extend inland from the coast to the Surrey Hills.

Detailed desktop investigations identified small rural communities throughout the area of interest including Staverton, Erriba, Nietta, Loongana, Wilmot, Preston, Gunns Plains, Riana, Natone and Hampshire. Community and stakeholder input revealed the livelihoods for residents in these communities include farming, forestry and tourism and to a lesser extent mining.

This is reflected by the major industries being forestry and farming and mining occurring in the north western section. Native forests have been progressively converted to plantation forests over the past 30 years. The Surrey Hills mill near Hampshire processes hardwood timber from plantations in the Surrey Hills and surrounding area. Kara mine north of St Valentines Peak produces magnetite which is exported through the Port of Burnie. Intensive agriculture occurs in Gunns Plains with irrigators used throughout the fertile valley.

The area of interest is promoted for its natural features and values with local government initiatives aimed at increasing visitation to the area and local tourism-based businesses. Central Coast Council's *Coast to Canyon* initiative promotes the region's natural assets including its beaches, Gunns Plains' caves and Leven Canyon.

The Penguin to Cradle Walking Trail runs along the River Leven from Penguin to Cradle Mountain, passing through Gunns Plains and Leven Canyon before crossing Black Bluff via Brookes Track.

Notable attractions and tourist facilities in the area of interest (Figure 4-4) include:

- Wings Wildlife Park near Gunns Plains.
- Preston Falls.
- Woodhouse Lookout, which looks over Gunns Plains.
- Leven Valley Wines east of Gunns Plains.
- Cruickshanks Lookout, which looks over Leven Canyon and Black Bluff.
- Kaydale Lodge Gardens on Loongana Road.
- Mountain Valley Wilderness Holidays in Loongana.
- Winterbrook Falls and walk.
- Black Bluff (Paddys Lake) and Brookes Track.
- Cradle Vista Guest House near Staverton.

Key tourist roads include Cradle Mountain Road, Belvoir Road and Loongana Road with tourist drives running inland from Ulverstone and Penguin creating a round trip via Gunns Plains. Loongana Road is a dead-end road with no public access to Ridgley Highway. Ridgley Highway is a key tourist road, providing links to the Murchison Highway, which provides access to Belvoir Road and West Coast tourist attractions.

4.4 Landscape and scenic values

Scenic landscapes, scenic corridors and roads and scenic management areas are included in overlays in local government planning schemes. These overlays protect landscapes and scenic tourist roads in Tasmania. The route selection process considered these overlays and all prudent and feasible corridors avoid these locations.

Each corridor includes areas where the terrain and land use limit opportunities to reduce views to the transmission line. These areas include the Vale of Belvoir and Black Bluff Range in the southern corridor, views from River Leven Canyon lookouts in the central corridor and Gunns Plains and its encircling escarpments in the northern corridor. In addition, prominent peaks throughout the area of interest which have 360 degree panoramic views of the surrounding areas. Sections of potential transmission line routes in each corridor will be visible from these peaks.

TasNetworks is undertaking a landscape and visual impact assessment that includes viewshed analysis and characterisation of the features that define the landscape, the viewing experience and values that people have in the existing landscape. This assessment process will be used to identify and evaluate how the landscape and views will change as a result of the development of the preferred OHTL.

Visibility of the transmission line is a key consideration in the route selection process. When approaching transmission line design terrain will be utilised, where practicable to hide it in the landscape (e.g., in valleys), backdrop it against higher ground and maximise separation to houses and roads, including roads providing access to tourist sites, e.g., Leven Canyon day visitors area.

Figure 4-3
Area of interest (reserves)

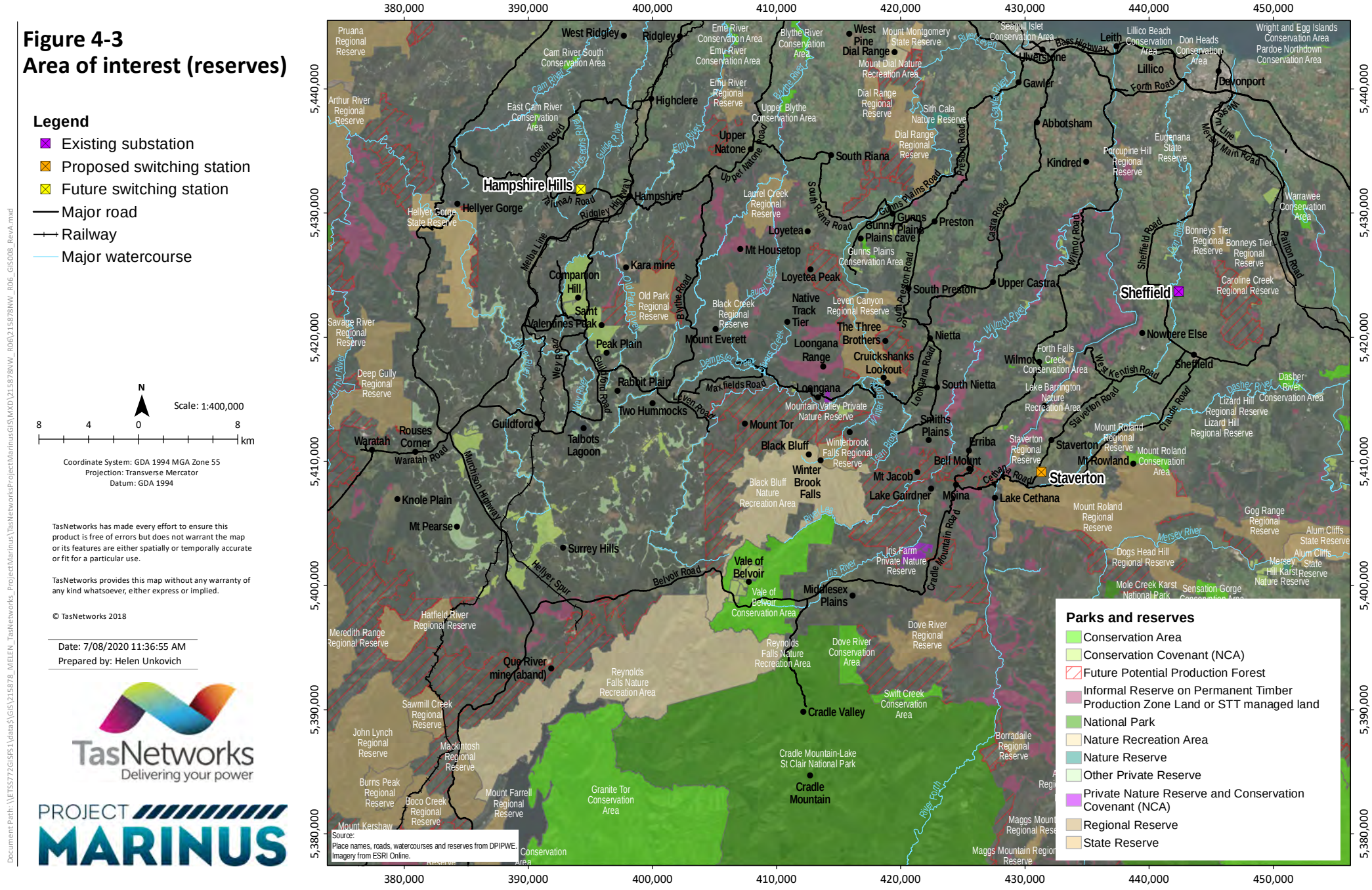


Figure 4-4
Area of interest (tourism sites and tourist roads)

Legend

- Existing substation
- Proposed switching station
- Future switching station
- Coast to Canyon tourist route
- Other tourist route
- Penguin to Cradle Trail
- Major road
- Railway
- Tourism park/reserve

N

Scale: 1:400,000

8 4 0 8 km

Coordinate System: GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994

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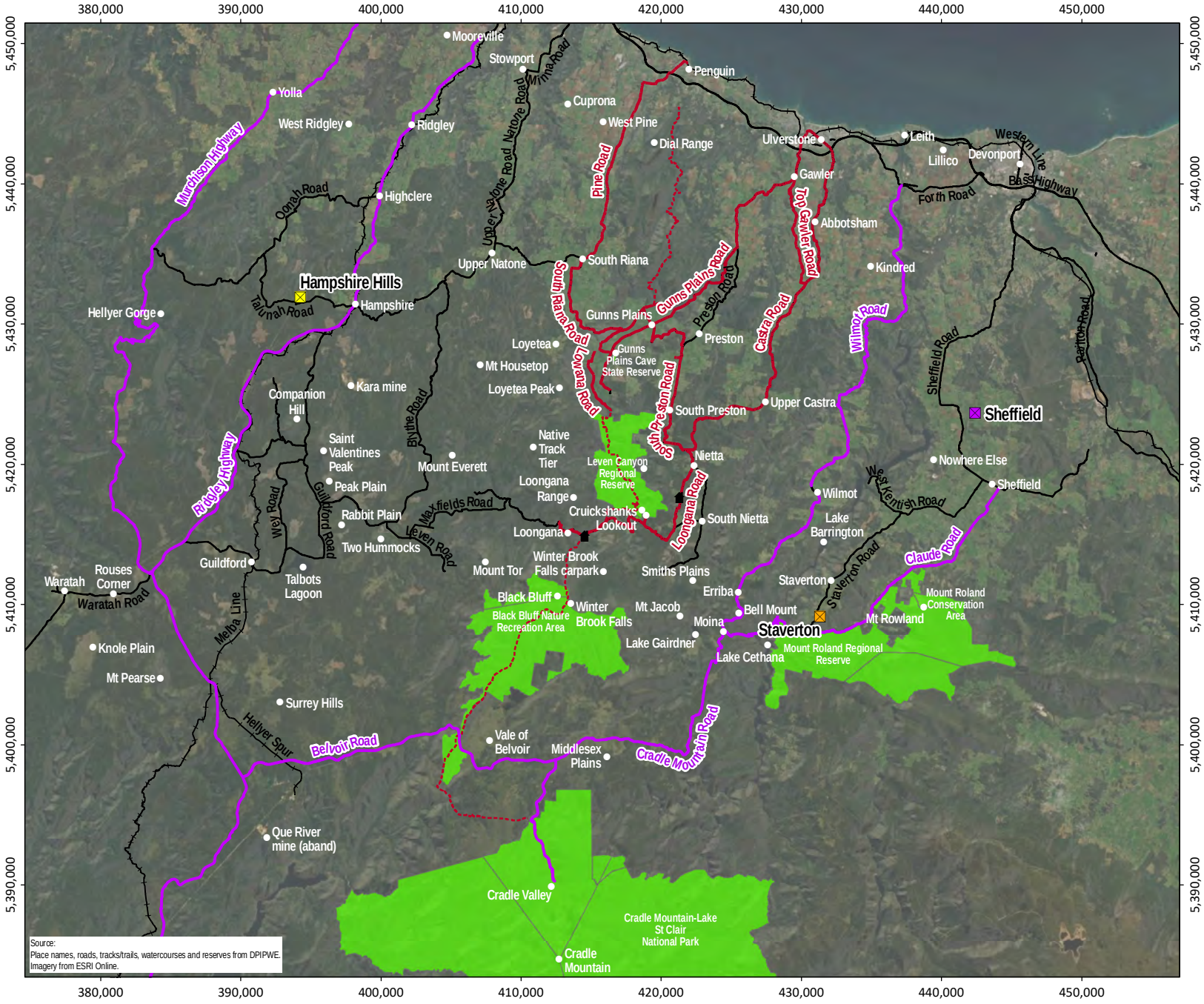


5 How do the existing values inform route selection?

The existing physical, biological and socioeconomic values constrain route options but also provide opportunities, particularly those created by existing linear infrastructure.

Constraints, opportunities and prudent and feasible corridors and routes are mapped and identified, respectively, by:

- Collating all relevant publicly available information including spatial data, reports and previous investigations into transmission line projects.
- Building a project geographic information system (**GIS**) to store and facilitate analysis of publicly available spatial data.
- Using the project GIS to understand constraints to route selection and to support the identification and evaluation of prudent and feasible alternatives.

Data sources used to identify constraints and opportunities, together with their limitations are listed in Appendix 1.

5.1 Constraints to route selection

Constraint identification and evaluation is used to guide route selection. It provides an indication of the areas of least constraint in which prudent and feasible routes might be identified.

Constraints to route selection are primarily based on statutory requirements, technical considerations and societal expectations. For example, legislation and planning controls detail what land uses are permissible in reserves and planning zones. Australian and Tasmanian Government legislation lists and protects threatened ecological communities and species and cultural heritage sites.

Constraints have been grouped as ‘very high’, ‘high’, ‘moderate’ and ‘low’. These groups are defined as follows:

- ‘Very high’ constraint areas are those areas or land uses where transmission infrastructure may have significant impacts that may be difficult to effectively manage, and avoidance is a key objective.
- ‘High’ constraint areas are those areas or land uses where avoidance is prudent, but transmission infrastructure could be sited and managed with careful route selection and design and/or specific management measures.

- 'Moderate' constraint areas are those areas or land uses where transmission infrastructure could be sited, and impacts can be managed with standard mitigation and site-specific measures that address the type and nature of constraint.
- 'Low' constraint areas are those areas or land uses where transmission infrastructure is compatible with existing land uses and/or the impacts can be effectively managed with standard mitigation.

The constraints defined for this route selection exercise are detailed in Table 5-1.

Table 5-1 Constraints (as defined by layers in the project GIS)

Category	Constraint
Very high	World Heritage Areas*
	National, marine and coastal parks declared under the *National Parks and Reserves Management Act 2002* (Tas)* and conservation covenants registered under the *Nature Conservation Act 2002* (Tas)
	Residential, township and village-zoned land**
	Cemeteries and crematoriums***
High	Conservation areas and reserves declared under the *Nature Conservation Act 2002* (Tas) and land managed for conservation purposes under the *Forest Management Act 2013* (Tas) and the *Forestry (Rebuilding the Forest Industry) Act 2014* (Tas)
	Threatened native vegetation communities listed under the *Nature Conservation Act 2002* (Tas) and ecological communities listed under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth)
	Nationally important wetlands and Ramsar wetlands
	Registered historic cultural heritage properties and places
	Registered Aboriginal cultural heritage places and sensitivity areas
	Planning scheme zones, overlays and land use including: • landslide hazard areas • environmental management (contamination) • significant landscapes • scenic landscapes, roads and management areas • priority habitat • tree preservation and significant vegetation • commercial development

Category	Constraint
	• operational airspace and airport environments • significant agricultural land
	Airstrips and runways
	Intensive agriculture including animal husbandry, vineyards
	Mining leases
	Properties less than 0.4 ha
	Houses****
	Defence training areas
	Igneous rock, karst limestone and alluvial/swamp deposits
Moderate	Unreserved Crown land
	Waterbodies
	Planning scheme zones, overlays and land use including: • cropping and irrigated grazing and plantations • manufacturing uses • special uses
	Community facilities
	Properties between 0.4 ha and 2 ha
	Metamorphic rock
Low	Native vegetation not listed for protection.
	Planning scheme zones overlays and land use including: • industrial areas • electricity transmission infrastructure sites • farming land • roads

	Mineral and petroleum exploration licences and permits
	Sedimentary rock

* Existing transmission lines traverse these areas and reserves; re-use of existing easements and widening of existing corridors is not excluded.

** Existing electricity network assets traverse these areas; re-use of existing easements and widening of existing corridors is not excluded, nor is creation of a suitable corridor through these areas to connect new assets to existing transmission assets

*** Cemeteries can be overflown by overhead transmission lines. Underground cables are unlikely to be appropriate.

**** As defined by building point or house point in applicable datasets. Proximity to houses, schools and other sensitive occupancies was verified by interrogation of satellite imagery and ground-truthing.

Constraints to corridor and route selection for the Staverton–Hampshire Hills route are shown in Figure 5-1.

5.2 Opportunities for route selection (existing infrastructure corridors)

Existing infrastructure corridors are generally considered first when planning new transmission developments. Where there is an existing corridor in the geographic area requiring transmission development and where the uses are compatible, terrain and land use are not constraints and easement widening, or replacement of existing ageing transmission lines is possible, they can be prudent and feasible options.

For the Staverton–Hampshire Hills route, transmission corridors that provide opportunities for re-use or widening of existing easements include:

- Sheffield–Farrell 220 kV OHTL which runs southwest from Sheffield through the Vale of Belvoir to Farrell on the Pieman River and Lake Rosebery.
- Burnie–Waratah 110 kV OHTL which runs southerly from Burnie to Waratah near the Ridgley Highway.

These transmission lines are shown in Figure 5-2.

Other existing infrastructure corridors such as existing road networks, including the extensive plantation and production forest access roads and tracks throughout the area of interest can be considered. Transmission lines require ongoing access to the assets for operation and maintenance. Requirements for new access tracks can have a significant impact where long tracks are required to access tower sites. Utilising existing roads and tracks reduces this impact.

Figure 5-1
Constraints

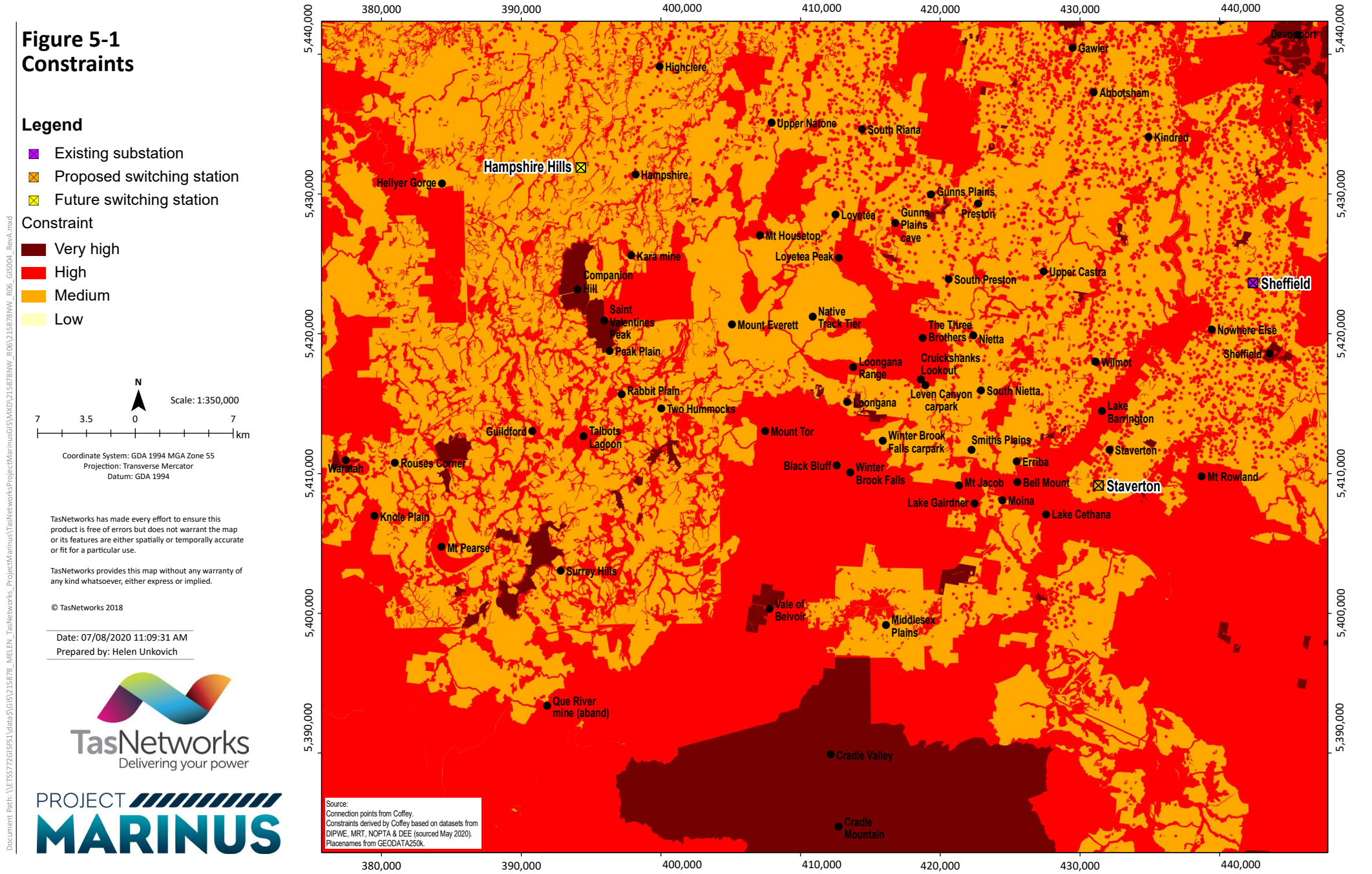
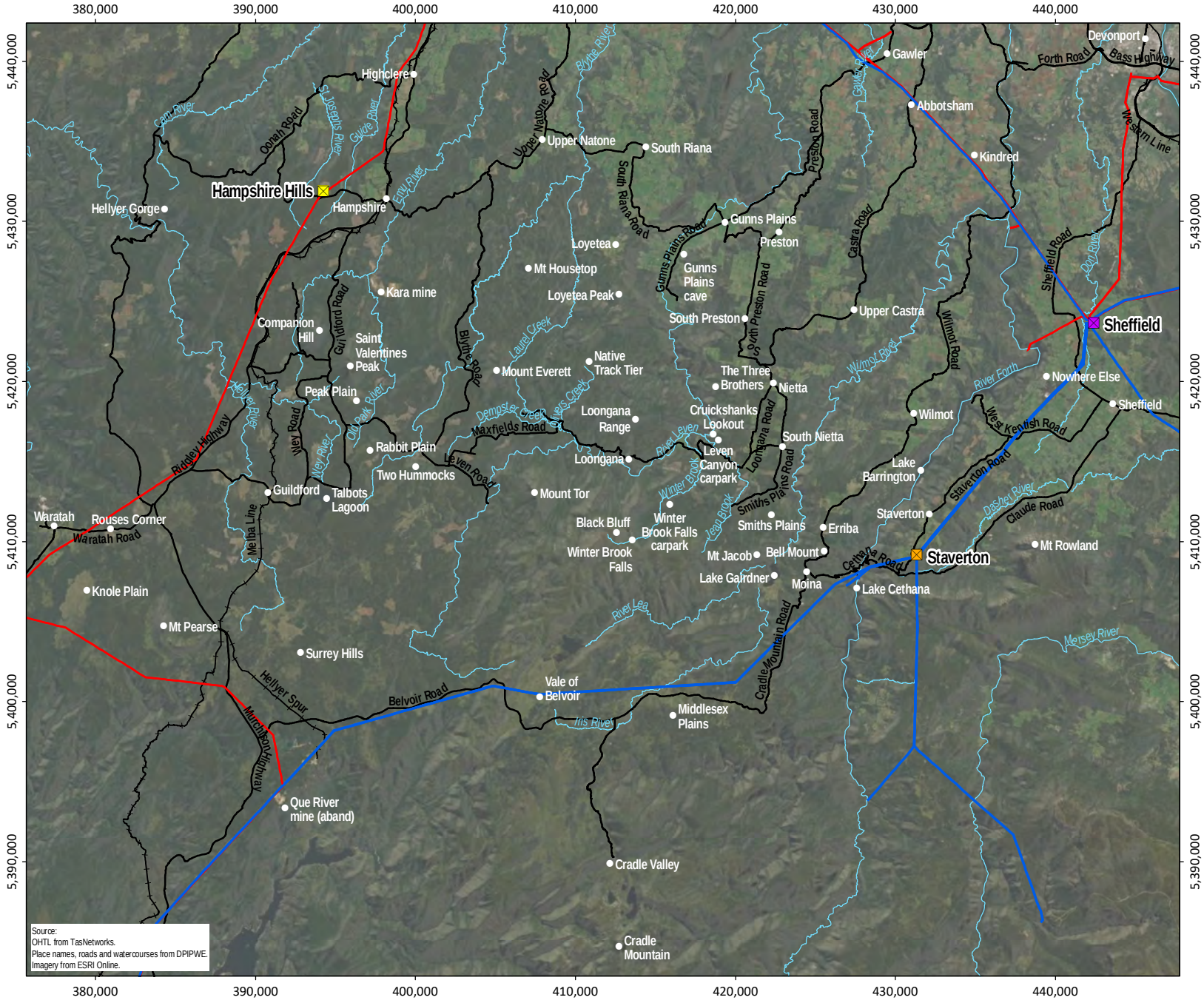


Figure 5-2
Existing corridors



6 Identify prudent and feasible corridors

Informed by strategic constraints, the next step is to identify prudent and feasible corridors. This commences with a notional straight line between Staverton and Hampshire Hills. This represents the shortest distance and using a unit cost per kilometre for construction of the OHTL, the least cost option. The straight line between Staverton and Hampshire Hills passes through Leven Canyon, Loongana Range and Native Track Tier.

These constraints and those imposed by topography, geology, geomorphology, land use, conservation assets and cultural heritage necessitate indirect routes. Use of existing infrastructure corridors may provide opportunities to cost-effectively overcome some of these constraints.

The constraints mapping and opportunities described in Section 5 and shown in Figure 5-1 and Figure 5-2 informed the identification of prudent and feasible corridors within which prudent and feasible routes are identified. Strategic constraints inform identification of the corridors and tactical constraints potential routes.

6.1 Strategic constraints

Significant features in the area of interest that are strategic constraints to corridor selection are:

- Black Bluff Range, which has a precipitous northern escarpment. Winter Brook Falls cascade down the escarpment and are the source of Winter Brook which flows into the River Leven upstream of Leven Canyon. The Black Bluff Range is protected by the Black Bluff Nature Recreation Area. Winterbrook Falls is protected by the Winterbrook Falls Regional Reserve.
- Loongana Range, which extends west from Leven Canyon and is a steep rocky ridge.
- Leven Canyon, which extends from Loongana to Gunns Plains passing between Loongana Range, Native Track Tier and Three Brothers. The canyon is a tourist attraction and protected by the Leven Canyon Regional Reserve.
- Mt Everett, the prominent peak at the western end of Native Track Tier. Native Track Tier is north of Loongana Range.
- Mt Housetop, the prominent peak north of Native Track Tier and west of Gunns Plains. The extensive areas of outcropping granite that occur around Mt Housetop are undesirable for OHTL construction. Laurel Creek Regional Reserve is located north of Mt Housetop. Black Creek Regional Reserve is located south of the mountain.

- St Valentines Peak, the prominent peak at the northern end of Rabbit Plain and Peak Plain, which form part of the Surrey Hills. Old Park Regional Reserve located east of St Valentines Peak protects the middle and upper reaches of Old Park River.

6.2 Potential corridors

Three corridors (Figure 6-1) presented themselves having regard to these features and the opportunities identified in Section 5.2. They are:

- Southern corridor along the existing Sheffield–Farrell 220 kV OHTL and Burnie–Waratah 110 kV OHTL. This corridor passes south of Black Bluff Range, running through the Vale of Belvoir.
- Central corridor through the River Leven valley between Black Bluff Range and Loongana Range.
- Northern corridor through Nietta, Preston, Gunns Plains, South Riana and Upper Natone. This corridor passes north of Leven Canyon.

Figure 6-1
Prudent and feasible corridors

Legend

- Existing substation
- Proposed switching station
- Future switching station
- Central corridor
- Northern corridor
- Southern corridor
- Existing 220 kV OHTL
- Existing 110 kV OHTL
- Major road
- Railway
- Major watercourse

N

Scale: 1:400,000

8 4 0 8 km

Coordinate System: GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994

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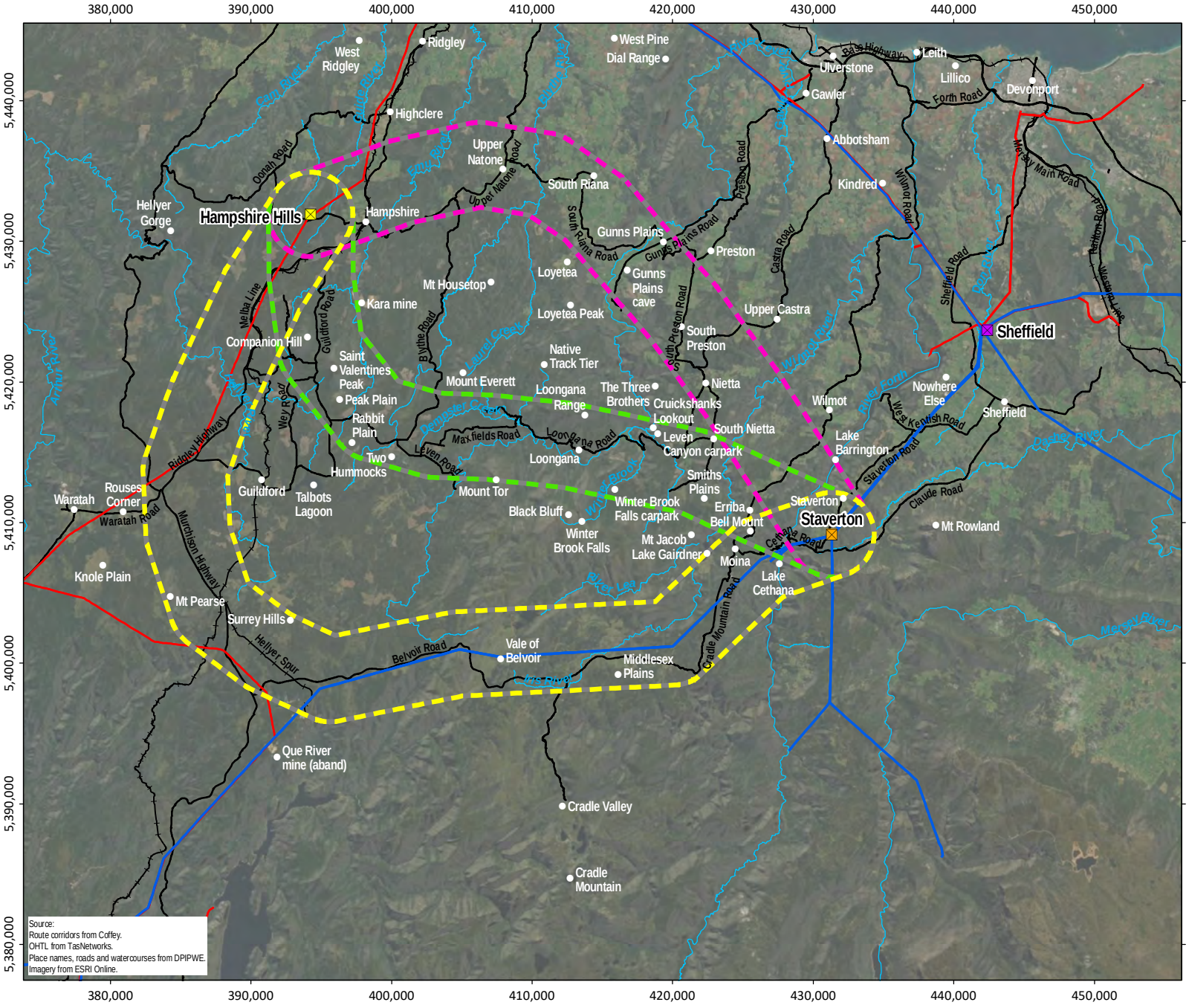


7 Identify prudent and feasible routes within the corridors

Prudent and feasible routes were identified in the southern, central and northern corridors having regard to the route selection criteria which incorporate the identified constraints and opportunities (see Section 5).

7.1 Route selection criteria

Route selection criteria, developed to guide identification and evaluation of prudent and feasible routes within the corridors, are based on the constraints identified in Section 5.1 and the technical requirements and engineering considerations for transmission infrastructure. Environmental and social criteria capture high and moderate constraints, which have been grouped into key differentiators. The criteria enable prudent and feasible alternatives to be compared to identify the option that is least constrained. Route selection criteria adopted for this project are detailed in Table 7-1.

Table 7-1 Route selection criteria

Route selection criterion	Considerations
Cost	• capital expenditure (construction costs) • operating expenditure (including maintenance and transmission energy loss costs)
Availability of land for switching stations	• sufficient area including potential for buffers • stable landforms • suitable terrain, geology and geotechnical conditions • good access
Constructability	• ease of access • disruption to existing access, services and businesses • potential for relocation of existing services • potential for contaminated land • ground conditions/ geotechnical considerations (e.g., exposure to hard and/or fractured strata)
Avoid co-location with incompatible linear infrastructure	• e,g. steel pipelines, fences, long buildings and other metallic structures parallel to the transmission line, which increase potential

Route selection criterion	Considerations
	for induced current in steel infrastructure and fault current affecting the steel infrastructure
Natural features	• topography • waterways/wetlands
Network security	• bushfire risk • hazard trees • geographic diversity to avoid single contingency events
Capacity to facilitate connection of renewable generation and storage	• for wind, solar and pumped hydroelectric storage projects
Expansion potential	• capacity to accommodate future transmission lines
Opportunity for third party benefit/ contribution/ synergies	• connection inquiries • renewable energy zones
Land reserved for conservation purposes	• e.g., World Heritage Areas, national parks, conservation covenants, nature reserves
Land tenure	• freehold, Crown land, reserves • captures tourist sites protected by reserves declared under *Nature Conservation Act 2002* (Tas) including Leven Canyon Regional Reserve and Black Bluff Nature Recreation Area • land holdings (small private and commercial properties)
Occupation	• proximity to houses
Land use	• potentially incompatible land uses (e.g airports, quarries, crop dusting operations, corrosive emissions) • impacts on agriculture, tourism • incompatible linear infrastructure
Registered historical cultural heritage properties and places	• under federal and state legislation

Route selection criterion	Considerations
Registered Aboriginal cultural heritage places and sensitivity areas	• under federal and state legislation
Planning	• zones and overlays • zones include major tourism • overlays include scenic landscapes (scenic protection areas and scenic road corridors), scenic roads and scenic management areas, landslip hazard and contaminated land
Native vegetation	• TASVEG (digital map of Tasmania's vegetation) • potential threatened species habitat
Threatened ecological communities	• native vegetation communities listed under federal and state legislation
Threatened species	• eagle nests within 1 km • records of threatened flora and fauna species listed under federal and state legislation

7.2 Prudent and feasible routes within the corridors

Prudent and feasible routes identified in the southern, central and northern corridors are described in this section and shown in Figure 7-1 and Figure 7-2.

7.2.1 Southern corridor

Prudent and feasible routes in the southern corridor are generally adjacent to the existing OHTLs as they provide opportunities to co-locate infrastructure. The routes are common from Staverton to Que River and from Guildford to Hampshire Hills. The routes traverse conservation areas declared, and conservation covenants registered under the *Nature Conservation Act 2002* (Tas) (**NC Act**) including the Vale of Belvoir, Iris Farm, Daisy Dell, Romney Marsh and Hatfield Plain. The options are:

Mt Pearse east option. An 81 km route parallel to the Sheffield–Farrell 220 kV OHTL from Staverton to Hellyer Spur Line; then generally parallel to the spur line to Murchison Highway; then east of Micklethwaite Marsh to the existing Burnie–Waratah 110 kV OHTL near the intersection of Guildford Road and Ridgley Highway; then parallel to this OHTL to Hampshire Hills.

Mt Pearse west option. A 93 km route parallel to the Sheffield–Farrell 220 kV OHTL from Staverton to its intersection with the existing Farrell–Waratah 110 kV OHTL; then parallel to this OHTL to near Netherby Creek; then north between Knole Plain and Mount Pearse, east of Bischoff Reservoir to the existing Burnie–Waratah 110 kV OHTL at Rouses Corner (northeast of Waratah); then parallel to this OHTL to Hampshire Hills.

7.2.2 Central corridor

The most direct route between the existing OHTLs (Sheffield–Farrell 220 kV in the east and Burnie–Waratah 110 kV in the west), excluding the straight line between Staverton and Hampshire Hills, is through the River Leven valley. The existing OHTLs are 42 km apart in the central corridor. Two prudent and feasible routes were identified in the central corridor. The routes are generally common east of Dempster Creek due to the constraints imposed by the River Leven crossing. The options are:

Peak Plain option. A 59 km route along the Sheffield–Farrell 220 kV OHTL to Cethana; then northwest across River Forth and Wilmot River (passing between Erriba and Bell Mount) to Smiths Plains; then northwest to near Loongana Road; then west to River Leven; northwest across River Leven; north of Loongana; then west along the watershed between Dempster Creek and River Leven to Surrey Hills; then northwest through Rabbit Plain to the Burnie–Waratah 110 kV OHTL near Wey River; then parallel to this OHTL to Hampshire Hills.

Old Park River option. A 51 km route along a similar route to the Peak Plains option to Smiths Plains; then northwest and west of Jean Brook to near Loongana Road; then westerly along the face of Loongana Range and southern slopes of Mt Everett to Blythe River; then west-northwest through Peak Plain to Old Park River; then northerly along and west of Old Park River, east of St Valentines Peak and west of Kara mine to Hampshire Hills.

7.2.3 Northern corridor

Two prudent and feasible routes were identified in the northern corridor. They are common from South Preston to Hampshire Hills due to the constraints imposed by Leven Canyon Regional Reserve, Laurel Creek Regional Reserve and Mt Housetop. The routes are:

South Nietta option. A route along the Sheffield–Farrell 220 kV OHTL to Cethana; then northwest across River Forth and Wilmot River (passing between Erriba and Bell Mount) to Smiths Plains; then northerly to Nietta (passing west of South Nietta); then northwest and north to near South Preston. The route runs west-northwesterly, south of Gunns Plains Conservation Area to cross Gunns Plains approximately 2.5 km downstream of Leven Canyon Regional Reserve. Passing north of Loyetea Peak, the route passes west of Loyetea to run around the eastern and northern boundaries of Laurel Creek Regional Reserve. North of the

reserve, the route turns westerly to run south of Upper Natone to the Burnie–Waratah 110 kV OHTL which it follows southwest to Hampshire Hills. This route is 57 km.

Wilmot option. A route north along the Sheffield–Farrell 220 kV for 2 km; then northwest across the River Forth (Lake Barrington); then northerly to the west of Narrawa Road Conservation Area across the Wilmot River; then west-northwesterly to South Preston where it joins and follows the previously described route to Hampshire Hills. This route is 56 km.

Figure 7-1
Prudent and feasible routes

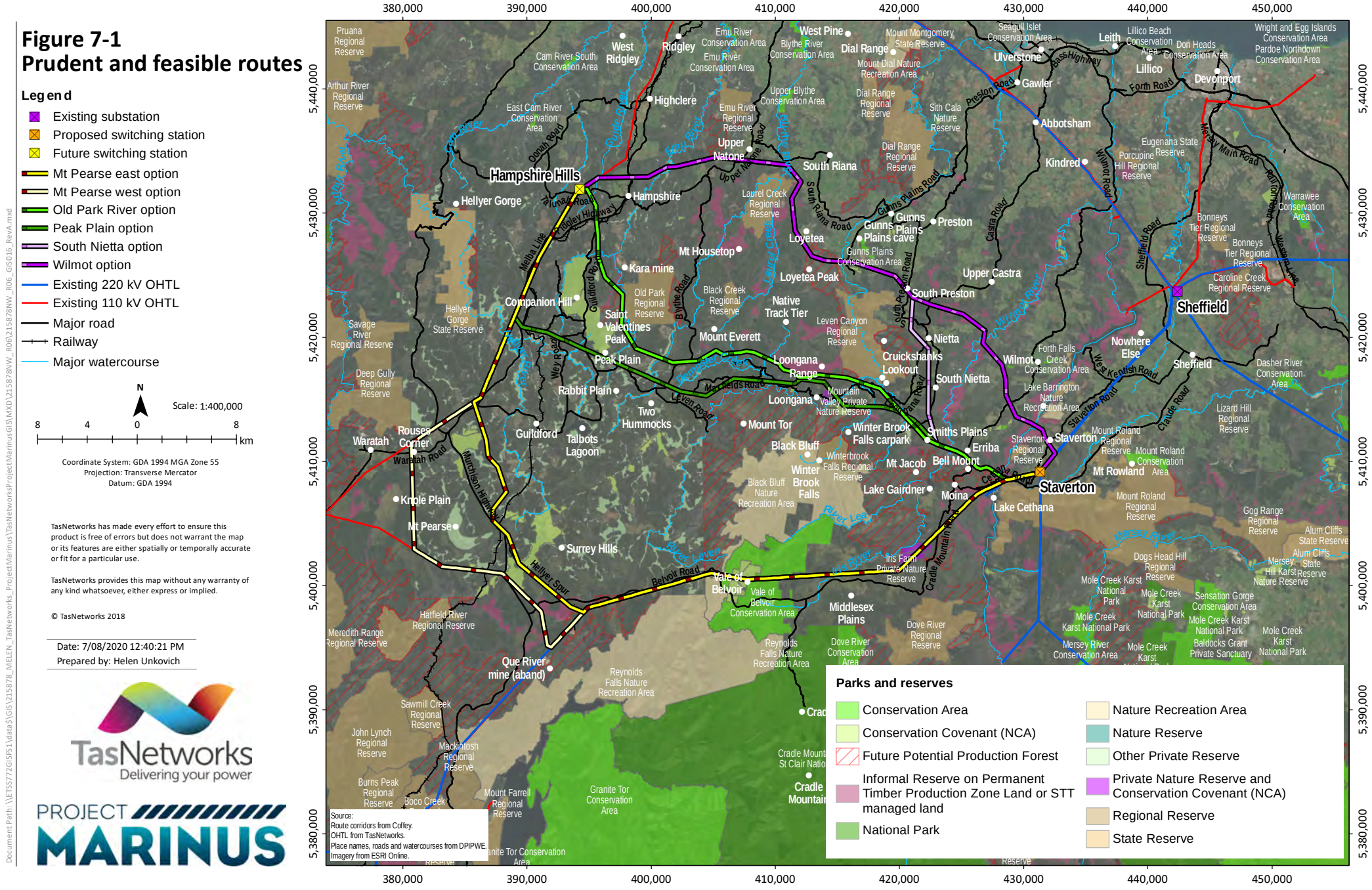
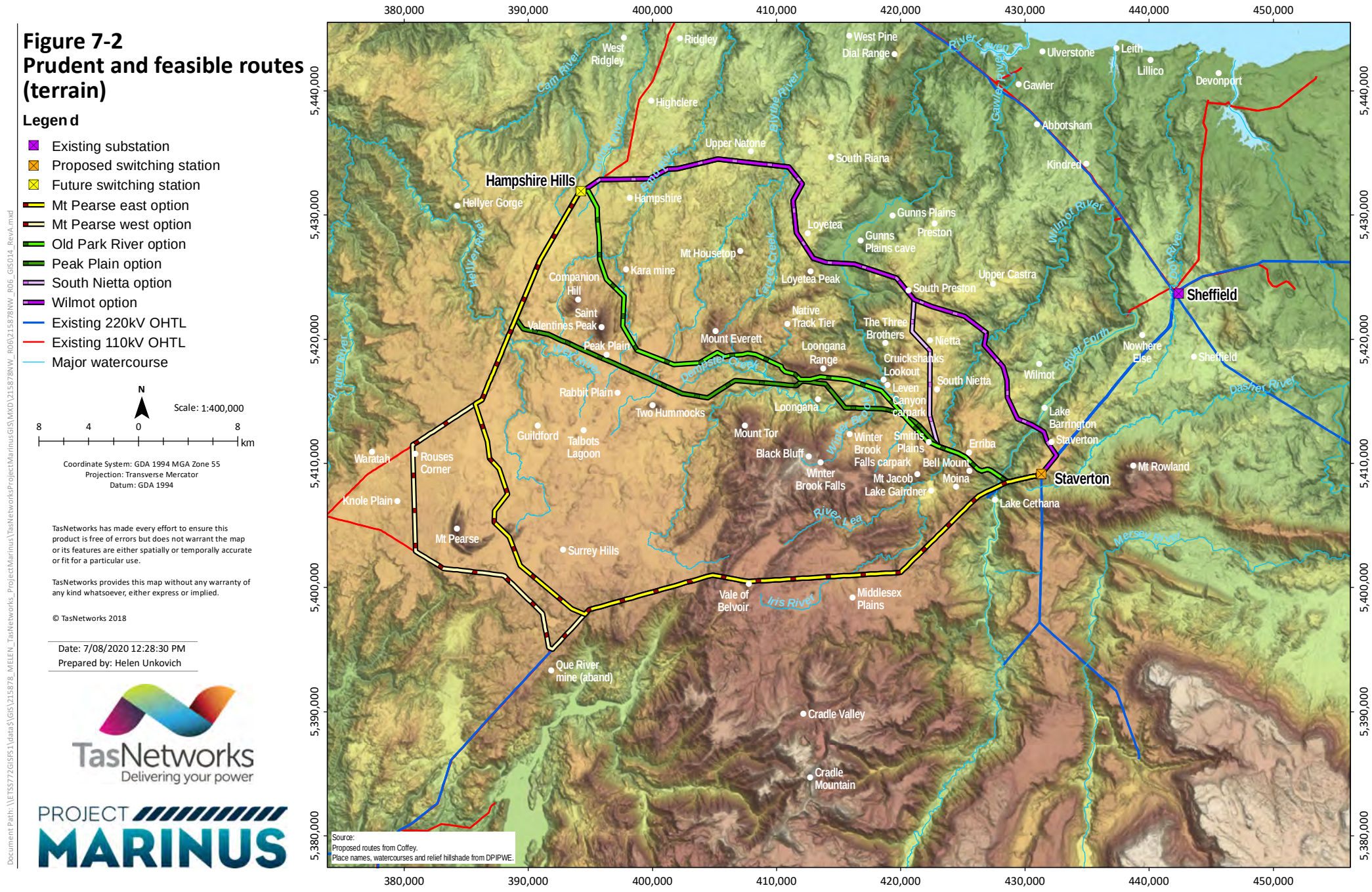


Figure 7-2
Prudent and feasible routes (terrain)



8 Evaluate prudent and feasible routes

Key statistics for the identified routes in each corridor were compiled to support the evaluation. The statistics were derived by intersecting the route options with layers in the project GIS. Appendix 2 presents the key statistics for the identified routes.

The identified routes were compared with each other for each route selection criterion using a 'traffic light' system to understand the level of constraint for each route relative to the other routes. The results of this analysis are presented in Table 8-1.

The results of the evaluation were reviewed to identify the route or routes that were least constrained. The reasons for high constraints were investigated and assessed to understand if they were manageable. The assessment discussed below informed the decision on the proposed route.

Table 8-1 Comparison of identified route options for each route selection criterion

Key statistic	Northern corridor		Central corridor		Southern corridor	
	South Nietta option	Wilmot option	Peak Plain option	Old Park River option	Mt Pearse east option	Mt Pearse west option
Technical criteria						
Cost (informed by length)						
Availability of land for switching stations						
Constructability						
Incompatible land uses						
Incompatible linear infrastructure						
Network security						
Capacity to facilitate renewable generation						

Key statistic	Northern corridor		Central corridor		Southern corridor	
	South Nietta option	Wilmot option	Peak Plain option	Old Park River option	Mt Pearse east option	Mt Pearse west option
Expansion potential						
Opportunity for third-party contributions						
Environmental and social criteria*						
Land tenure (freehold)						
Land tenure (Crown)						
Land tenure (reserves)						
Occupation						
Land use						
Planning (zones)						
Planning (overlays)						
Planning (landslip hazard)						
Native vegetation (TASVEG)						
Threatened ecological communities						
Threatened species						
Threatened species (raptor nests)						

* Historic heritage overlays were considered in this stage (no difference between routes). Registered Aboriginal heritage sites were considered in the review of the proposed and alternative routes, i.e., the next stage.

8.1 Evaluation findings

The analysis presented in Table 8-1 indicates routes in the central corridor are least constrained.

Routes in the **northern corridor** traverse more freehold parcels and rural settlements, and consequently are closer to a higher number of houses than the other routes. These routes impact intensively farmed land in Gunns Plains. The routes are exposed to landslip hazard on the east side of Gunns Plains and granite formations on the west side of the valley increasing construction difficulty and cost.

Routes in the **southern corridor** are up to 57 per cent longer than the other routes, adding significant cost to the project. The routes traverse conservation areas declared, and conservation covenants registered under the NC Act including the Vale of Belvoir, Iris Farm, Daisy Dell, Romney Marsh and Hatfield Plain. While these routes may help to strengthen the transmission network to the West Coast, compared to the other options to connect Staverton and Hampshire Hills they would cost substantially more, and have a range of higher impacts.

The routes in the **central corridor** each have a high constraint. The Peak Plain route is within 500 m of three wedge-tailed eagle nests. Impacts on wedge-tailed eagles can be managed during construction by restricting construction activities during times the nests are active and until fledglings have left the nest. Terrain east of St Valentines Peak is difficult. The proposed route runs at the base of the steep sided foothills through button grass plains adjacent to Old Park River. An extensive access track network would need to be constructed to develop this route. This route is exposed to granite formations north of St Valentines Peak, west of Kara mine.

Consistent with the North West Tasmania Strategic Transmission Plan (TasNetworks 2019), all routes in the central corridor provide opportunities to enable connection and transport of forecast North West and Far North West wind development and West Coast wind and pumped hydroelectric storage projects. They also all provide opportunity to re-purpose existing transmission lines between Staverton and Sheffield, and to facilitate forecast Mersey–Forth pumped hydroelectric storage projects. The Peak Plains route provides more flexibility for connection of potential Surrey Hills wind projects forecast in the region. For these reasons, the Peak Plain route in the central corridor was identified as the proposed route for the Staverton–Hampshire Hills section of the North West Transmission Developments.

9 2019 Proposed route

The proposed route that TasNetworks released for public consultation in November 2019 is shown in Figure 9-1 and described in detail below.

Commencing at Staverton, the route follows the Sheffield–Farrell 220 kV OHTL to the edge of the plateau above Lake Barrington. Diverging from the existing OHTL, the route follows the spur adjacent to Cethana Road to make a perpendicular crossing of Lake Barrington, which is in a deeply incised valley. The route passes through the edge of the Mount Roland Regional Reserve which extends to the Cethana Road. This section of the route crosses two mining prospects (DH PD84 CC9 (pyrite) and West Cethana Prospect (lead)) that do not have registered mining leases and have not been developed. Proximity to Cethana Road reduces the length of tower access tracks.

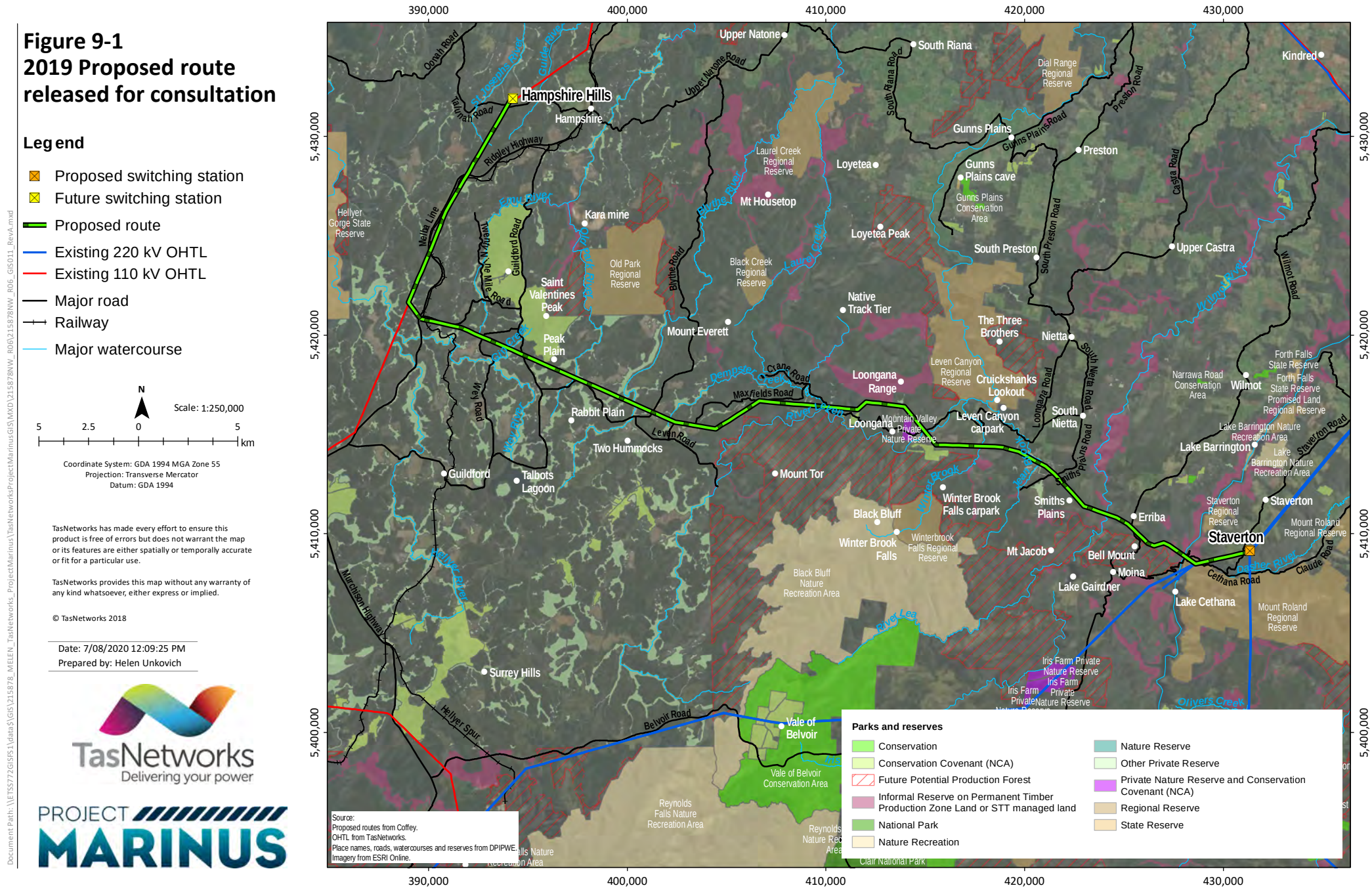
West of Lake Barrington, the route follows a ridge largely through and along the edge of plantation coups to the plateau between Lake Barrington and Wilmot River, passing north of Bell Mount – a prominent feature at the end of the plateau. Cradle Mountain Road, a popular tourist road, is crossed northeast of Bell Mount (Plate 9-1). A raptor nest is located on the ridge to the west of the route, 450 m from the proposed OHTL.

West of Cradle Mountain Road, the route traverses plantations to a prominent spur above Wilmot River. This alignment enables a perpendicular crossing of Wilmot River, which is in a deeply incised valley. Riparian vegetation along the river will be overflown by siting towers high above the river on the spur and terrace west of the river. The route ascends the small escarpment that forms the eastern edge of Smiths Plain to run largely in plantations down the eastern side of Jean Brook to near Loongana Road. The route avoids the alluvial deposits and swampy areas associated with Jean Brook and patches of threatened native vegetation communities (*Eucalyptus viminalis* wet forest).

Turning west, the route runs along the undulating plateau through plantations to the spur above Winter Brook. A route along Loongana Road and through Griffiths Flats was discounted due to amenity impacts on properties and Loongana Road, which is the main access road to Leven Canyon visitor areas and viewpoints. Looking from Cruickshanks Lookout (situated at Leven Canyon visitor area), the proposed overhead transmission line will be visible partly and remotely where it crosses the River Leven. It will not be visible from the lower viewing platform (Plate 9-2).

After crossing Winter Brook valley, the route runs in plantations adjacent to an unnamed tributary of the River Leven, passing north of a sinkhole formed in the underlying karst limestone. The karst limestone formation extends down the watercourse to the River Leven valley. The route has been sited to enable towers to be located either side of the karst limestone in weathered basalt formations. The River Leven crossing has been sited between Webbs Flats and Taylors Flats and between Leven Cave and Tiger and Wicked caves, which are located adjacent to the river. The steep sided valley will be overflown by the OHTL with towers placed at the top of the sides of the valley. Riparian vegetation in the valley will be preserved. The crossing location is shown in Plate 9-3.

Figure 9-1
2019 Proposed route released for consultation



Source: Coffey

Plate 9-1 Looking south along Cradle Mountain Road to the 2019 proposed route in the saddle

Source: Coffey

Plate 9-2 View southwest along River Leven valley to Black Bluff from Cruickshanks Lookout at Leven Canyon visitor area. Loongana Range is visible in the right of the image. The proposed OHTL crosses the River Leven between the prominent ridges.

The route crosses into plantations west of River Leven to run along the base of Loongana Range to the spur above an unnamed tributary of the River Leven. A conservation covenant has been registered over private freehold either side of this watercourse. The proposed OHTL will overfly the native vegetation by careful placement of towers in the adjacent plantation coups. The route continues in plantations to the crest of Dempster Creek valley. Loongana Road runs along the eastern side of the creek, which discharges to the River Leven south of the road. Dempster Creek has intact riparian vegetation near its confluence with the River Leven. This large tract of native vegetation will be overflown by careful placement of towers in the adjacent plantation coups.

Source Google Maps™ street view © 2020 Google

Plate 9-3 View looking south to proposed OHTL crossing of River Leven and Loongana Road (middle foreground)..

West of Dempster Creek, the route traverses plantation coupes located south of Maxfields Road. The plantations have been established on the watershed between the Dempster Creek and River Leven catchments. Several houses are located on a large parcel of land south of the plantation coups and Maxfields Road. The route is approximately 150 m from the nearest house. The route turns southwest to generally follow Dempster Creek Road which runs along the watershed between a tributary of Dempster Creek and River Leven. The road provides access to plantation coups through which the route has been located.

East of Dempster Creek Road intersection with Maxfields Road, the route turns west-northwest to run mostly in plantation coups established on Rabbit Plain and Peak Plain between Surrey Hills and St Valentines Peak.

The route crosses the headwaters of Blythe River and Old Park River east of St Valentines Peak. After crossing Old Park River, the route runs along the watershed between Wey River and Emu River to the Ridgley Highway and the Melba Line.

West of Ridgley Highway the route crosses the Burnie–Waratah 110 kV OHTL which it then follows north to the future switching station site at Hampshire Hills. The existing easement will be widened to accommodate the proposed OHTL.

10 Seek landowner and community feedback

TasNetworks released the proposed Staverton–Hampshire Hills route for consultation in November 2019. Landowner, community and other stakeholder feedback was sought, including through a survey and a series of workshops and meetings with individuals, groups and organisations.

10.1 Summary of landowner and community feedback

A number of individuals, groups, communities and organisations raised concerns about the 2019 proposed route and requested changes including proposals for alternative routes. A number of stakeholders raised broader concerns about new renewable energy projects in Tasmania and the corresponding need for any new transmission. A report summarising the feedback provided during these engagement activities is available on TasNetworks' website: Summary of Engagement October - December 2019. https://talkwith.tasnetworks.com.au/59134/widgets/304463/documents/176795

The key feedback relating to the 2019 proposed route and route change requests can be broadly grouped as follows:

- requests for an underground option
- a strong preference for a southern route through the Vale of Belvoir
- requests for refinement of the 2019 proposed route – with several variations put forward for consideration.

10.2 Consideration of landowner and community feedback

Feedback was reviewed to determine if it raised material new information not known or considered in the initial work. In some instances, the feedback and suggestions introduced material new information. This material new information was considered in conjunction with the other feedback and requests. Appendix 3 provides a summary of community feedback relevant to route selection together with a reference to the sections of this report responding to the issues and concerns raised.

10.2.1 Underground considerations

Some community feedback requested undergrounding the transmission line. This section provides information on this aspect in the context of route selection generally and relates to underground considerations for high voltage AC (**HVAC**) technologies only. Different considerations apply to underground HVDC technologies which are often used for interconnector transmission assets.

Transmission circuits can be constructed as OHTL or underground cables. A range of factors determine the feasibility of overhead or underground technologies. TasNetworks prefers to use OHTLs when progressing HVAC projects, as this reflects our existing transmission network assets, provides flexibility for additional connection and is generally the least cost to deliver energy to customers, while still allowing land use and environmental impacts to be managed. This preference reflects the following broad considerations:

- **Double circuit OHTLs provide a lower cost outcome, with equivalent capacity HVAC underground cables having a significantly higher cost than HVAC double circuit OHTLs.**

  Considerations that influence cost differential where high capacity equivalent underground assets are required include, length of route, difficult terrain, horizontally directionally drilled road and watercourse crossings and weather conditions limiting construction timeframes, e.g., in subalpine and alpine climates. Partial undergrounding options for sections further increase costs, as sealing end installations are required at each transition between overhead and underground.

  Underground cable routes are typically longer than OHTL routes, as gentler slopes or existing roads are required to avoid unstable slopes. Route lengths may increase by up to 20 per cent for underground solutions, and even more where difficult terrain is encountered.

  Undergrounding transmission circuits require digging a trench and keeping an easement clear of deep-rooted vegetation for the entire length of the route. The exception is where trenchless methods such as horizontal directional drilling (**HDD**) are used to cross major roads and watercourses and bore under short sections of sensitive vegetation. HDD can only be used where favourable geotechnical conditions exist.

- **OHTLs can more effectively address land use and environmental constraints through route selection, tower siting and tower heights.**

  OHTLs can overfly sensitive vegetation communities. Undergrounding transmission circuits require digging a trench for the entire length of the route, except where trenchless methods such as HDD are used to cross major roads and watercourses and bore under short sections of sensitive vegetation or other sensitive cultural heritage sites or features. A nominal 15-m to 20-m-wide easement is required to accommodate two 220 kV circuits, i.e., six extra high voltage (EHV) cables are required for each circuit (two cables per phase) that match the capability of a 220 kV OHTL utilising twin conductor bundles.

In addition OHTLs do not require the full easement to remain cleared (as is the case with underground cables) increasing habitat availability (wildlife corridors) and decreasing the potential for erosion.

- **OHTLs more effectively manage EMF without compromising performance.**

  Managing EMF from underground cables requires deep burial which affects cost and transfer capacity.

- **Underground cables may have lower operation and maintenance costs, but these savings do not outweigh the capital cost difference over the life of the asset.**

  Underground cables are less exposed to lightning strike, vegetation impacts, weathering and atmospheric conditions. Vegetation over underground cables still needs to be managed to reduce the risk of roots damaging the cables, causing localised heating and potential failure. When faults occur on underground cables, repair times are longer and repair costs are higher than for OHTLs.

- **Amenity impacts from OHTLs can be reduced through in-step siting of towers, tower spacing and tower height.**

  Careful design can reduce but not eliminate the impact of OHTLs in the landscape. Detailed design will consider the outcomes of the landscape and visual impact assessment to reduce amenity impacts where practicable. This could include route location and design responses, vegetation or other screening, tower or conductor treatments.

  Riparian and other sensitive vegetation can be overflown by OHTLs whereas underground cable easements need to be maintained free of deep-rooted vegetation to protect the integrity of the cables. Underground cable easements are still visible where cleared through vegetation, require access tracks and impact landscape values.

- **Underground cables (including partial underground options) will be investigated where no OHTL options are considered prudent and feasible having regard to a number of factors, including cost (construction, operation and maintenance), technical and operational constraints, constructability, biodiversity impacts, social and cultural impacts and land use constraints.**

  The 2019 proposed route (and preferred route) for Staverton to Hampshire Hills is best constructed as an OHTL, as the route traverses deeply incised valleys, unstable geology including karst limestone and landslip hazard zones and this report assesses these OHTL options.

10.2.2 Sheffield to Farrell corridor considerations

Routes in the southern corridor were discounted in the 2019 assessment due to their additional length and impact on conservation values. Notwithstanding, numerous requests were made by individuals, groups, organisations and community members to reconsider this option. In response, TasNetworks revisited routes in the southern corridor through the Vale of Belvoir undertaking a more detailed assessment including overhead and underground options. The results of that assessment are summarised in this section and presented in detail in Appendix 4.

The Hydro-Electric Commission of Tasmania (**HEC**) investigated routes from Sheffield to Farrell in the late 1970s and 1980. The routes investigated generally align with the southern, central and northern corridors identified in this route selection exercise. Considering technical issues and landowner, community and key stakeholder feedback, HEC recommended a route through the Vale of Belvoir. The route was approved and the double circuit Sheffield–Farrell 220 kV OHTL constructed in 1984. The OHTL was constructed using Austen50 towers along the Cradle Mountain Road near Iris River and Middlesex Plains. Belvoir Road, formerly Cradle Mountain Link Road, which was constructed in 1985-6 and gazetted in 1989. The road links Cradle Mountain Road with the Murchison Highway enabling tourists to more easily access the West Coast. The road also improved access to the Sheffield–Farrell 220 kV OHTL.

In 2000, the Tasmanian Government proclaimed the Vale of Belvoir a conservation area under the *National Parks and Wildlife Act 1970* (Tas), subsequently repealed and replaced by the *Nature Conservation Act 2002* (Tas). The conservation area includes land occupied by the Sheffield–Farrell 220 kV OHTL. In 2010, the Tasmanian Land Conservancy (**TLC**) established the Vale of Belvoir Reserve and registered a conservation covenant on the land (see https://tasland.org.au/reserves/vale-of-belvoir-reserve/.

The Vale of Belvoir Reserve protects listed threatened native vegetation communities and listed threatened flora and fauna species and their habitat. Sensitive ecological communities include subalpine grasslands, sedgelands and wetlands, old-growth forests and karst systems. TLC actively manages the reserve undertaking scientific research, ecological burns and conservation programs aimed at protecting and enhancing its values. The covenant does not extend over the existing 60-m-wide OHTL easement protecting the Sheffield–Farrell 220 kV OHTL.

Overhead and underground routes through the Vale of Belvoir were investigated to understand if impacts on the Vale of Belvoir Conservation Area and Vale of Belvoir Reserve would be significant and if so, whether they could be managed. An overhead route adjacent to the existing OHTL would cause significant impacts due to construction and upgrade of access tracks and construction of towers in areas with high densities of threatened flora species and threatened ecological communities. Underground routes adjacent to the existing easement and along Belvoir Road were investigated. The route options would have significant impacts due to the need to excavate a trench for almost the entire route. Terrain, unfavourable geology and watercourses constrained route options along Belvoir Road forcing that route option away from the road increasing impacts. The overhead and underground options were estimated to cost an additional $50 million

and up to $115 million respectively, with a partial overhead and partial underground option costing an additional $70 million.

Notwithstanding the outcome of this assessment, TasNetworks consulted the TLC on its views of a route through the Vale of Belvoir. The organisation expressed considerable concern about a route through the Vale of Belvoir noting their considerable efforts in protecting the Vale of Belvoir's threatened ecological communities and species since declaration of the conservation area in 2000 and registration of the conservation covenant in 2008.

The detailed assessment set out in Appendix 4 confirms the 2019 assessment that routes along the Sheffield–Farrell 220 kV OHTL would have significantly higher impacts than routes through the central corridor including on Iris Farm, Daisy Dell, Romney Marsh and Hatfield Plain conservation covenants.

10.2.3 Refinement of 2019 proposed route

Following public disclosure of the proposed route in 2019, TasNetworks received several requests for changes to the proposed route and suggestions for alternative routes. The route change requests are summarised as:

- requests to move the route from small landholdings.
- requests to move the route from impacting views from adjacent properties.
- requests to increase separation of the route from potential house sites on properties.
- requests to reduce impacts on forest coupes and forestry operations.

These requests instigated a review of the 2019 proposed route to determine if realignment would address these requests and whether the alternative routes were prudent and feasible and would not significantly increase costs.

11 Evaluate feedback and route change requests

Route change requests comprised proposals for alternative routes not previously investigated and refinements to the 2019 proposed route.

11.1 Loongana to Hampshire Hills alternative route

An alternative route from Loongana direct to Hampshire Hills was proposed to address concerns about impacts on commercial plantations. The conceptual route was identified, designed and evaluated. The feasible route was discounted as it:

- increased impacts on native production forests and planned coupes;
- exposed the route to sandstone near Native Track Tier and Blythe River and extensive granite around Mt Housetop;
- increased impacts on dry eucalypt forests and woodlands and wet eucalypt forests and woodlands. Threatened ecological community *Eucalyptus amygdalina* forest and woodland on sandstone has been recorded in sandstone formations southwest of Mt Housetop near Blythe River. Sandstone occurs on Native Track Tier. *Eucalyptus viminalis* wet forest, a threatened ecological community occurs in wet eucalypt forests and woodlands. A patch has been identified in Loongana and is protected by a conservation covenant;
- would require development of an extensive access track network in the Native Track Tier and Black Creek sections;
- did not facilitate connection of renewable generation projects as effectively as the proposed route i.e., failed to realise the intent of the North West Tasmania Strategic Transmission Plan.

11.2 2019 Proposed route refinement

Further review of route change requests and suggested alternative routes warranted breaking the 2019 proposed route into sections to assist evaluation of the alternatives. The sections are:

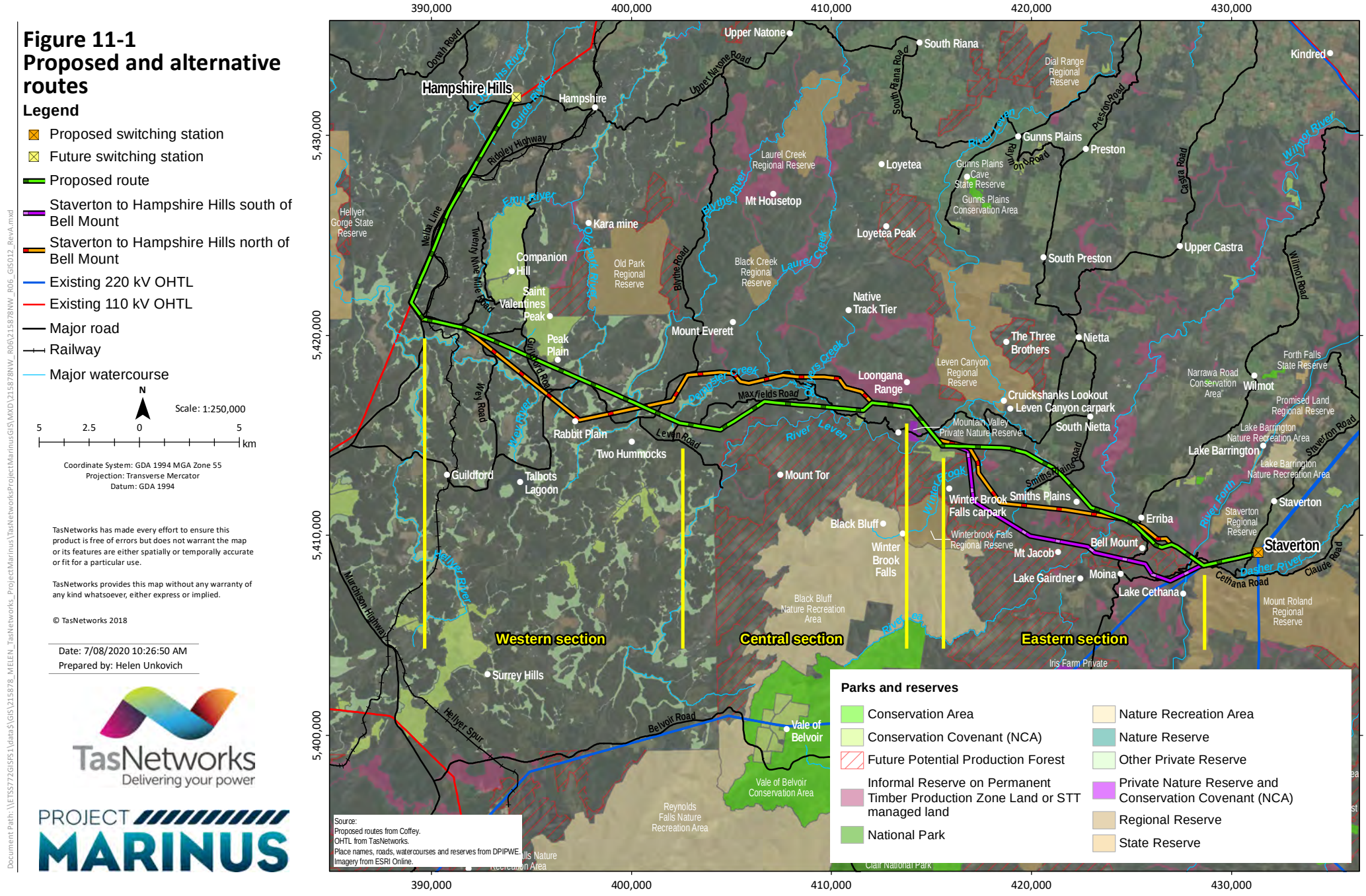
- Staverton to Cethana. The 2019 proposed route is adjacent and parallel to the Sheffield–Farrell 220 kV OHTL in this section. No feasible alternative routes exist in this section.

- Cethana to River Leven (eastern section). Two alternative routes were proposed in this section.
- River Leven crossing. The River Leven crossing is a ‘pinch point’. Alternative routes were investigated in identifying the 2019 proposed route and were discounted as they would significantly impact small landholdings, conservation assets and covenants, and visual amenity.
- River Leven to Blythe Road (central section). An alternative route north of the 2019 proposed route was requested in this section, as well as several localised realignments.
- Blythe Road to Wey River (western section). An alternative route south of the 2019 proposed route was requested in this section.
- Wey River to Hampshire Hills. The 2019 proposed route is adjacent and parallel to the Burnie–Waratah 110 kV OHTL in this section. No changes to the 2019 proposed route were requested.

A viewshed analysis was used in reviewing the realignment requests and designing the alternative routes, specifically Cruickshanks Lookout viewshed. The viewshed analysis identifies those areas and sensitive viewpoints that will see the transmission line. Visibility with and without vegetation was calculated. Viewsheds without vegetation are used in landscape and visual impact assessment, as vegetation can be cleared or blown down or burnt opening areas to views.

The alternative routes are described below. The proposed and alternative routes are shown in Figure 11-1. Figures 11-2, Figure 11-4 and Figure 11-5 show the 2019 proposed route and alternatives considered in each section. Figure 11-3 shows the proposed and alternative routes in the Eastern section within Cruickshanks Lookout viewshed.

Figure 11-1
Proposed and alternative routes



11.2.1 Eastern section

Two feasible alternative routes were identified in the eastern section between Cethana and River Leven. The alternative routes – north of Bell Mount and south of Bell Mount – are described in the following sections. Figure 11-2 shows the 2019 proposed route and alternatives considered in the Eastern section. Figure 11-3 shows the 2019 proposed route and alternatives in the Eastern section within Cruickshanks Lookout viewshed.

11.2.1.1 North of Bell Mount

The north of Bell Mount route adopts the 2019 proposed route from Staverton to the west side of the River Forth (Lake Barrington) at Cethana. The route adopts a slightly different alignment as it approaches Cradle Mountain Road, crossing the road in the saddle north of Bell Mount.

After crossing the Wilmot River on the same location as the proposed route, the route runs westerly through Smiths Plains increasing separation to Loongana Road. The route turns north-northwest near Smiths Plains Road to cross Winter Brook upstream (south) of the proposed route crossing and west of the quarry reserve, which is west of the watercourse.

After crossing Winter Brook, the route runs north of the proposed route to the eastern side of the River Leven crossing. This realignment increases separation to potential house sites on adjacent properties and the sinkhole at the head of a side gully of the River Leven. It reduces views of the OHTL from Cruickshanks Lookout.

11.2.1.2 South of Bell Mount

A route south of Bell Mount was suggested to reduce amenity impacts on adjacent properties in the Erriba area. The south of Bell Mount route follows the Sheffield–Farrell 220 kV OHTL to the west side of the River Forth (Lake Barrington) where it turns northwesterly to cross Cethana Road and Lincoln Creek to run up the spur north of the watercourse. The route crosses Cradle Mountain Road in the saddle south of Bell Mount to the Wilmot River, running south of Washington Road and north of mining licence 1M/1986, a gold mining prospect.

The route crosses the Wilmot River downstream of Lake Gairdner to run across the face of the Mt Jacob cirque, crossing the prominent Mt Jacob ridge in a saddle. West of the saddle, the route runs westerly, then northwesterly and northerly crossing Smiths Plains Road and Winter Brook upstream (south) of the north of Bell Mount route.

West of Winter Brook, this route adopts a similar alignment to the north of Bell Mount route to achieve the same improvements; although this section of the route is more visible from Cruickshanks Lookout.

Figure 11-2
Proposed and alternative routes (Eastern section)

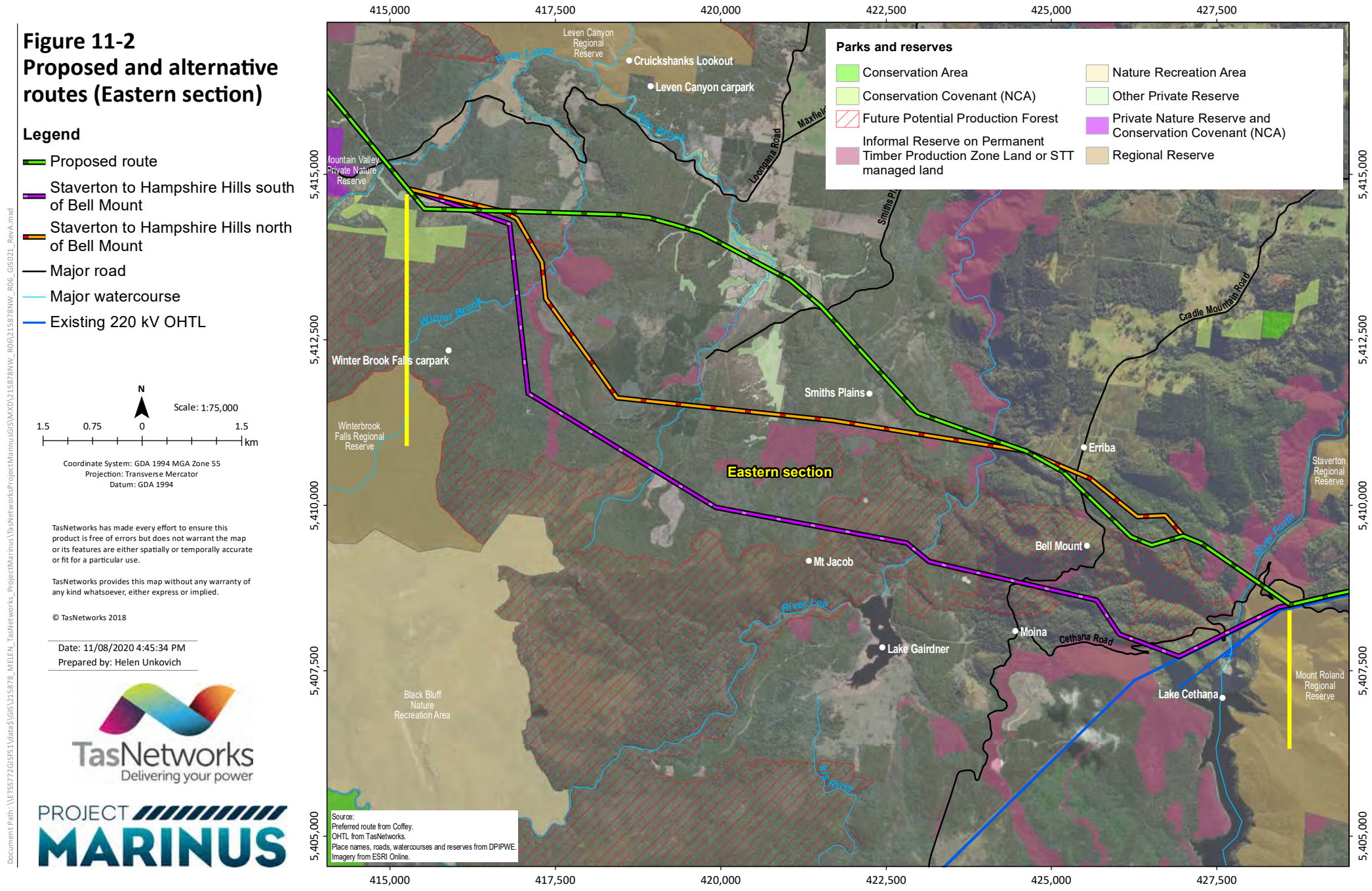
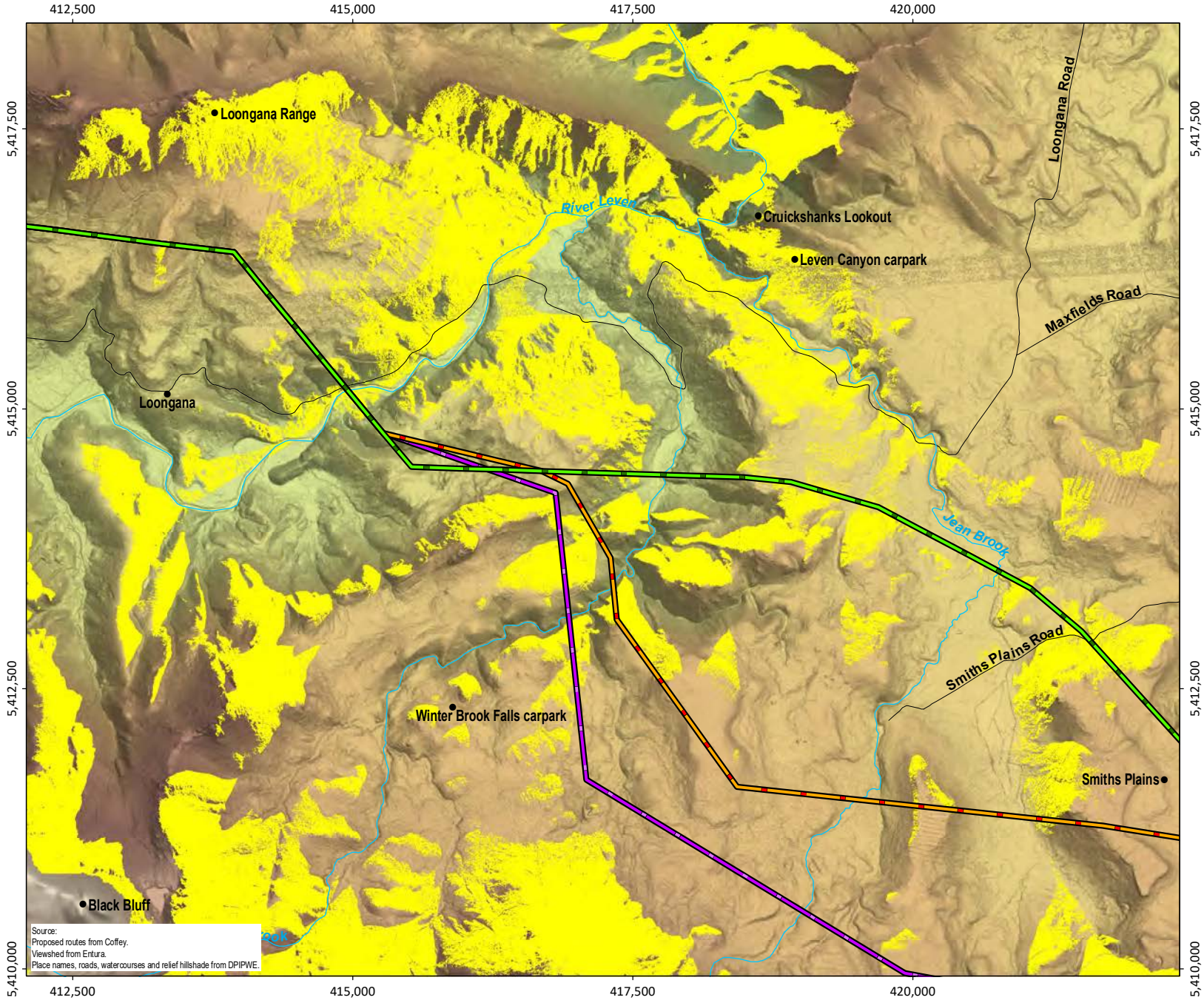


Figure 11-3
Proposed and alternative routes within Cruickshanks Lookout viewshed



Legend

- Proposed route
- Staverton to Hampshire Hills south of Bell Mount
- Staverton to Hampshire Hills north of Bell Mount
- Major watercourse
- Major road
- Cruickshanks lookout viewshed (no vegetation)

N

Scale: 1:50,000

1 0.5 0 1 km

Coordinate System: GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994

Source:
Proposed routes from Coffey.
Viewshed from Entura.
Place names, roads, watercourses and relief hillshade from DPIPWE.

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Prepared by: Helen Unkovich

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11.2.2 Central section

West of River Leven, landowners and Loongana residents raised numerous concerns about the proposed route. Loongana residents and landowners requested the route be moved from small landholdings and increase separation to houses. Commercial landowners requested realignment of the route to reduce impacts on plantations and native production forests. A group of Loongana residents suggested an alternative route north of the proposed route. TasNetworks met with affected landowners and some neighbours to discuss their concerns.

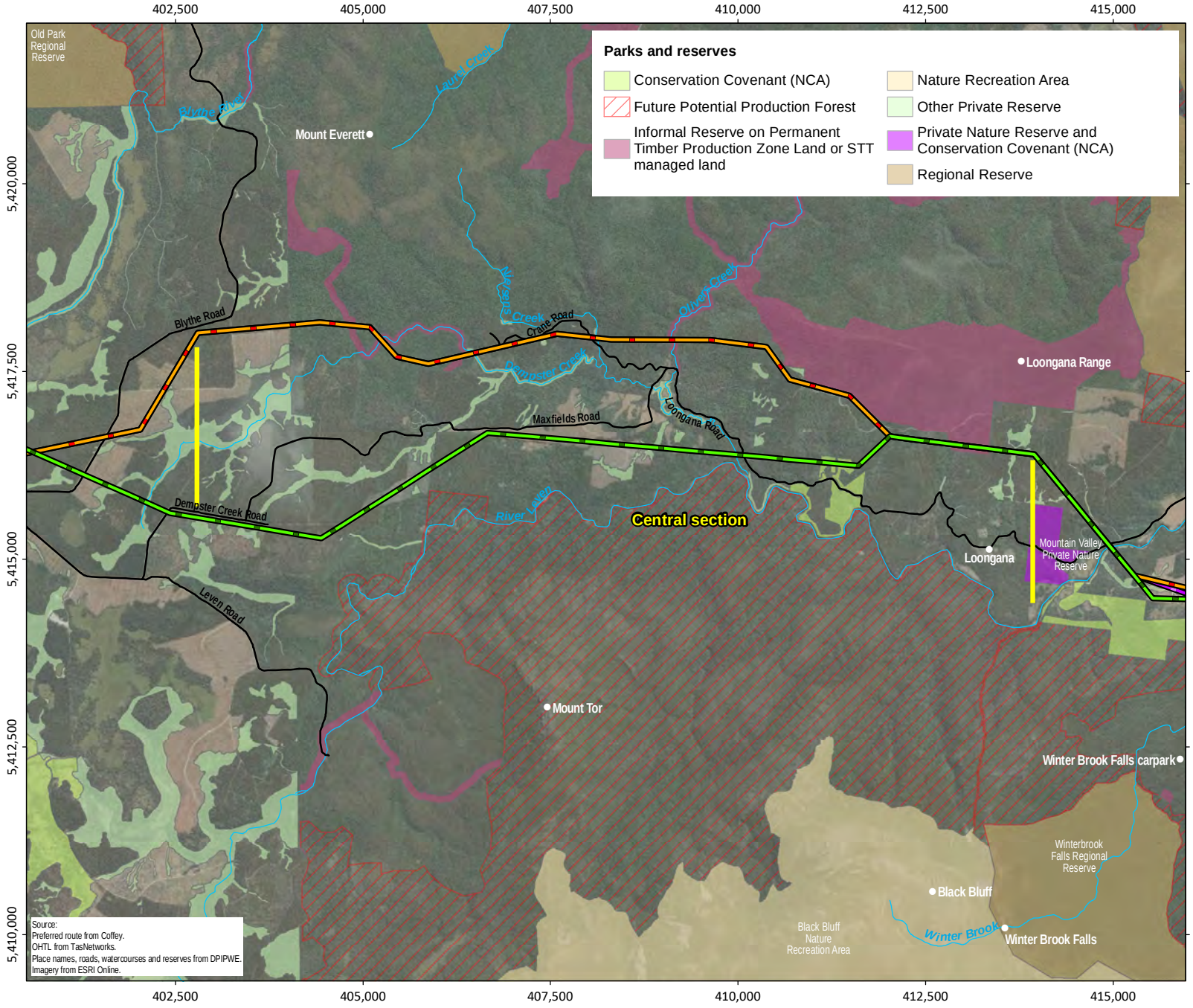
This feedback prompted a review of the proposed route in the Loongana and Rabbit Plains area, as changes in either area had implications for the other area. A revised route that largely addresses these concerns was identified and is described below.

After crossing River Leven, the alternative route follows the proposed route to near Gatehouse Road, northwest of Frosts Flats. From this point, the route runs northwest and then west to follow Gatehouse Road for approximately 1.5 km where it turns northwest to the saddle between a high point and Loongana Range.

The route turns west at the saddle to cross Alstergren Road, Olivers Creek and Nielsens Creek to join and generally follow Crane Road, which runs along the ridge between Nielsens Creek and Dempster Creek. Leaving Crane Road, the route makes several crossings of Dempster Creek to the Surrey Hills plateau north of the proposed route.

From this point, the alternative route turns southwesterly to approximately follow Blythe Road to the Blythe River, where it crosses the original proposed route. Figure 11-4 shows the 2019 proposed route and alternatives considered in the Central section.

Figure 11.4
Proposed and alternative routes (Central section)



Legend

- Proposed route
- Staverton to Hampshire Hills south of Bell Mount
- Staverton to Hampshire Hills north of Bell Mount
- Major road
- Major watercourse

N

Scale: 1:75,000

1.5 0.75 0 1.5 km

Coordinate System: GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994

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Prepared by: Helen Unkovich

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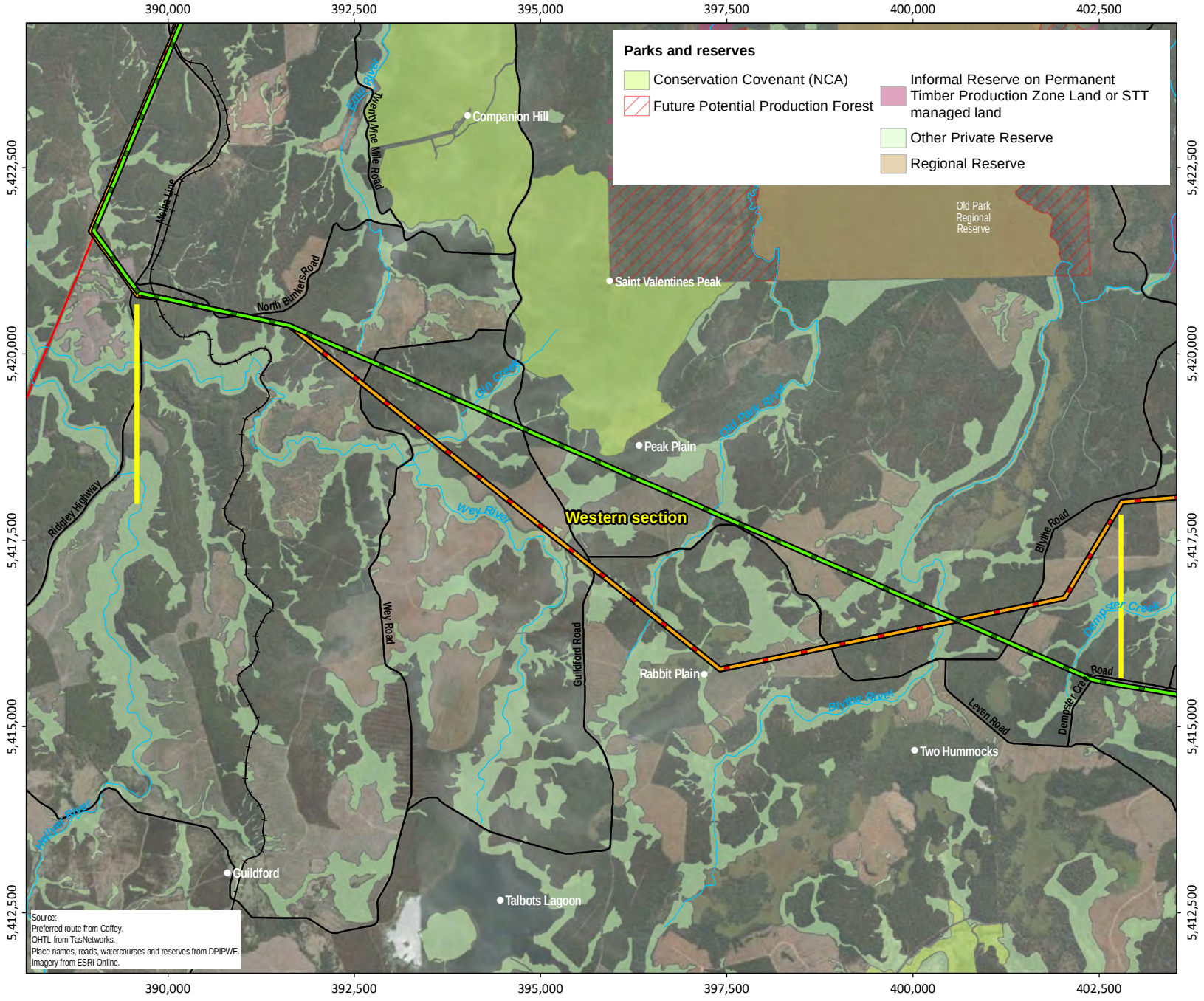
11.2.3 Western section

The alternative route takes a more southerly path through Rabbit Plain. It turns northwest at Rabbit Plain and runs along the edge of the plateau to the north of the incised Wey River valley. Figure 11-5 presents to 2019 proposed route and alternatives considered in the Western section.

Figure 11.5
Proposed and alternative routes (Western section)



Legend

- Proposed route
- Staverton to Hampshire Hills south of Bell Mount
- Staverton to Hampshire Hills north of Bell Mount
- Major road
- Railway
- Major watercourse
- Existing 110 kV OHTL

N

Scale: 1:75,000

1.5 0.75 0 1.5 km

Coordinate System: GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994

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11.3 Evaluation of alternative routes against the 2019 proposed route

Desktop baseline studies were commissioned for the alternative routes to understand the impacts associated with developing each route to inform the evaluation of route options. In assessing these alternatives, detailed ecology, cultural heritage and geomorphology desktop studies, an eagle nest survey and a site inspection from the public road network to inform the geomorphology study, were undertaken to ensure the evaluation process was based on an equivalent level of data to that used for the 2019 proposed route. The addition of viewshed analysis for Level Canyon lookout assisted with visual impact considerations. The review of the alternative routes against the proposed route applied the same rigour as the initial route selection, using the technical, environmental and social criteria to identify realignments and evaluate the alternative routes.

The evaluation was informed by key statistics and undertaken with TasNetworks' subject matter experts in transmission system planning and OHTL design, construction and operation. The preliminary impact assessments assume the area of disturbance (AoD) will be the 90-metre wide easement to support strategic network planning. Up to 60 m will be cleared and disturbed for the proposed Staverton–Hampshire Hills 220 kV OHTL. A survey corridor 290 m wide (proposed easement plus a 100 m buffer) was defined for these studies to allow for micro-siting towers and minor realignments to address site-specific constraints. The assessments did not include access tracks or laydown areas, the siting of which is yet to be developed in detail.

The findings of the baseline studies and technical specialists' advice on considerations for route selection have been used as the basis for the analysis presented in this section (CHMA & ELA 2020a CHMA & ELA 2020b, CHMA & ELA 2020c, Entura 2020a, Entura 2020b, Entura 2020c).

This exercise involved comparing the alternative routes to the 2019 proposed route in each section, as opposed to a wholesale revisiting of each alternative route in its own right. The detailed ecology, cultural heritage and geomorphology desktop studies found the difference between the 2019 proposed route and alternative routes was marginal with respect to almost all route selection criteria. Appendix 5 presents key statistics, on a section by section basis, for the 2019 proposed route compared to the alternative routes. As the difference between the 2019 proposed route and the alternative routes was marginal with respect to almost all route selection criteria, a more refined scale evaluating detriment and improvement of the alternative routes over the 2019 proposed route has been deployed. The outcomes of that assessment are summarised in Table 11-1 below and provided in detail in Appendix 6.

Table 11-1 Evaluation of alternative routes against 2019 proposed route for relevant sections

Key statistic	Evaluation of alternatives against 2019 proposed route for each section			
	Eastern section		Central section	Western section
	North of Bell Mount	South of Bell Mount		
Construction cost	No change	Moderate detriment	Small detriment	Small detriment
Operation and maintenance cost	No change	Moderate detriment	Small detriment	No change
Native vegetation	Small detriment	Moderate detriment	Moderate detriment	No change
Listed threatened ecological communities and species	No change	No change	Not assessed[1]	Not assessed[1]
Listed threatened species – wedge-tailed eagle nests within 1 km	No change	Small improvement	Moderate improvement	No change
Declared reserves	No change	Small detriment	Small improvement	No change
Informal and other private reserves	No change	No change	No change	No change
Landholdings (small private properties)	Moderate improvement	Moderate improvement	Large improvement	No change
Landholdings (commercial properties)	No change	Large improvement	No change	Moderate improvement
Cultural heritage	No change	No change	No change	Small detriment
Visual amenity	No change	Small improvement	Small improvement	No change
Network security	No change	Small detriment	Small detriment	No change
Constructability	No change	Small detriment	Small detriment	No change

[1] Insufficient desktop data available to make assessment

11.4 Evaluation findings

The evaluation of the alternative routes against the 2019 proposed route revealed the following:

Eastern section

- While the south of Bell Mount alternative route reduces amenity impacts on neighbours, it introduces a newly affected community (Lake Gairdner).
- The south of Bell Mount alternative route is exposed to geotechnical and landslip risk as it crosses the Mt Jacob cirque increasing construction and operation and maintenance costs. Access tracks across the cirque will be highly visible from Lake Gairdner properties and difficult to maintain.
- The south of Bell Mount route impacts more native vegetation south of Bell Mount, near the Wilmot River and in the southern and western parts of Smiths Plains. This increases the risk of impacts on threatened ecological communities and species and their habitat.
- Relative to 2019 proposed route, the north of Bell Mount alternative route is likely to have similar avoids one private property and reduces visual impact from three private properties.
- The north of Bell Mount route has been adopted as the preferred route for this section.

Central section

- The alternative route i.e. north of Loongana, introduces constructability and operation and maintenance risks increasing cost. More native vegetation is traversed by this alternative route increasing the risk of impacts on threatened ecological communities and species and their habitat.
- The north of Loongana route avoids impacts on small private landholdings addressing concerns raised by individuals and groups of residents and is consistent with the intent of the alternative route suggested by some Loongana residents.
- The north of Loongana route runs along Crane Road and in Dempster Creek valley, reduces views to the OHTL and removes the OHTL from views to Black Bluff from Loongana properties.
- The north of Loongana avoids four small private landowner properties previously directly impacted by the 2019 proposed route.
- The alternative route has been adopted as preferred route for this section.

Western section

- The alternative route through Rabbit Plain reduces impacts on high productivity forestry area.
- The alternative route has been adopted as the preferred route in this section.

12 Preferred route

12.1 Description

Evaluation of the alternative routes found that a combination of route segments would result in a route that responded to route change requests and some suggested alternative routes, and better addressed landholder and community concerns. The preferred route for the proposed Staverton–Hampshire Hills 220 kV OHTL is the combination of 2019 proposed route and alternative routes as detailed in preferred route.

Table 12-1 Preferred route

Section	Route adopted
Staverton to Cethana	2019 proposed route
Cethana to River Leven (eastern section)	Alternative route (North of Bell Mount)
River Leven crossing	2019 proposed route
River Leven to Blythe Road (central section)	Alternative route (north of Loongana)
Blythe Road to Wey River (western section)	Alternative route (Rabbit Plain realignment)
Wey River to Hampshire Hills	2019 proposed route

The preferred route is shown in Figure 12-1.

The preferred route is further described below in relation to the sections and shown in Figure 12-2.

Figure 12.1
2020 preferred route

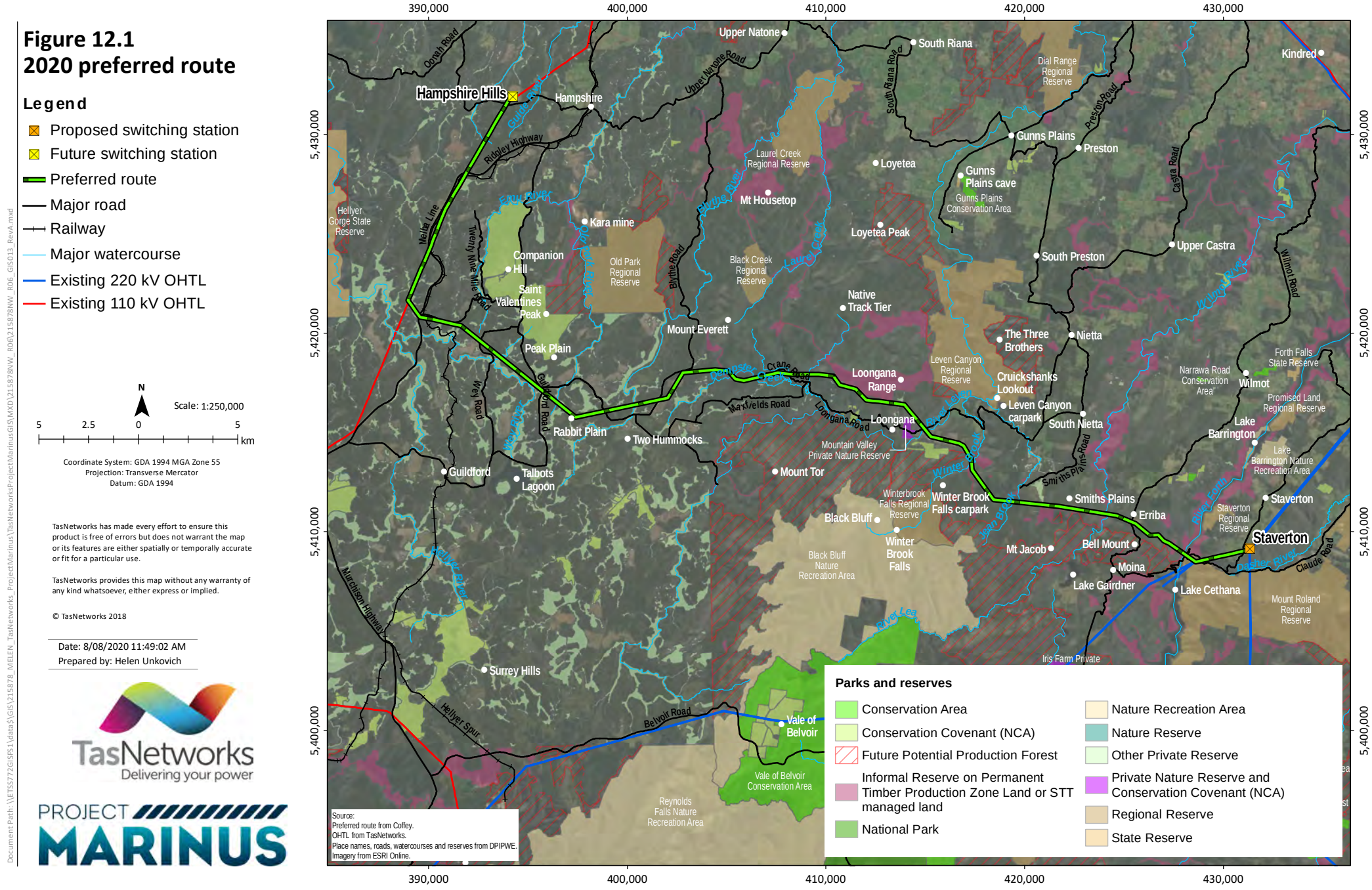
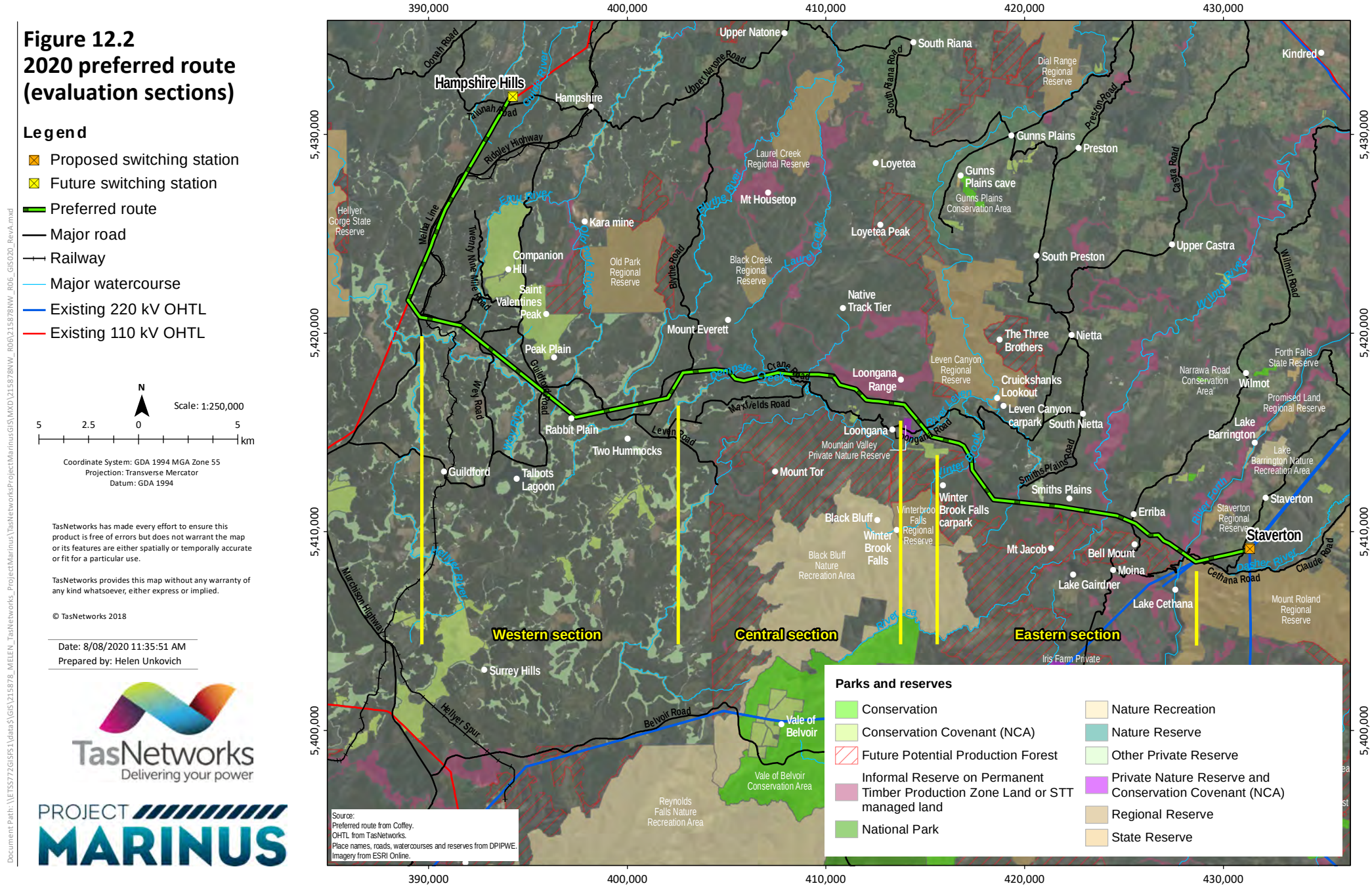


Figure 12.2
2020 preferred route (evaluation sections)



12.1.1 Staverton to Cethana

Commencing at Staverton, the preferred route follows the Sheffield–Farrell 220 kV OHTL to the edge of the plateau above Lake Barrington.

12.1.2 Cethana to River Leven (eastern section)

Diverging from the existing OHTL at Cethana, the route follows the spur adjacent to Cethana Road to make a perpendicular crossing of Lake Barrington (River Forth) which is in a deeply incised valley. The route passes through the edge of the Mount Roland Regional Reserve which extends to the Cethana Road. This section of the route crosses two mining prospects (DH PD84 CC9 (pyrite) and West Cethana Prospect (lead)) that do not have registered mining leases and have not been developed. Proximity to Cethana Road reduces the length of tower access tracks.

West of Lake Barrington, the route runs to the north of the prominent ridge east of Bell Mount to the saddle north of Bell Mount where it crosses Cradle Mountain Road. Tower heights have been reduced in the saddle to reduce amenity impacts on this tourist road and adjacent properties.

The preferred route crosses the Wilmot River from a prominent ridge on the eastern side of the river to the terrace on the western side of the river to maximise clearance over riparian vegetation in the Wilmot River valley.

After crossing the Wilmot River, the preferred route runs westerly through Smiths Plains across Jean Brook and Smiths Plains Road before turning northwest to follow Smiths Plains Spur 5 plantation access track to Winter Brook. Long spans across Smiths Plains and Jean Brook avoid towers in those valleys.

The preferred route crosses Winter Brook from the prominent spur on the east side of the watercourse; passing through a saddle on the western side of the watercourse to the plateau west of Winter Brook. The preferred route passes through the informal reserve on ‘permanent timber production’ zoned land that runs along the east bank of Winter Brook, and ‘future potential production forest’ zoned land that runs along, and west of, the watercourse.

After crossing Winter Brook, the preferred route runs west-northwest to the River Leven. The route runs down the valley of a side gully of the River Leven behind the ridge to the north, which screens this section of the route from Leven Canyon lookouts. The preferred route is 150 m from the closest small private property and increases separation to the sink hole in the gully draining to the River Leven.

12.1.3 River Leven valley crossing

The River Leven valley crossing is unchanged and located between Webbs Flats and Taylors Flats and between Leven Cave and Tiger and Wicked caves which are located adjacent to the south bank of the river. The steep-sided valley will be overflown by the OHTL with towers placed at the top of the sides of the valley. Riparian vegetation in the valley will be preserved.

12.1.4 River Leven to Blythe Road (central section)

West of River Leven the preferred route is generally adjacent to Gatehouse Road north of small private properties. The preferred route avoids impacts on those properties and reduces impacts on commercial plantation coupes.

West of Loongana, the preferred route continues along and adjacent to Gatehouse Road northwesterly, westerly and southwesterly to Alstergren Road. The route crosses Olivers Creek and Nielsens Creek to join and generally follow Crane Road, which runs along the ridge between Nielsens Creek and Dempster Creek. Leaving Crane Road, the route makes several crossings of Dempster Creek to run adjacent to the northern boundary of the small private properties (several of which have been developed for plantation forestry) to Blythe Road.

12.1.5 Blythe Road to Wey River (western section)

Turning southwest, the preferred route runs through plantation coupes to cross Blythe Road again. After crossing the road it turns westerly to cross Blythe River and Blythe Road again to east of Old Park River in Rabbit Plain.

Turning northwest at Rabbit Plain, the preferred route runs along the edge of the plateau, north of the incised Wey River valley to the Ridgley Highway near its intersection with North Bunkers Road. The route crosses Old Park River and Gin Creek, a tributary of Wey River.

12.1.6 Wey River to Hampshire Hills

The preferred route crosses Ridgley Highway to join and follow the Burnie–Waratah 110 kV OHTL to Hampshire Hills.

12.2 How does the preferred route address community concerns?

The preferred route has reduced some impacts and marginally increased some impacts. The route attempts to balance the competing interests of landowners, communities and TasNetworks' regulatory requirements regarding net cost-benefit planning and augmentation of the North West Tasmanian transmission system.

Landowner and community concerns have been partially or wholly addressed as follows:

- conservation covenants have been avoided;
- the number of small landholdings crossed has been reduced;
- separation distances to small landholdings have been increased, with a few exceptions where the separation distances remain unchanged or slightly reduced;
- the route has been moved away from public roads servicing the Loongana community, except at the River Leven crossing;
- the route has been moved north of Loongana, as proposed by some community members;
- realignment has reduced impacts on high productivity plantation coupes and existing and planned high value production forest coupes;
- realignment in the Winter Brook area has reduced the extent of the OHTL within the Cruickshanks Lookout viewshed;
- realignment adjacent to Dempster Creek has lowered the OHTL in the landscape west of Loongana Range, reducing its visibility in that area;
- preliminary design has reduced tower heights in sensitive areas to reduce landscape and visual impacts;
- preliminary design has avoided impacts on known Aboriginal cultural heritage sites by careful placement of towers;
- watercourse crossings have been selected and designed to achieve, where practicable, maximum clearance over riparian vegetation to protect wildlife corridors; and
- access track lengths have been reduced to the extent possible through use of existing tracks and roads.

13 Next steps

TasNetworks will use the preferred route to progress further planning and engagement activities. Landowners, communities and stakeholders will have multiple opportunities to comment on the preferred route and its impacts. Formal opportunities to make submissions are provided through comprehensive and robust environmental, planning and heritage assessment processes, and informal opportunities are available through planned engagement activities.

Identification of the preferred route will enable:

- Tower positions to be confirmed, which will inform environmental, planning and heritage assessments and land access negotiations.
- Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 referral application.
- Land access negotiations to be completed to enable field surveys.
- Detailed terrestrial ecology, cultural heritage and geomorphology field surveys to accurately map existing conditions for environmental impact assessment purposes.
- Landscape and visual impact assessment to understand how the preferred route addresses community concerns about views from their properties and key tourist viewpoints. Community input on views and landscapes will inform this assessment and the development of appropriate mitigation.
- Preliminary geotechnical and constructability investigation (walk-through) to identify features and site conditions that require detailed investigation to inform detailed design.
- Environmental, cultural heritage and socioeconomic technical studies to inform environmental impact assessment and cultural heritage and planning approvals. The outcomes of these studies may require route refinement to address site-specific constraints and manage impacts.
- Landowner negotiations for the required easement, valuations and compensation agreements.
- Detailed design of the proposed double circuit 220 kV OHTL and Staverton Switching Station having regard to the environmental impact assessment including cultural heritage and socioeconomic studies and proposed mitigation measures.
- Submission of environment, land use planning and heritage applications for approval.
- Environment, land use planning and heritage approval decisions determines the final design of the OHTL and Staverton Switching Station.

14 Glossary and references

Glossary of abbreviations and terms

Abbreviation/term	Description
AC	alternating current
AEMO	Australian Energy Market Operator
AoD	area of disturbance
BOM	Bureau of Meteorology
circuit	an electrical circuit configured as alternating or direct current
Cwlth	Commonwealth
DC	direct current (only used in this document in relation to Marinus Link)
double circuit	parallel electrical circuits supported on either side of transmission towers or as sets of underground cables; each circuit comprises three phases
DPIPWE	Department of Primary Industries, Parks, Water and Environment (Tas)
EHV	extra high voltage; voltages higher than 66,000 Volts or 66 kV
EPBC Act	*Environment Protection Biodiversity Conservation Act 1999* (Cwlth)
EMF	electric and magnetic fields, which are emitted by electrical circuits
GIS	geographic information system
ground-truthing	checking the accuracy of data bases and remotely sensed data by means of in-situ observations
ha	hectare; SI unit of measurement
HDD	horizontal directional drilling
HEC	Hydro-Electric Commission of Tasmania
HVAC	high voltage alternating current
HVDC	high voltage direct current
ISP	Integrated System Plan

km	kilometre; SI unit of measurement
kV	kilovolt or 1,000 volts; SI unit of measurement
LIST	Land Information System Tasmania
m	metre; SI unit of measurement
MW	megawatt or 1,000,000 watts; SI unit of measurement; a measure of energy transfer capacity
NC Act	*Nature Conservation Act 2002* (Tas)
NEM	National Electricity Market
NER	National Electricity Rules
OHTL	overhead transmission line
pinch point	a location where constraints preclude other route options
REZ	renewable energy zone, as defined in AEMO's Integrated System Plan 2018
shovel ready	the stage of a project when construction can commence
single circuit	single electrical circuit supported on transmission towers or as a set of underground cables; a single circuit comprises three phases
Tas	Tasmania
TASVEG	Comprehensive digital map of Tasmania's vegetation (DPIPWE)
TLC	Tasmanian Land Conservancy
TRET	Tasmanian Renewable Energy Target
TSP Act	*Threatened Species Protection Act 1995* (Tas)

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Appendix 1- Geospatial data sources and data limitations

Data sources

Data held by TasNetworks and publicly available data compiled in the project GIS was used to identify constraints and opportunities for route selection. Constraints were used to identify prudent and feasible routes and sites. Geospatial data used in route selection included:

- TasNetworks transmission network and easement/wayleave information.
- Tasmanian Government's Land Information System Tasmania (LIST) open data warehouse.
- Australian Government's national map geospatial data warehouse.

Publicly available data used in route selection included:

- Australian and Tasmanian Government publications including:
    - Threatened ecological community advisory notes.
    - Threatened species advisory notes.
- Relevant local government planning schemes.
- Information published by government and non-government organisations on their websites, for example, Tasmanian Land Conservancy's conservation properties and assets.

Data limitations

Tasmanian and Australian Government geospatial data comprises datasets of variable accuracy and currency. The accuracy and currency of data is taken into account in route selection and addressed through site inspections, ground-truthing and detailed desktop studies by technical specialists. Key data sources, their accuracy and currency are listed in Table A1-1.

Table A1-1 Geospatial data limitations

Data	Accuracy	Currency
Cadastre (parcels, easement and properties)	Digitised maps; high relative accuracy; good absolute accuracy.	Current; regularly updated.
Planning zones and overlays	Digitised maps; high relative accuracy; aligned with cadastre.	Current; regularly updated.
Parks, reserves and Crown land	Digitised maps; high relative accuracy; aligned with cadastre.	Current; regularly updated.
Mining and petroleum resource tenure	Digital data; high relative accuracy.	Current; regularly updated.
Native vegetation coverage	Digitised maps; good relative accuracy	Typically can be poorly maintained dataset; indicative only.
Native vegetation communities	Digitised maps and imagery; good relative accuracy; community boundaries poorly defined in some areas; identification poor in some areas; higher accuracy in ground-truthed areas.	Best available mapping; periodically updated by relevant government agency.
Flora and fauna records	Variable due to historic recording methods; incomplete where there has been no survey effort.	Current; periodically updated with field data.
Cultural heritage	Aboriginal cultural heritage variable due to historic recording methods; higher accuracy for recent surveys. Historic cultural heritage high relative accuracy and good absolute accuracy where included as overlay in planning scheme maps or heritage register.	Current; regularly updated.
Transport infrastructure	Digitised maps; high relative accuracy.	Variable; current and historic data; generally good in area of interest.
Utilities (gas, power, water)	Digitised maps; variable accuracy. Electricity transmission lines accurate; water supply pipelines relatively accurate; gas transmission pipelines inaccurate in some instances.	Not all current; historic data.
Land use	Variable; good relative accuracy in some areas.	Not current; historic data. Long periodic update interval.

Appendix 2 – Key statistics for prudent and feasible route options

Key statistics for the identified prudent and feasible routes derived by intersecting the route options with layers in the project GIS are set out in Table A2-1. The statistics inform the qualitative assessment presented in Section 8 of this report.

Table A2-1 Key statistics for identified prudent and feasible route options

Key statistic	Northern corridor		Central corridor		Southern corridor	
	South Nietta option	Wilmot option	Peak Plain option	Old Park River option	Mt Pearse east option	Mt Pearse west option
Length (km)	57	56	59	51	81	93
Number of roads and access tracks intersected	56	55	62	42	49	56
Land tenure						
Number of freehold parcels intersected	76	83	38	31	26	25
Number of Crown land parcels intersected	24	23	13	17	28	28
Number of reserve parcels intersected	23	20	44	30	54	59
Length in conservation covenants registered under *Nature Conservation Act 2002* (Tas) (km)	0	0	0.4	0	3.3	5.3
Length in conservation areas declared under *Nature Conservation Act 2002* (Tas) (km)	0	0	0	0	2.6	2.6

Key statistic	Northern corridor		Central corridor		Southern corridor	
	South Nietta option	Wilmot option	Peak Plain option	Old Park River option	Mt Pearse east option	Mt Pearse west option
Length in private nature reserves (km)	0	0	0	0	2.1	2.1
Length in regional reserves (km)	0.7	0.7	0.7	0	1.0	1.0
Length in nature recreation area (km)	0	0	0	0	0.5	0.5
Length in Informal reserves on permanent timber production zone land (km)	1.0	1.6	1.3	3.0	2.4	2.3
Length in future potential production forest (km)	2.1	2.1	0	3.1	3.9	6.1
Length in other private reserves and management agreements (km)	0.8	0.9	5.1	2.5	7.9	10.5
Occupation						
Number of buildings within 300 m	89	118	25	20	18	18
Land use						
Length in cropping land (km)	0.6	0.7	0	0	0	0
Length in grazing land (km)	7.5	9.1	0.7	1.5	0.7	0.7
Length in hardwood and softwood plantations (km)	25.3	24.5	34.7	19.1	22.1	20.3

Key statistic	Northern corridor		Central corridor		Southern corridor	
	South Nietta option	Wilmot option	Peak Plain option	Old Park River option	Mt Pearse east option	Mt Pearse west option
Length in production native forest and plantation forest (km)	13.8	12.5	14	19.6	27.5	34.8
Length in native vegetation (km)	3.4	3.3	1.5	1.3	7.3	7.3
Length in conservation area (km)	4.7	4.5	7	9.2	20.7	27.4
Length in other land uses (km)	1.3	0.8	0.8	0.6	2.2	2.2
Planning*						
Length in 26.0 Rural Resource zone (km)	51.3	53.4	53.7	46.5	70.6	82.8
Length in 28.0 Utilities zone (km)	0.1	0.1	0.3	0.1	0.4	0.4
Length in 29.0 Environmental Management zone (km)	5.2	1.9	4.7	4.7	9.5	9.5
Length in Landslip Hazard overlay (km)	14.3	15.5	8.3	11.4	10.8	11.4
Native vegetation (TASVEG)						
Length in agricultural, urban and exotic vegetation (km)	40.6	39.9	45.1	24.4	37.5	39.4
Length in native grassland (km)	0.1	0.1	0.4	0.1	5	5.7
Length in native forest and woodland (km)	15.7	14.9	13.1	24	27.9	33.5

Key statistic	Northern corridor		Central corridor		Southern corridor	
	South Nietta option	Wilmot option	Peak Plain option	Old Park River option	Mt Pearse east option	Mt Pearse west option
Length in scrub, heathland, highland and coastal complexes (km)	0.1	0.1	0	2.7	9.9	14
Length in other natural environments (km)	0.1	0.4	0.1	0.1	0.2	0.1
Threatened ecological communities						
Length in threatened ecological communities (km)	0.1	0.1	0.1	0	7.7	9.1
Threatened species						
Number of EPBC-listed flora species within 500 m	2	0	6	2	272	297
Number of EPBC-listed fauna species within 500 m	24	21	7	10	19	23
Number of NC Act-listed flora species within 500 m	2	0	6	2	272	297
Number of NC Act -listed fauna species within 500 m	24	21	7	10	19	23
Number of raptor nests within 500 m**	1	0	3	1	0	0

* Only zones and overlays intersected by the route options are listed in this table.

** TasNetworks conducted aerial surveys for eagle nests in the middle corridor in June 2019 and May 2020 to verify Natural Values Atlas records. Eagle nest records for the northern and southern corridors are from the Natural Values Atlas.

Appendix 3 – Summary of community feedback and responses

Table A3-1 presents the key concerns and issues raised by the community in relation to route selection, lists some examples of feedback (summarised from TasNetworks' report 'Summary of Engagement October - December 2019') and provides responses to how the preferred route has attempted to addressed those concerns. References to relevant sections of this report are provided.

Table A3-1 Issues and concerns raised by the community during 2019 proposed route community engagement and how the preferred route has responded to those concerns

Issue/concern directly relevant to route selection process	Feedback summary	Response in this report
Project need	*Can we consider a decentralized system, rather than centralized?* In addition, since 2019 engagement: '*Go back to the drawing board'*	Section 2 of this report describes the need for this project in the context of North West Tasmania and the broader National Electricity Market.
Route selection process	*Requests for details regarding corridor identification and the results of how the criteria assessment was derived.*	This report provides information on the process used to undertake corridor and route selection. Section 5 and 6 describe how constraints, opportunities and prudent and feasible corridors and routes are mapped and identified. Section 7 describes how selection criteria informed identification of prudent and feasible routes within the corridors.
Route selection process	*Is there opportunity to reconsider and revisit the central corridor or are you only wanting or able to*	Alternative routes to the central corridor were examined in detail following community

Issue/concern directly relevant to route selection process	Feedback summary	Response in this report
	optimise the preferred route? Request to release the decision matrix.	feedback, in particular routes in the southern corridor through the Vale of Belvoir. Alternative routes and realignments that improved the 2019 proposed route were also investigated in detail and are presented in this report. Section 7.1 details the route selection criteria. Section 8 provides the decision matrix for the proposed route selection in 2019, including a comparison of identified route options for each route selection criterion. Section 10.2 considers alternatives to the 2019 proposed route. Sect 11 details the evaluation of route alternatives and Section 11.3 provides the decision matrix for evaluating the alternative routes against the 2019 proposed route.
	Many residents sought more information about a non-preferred route which passes through the Vale of Belvoir, and why this option was eliminated. Participants noted opportunities to use existing infrastructure corridors along the Vale of Belvoir route to avoid impacts to the Loongana Valley.	In response to this feedback, more detail was provided regarding the route selection process during workshop presentations and more detailed maps were provided in workshops and online. Also in response to this feedback, this route was considered in more detail. The detailed assessment is summarised in Section 10.2.2 and provided in detail in Appendix 4. The detailed assessment validates the previous 2019 analysis that routes through the Vale of Belvoir

Issue/concern directly relevant to route selection process	Feedback summary	Response in this report
		would have significant impacts on the protected values.
	Can the transmission lines go underground?	Situations where underground technologies can be used are explained in Section 10.2.1 along with the reasons why OHTLs is suited to this route.
Ecology	*The introduction of weeds, impact on native flora and fauna including devils, wombats, quolls, eagles*	Impacts on native flora and fauna and their habitat are a key consideration in route selection. Native flora and fauna and their habitat are included in route selection criteria (see Section 7.1). The potential for impacts on species and their habitat are evaluated in sections 8, 11.3 and Appendices 2, 4 (see Section 6) and 5. This aspect will be considered in more detail as part of the environmental impact assessment process.
Visual impact	*Views from nearby properties, Coast to Canyon, Taylors Flats, Leven Canyon lookout and Black Bluff*	TasNetworks is very conscious of landowner and community concerns about landscape and visual impact. Visibility of the route was a key consideration in the initial route selection and in review and refinement of the route (see Section 4.4). Viewshed analysis from Cruickshanks Lookout informed the design of alternative routes described and evaluated in this report (see Section 11.3). The evaluation of alternative routes against the 2019 proposed route considered visual amenity (see Section 11.3 and Appendix 4, Section 6).

Issue/concern directly relevant to route selection process	Feedback summary	Response in this report
		This aspect will be assessed in more detail as part of the environmental impact assessment process and further information regarding opportunities for engagement are available on TasNetworks' website: **talkwith.tasnetworks.com.au**
Landowner impacts	*Visual amenity, property prices, access, impacts during construction, sense of place, livelihoods, general wellbeing of the regional community*	The alternative routes considered in response to landowner and community feedback have taken into account these concerns by increasing separation of residences to the preferred route, avoiding small landholdings where practicable, realigning the route to reduce impacts on commercial plantations, limiting the extent of native vegetation clearing in riparian corridors and, where practicable, reducing views to the OHTL. Socioeconomic impacts will be considered in more detail as part of the environmental impact assessment process and as the community benefits sharing framework for the project is developed. See also the above response in this table to 'Visual Impact'.
Business and tourism	*Impact on local businesses including eco and other tourism ventures*	Tourist roads and sites were identified in the description of the existing socioeconomic environment (see Section 4.3) and considered in route selection where they are recognised in planning controls (zones and overlays) (see Section 7.1).

Issue/concern directly relevant to route selection process	Feedback summary	Response in this report
		This aspect will be considered in more detail as part of the environmental impact assessment process and as the community benefits sharing framework for the project is developed.
Safety and security	*Concerns regarding Electric and Magnetic Fields (EMF) and security concerns regarding unauthorized access along easements*	While numerous published studies have not found a causal link between EMF and disease, TasNetworks continues to monitor research (see Section 3). EMF is most effectively managed by separation. Route selection has sought to maximise separation to residences, where practicable, noting that the proposed easement provides required electrical safety clearances. These aspects will be considered in more detail as part of the environmental impact assessment process.

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Appendix 4 - Sheffield to Farrell corridor considerations

Background

Routes in the southern corridor were discounted due to their additional length and impact on conservation values. Notwithstanding, numerous requests were made by individuals, groups, organisations and community members to reconsider this option. In response, TasNetworks revisited routes through the Vale of Belvoir undertaking a more detailed assessment including overhead and underground options. The results of that assessment are presented in this section.

At the request of community members, the assessment also considered previous investigations undertaken in the late 1970s and 1980 by the Hydro-Electric Commission of Tasmania (HEC).

The Vale of Belvoir is south of Black Bluff, north of Cradle Mountain and west of Middlesex Plains. The vale comprises subalpine native grasslands and karst systems, wetlands and old-growth rainforests. Native grassland and sedgeland communities are threatened and support threatened species and their habitat. The area is protected by the Vale of Belvoir Conservation Area declared in 2000 and the conservation covenant (Vale of Belvoir Reserve) registered by the Tasmanian Land Conservancy in 2008. The Vale of Belvoir Reserve is protected in perpetuity by the covenant. The covenant does not extend over the existing 60-m-wide overhead transmission line easement protecting the Sheffield–Farrell 220 kV OHTL. The Tasmanian Land Conservancy actively manages the reserve undertaking scientific research, ecological burns and conservation programs aimed at protecting and enhancing its values.

Before constructing the Sheffield–Farrell 220 kV OHTL, the HEC undertook investigations that considered four routes from Sheffield to Farrell on the West Coast, including a route through the Loongana valley and another through the Vale of Belvoir. Figure A4-1 shows the routes investigated by the HEC. Ultimately the HEC sought and achieved approval of route option through the Vale of Belvoir, which the HEC noted was environmentally significant and being used as grazing land, and screened from public roads except near Iris River and the Black Bluff Range.

The Sheffield–Farrell 220 kV OHTL was built in 1984, with Belvoir Road, formerly Cradle Mountain Link Road, then constructed in 1985-6 and gazetted in 1989. The road links Cradle Mountain Road with the Murchison Highway enabling tourists to more easily access the West Coast. The road improved access to the Sheffield–Farrell 220 kV OHTL.

In 2000, the Tasmanian Government proclaimed the Vale of Belvoir a conservation area under the *National Parks and Wildlife Act 1970* (Tas), subsequently repealed and replaced by the *Nature Conservation Act 2002*

(Tas). The Tasmanian Land Conservancy registered a conservation covenant over part of the conservation area in 2010. The part protected by the conservation covenant is known as the Vale of Belvoir Reserve.

The Sheffield–Farrell 220 kV OHTL traverses the conservation area and reserve. The Vale of Belvoir Conservation Area is between towers 518T105 and 518T114. The Vale of Belvoir Reserve extends from tower 518T110 to tower 518T113. The values protected by the conservation area and reserve including threatened native vegetation communities and threatened flora and fauna species and their habitat exist on the Sheffield–Farrell 220 kV OHTL easement.

The geology and topography vary between sandstone ridges, active talus slopes, glacial deposits on the valley floors, weathered basalt terraces and an area of limestone on the east bank of Vale River.

Overhead transmission line route

The Sheffield–Farrell 220 kV OHTL is a critical link between the West Coast and the rest of the Tasmanian transmission system. It is fully loaded and cannot be taken out of service for extended periods or decommissioned and replaced in-situ by a new higher capacity OHTL. Consequently, any potential new routes in this corridor will be adjacent to the existing OHTL.

TasNetworks has investigated the development of double circuit 220 kV OHTLs adjacent and parallel to the existing Sheffield–Farrell 220 kV OHTL (Figure A4-2). The proposed OHTL would be 30 m offset from the existing OHTL (Figure A4-3). The existing 60-metre wide easement would be widened by 60 m to accommodate the proposed Staverton–Hampshire Hills double circuit 220 kV OHTL and provide for future network development.

Initially, only one double circuit 220 kV OHTL would be built, requiring widening the existing easement by 30 m. Development of this OHTL would require clearing tall vegetation, constructing or upgrading access tracks and constructing towers in the conservation area and reserve. A nominal 50 m by 50 m hardstand workspace is required to construct each transmission tower. Each workspace is disturbed by construction activities, including delivery of material and assembly.

The existing access track network is informal and inadequate in most sections, necessitating major upgrade to facilitate heavy vehicle, concrete truck and crane access. It has been assumed an access track will be 6 m wide to accommodate the formation and table drains. Access to most towers would utilise linear access tracks off the existing Lake Lea access road. However, one tower would need to be accessed from the VDL Track with a ford at the Vale River. Culverts would be required in numerous locations. The following assumptions have been made regarding the length of access tracks required to be constructed or upgraded:

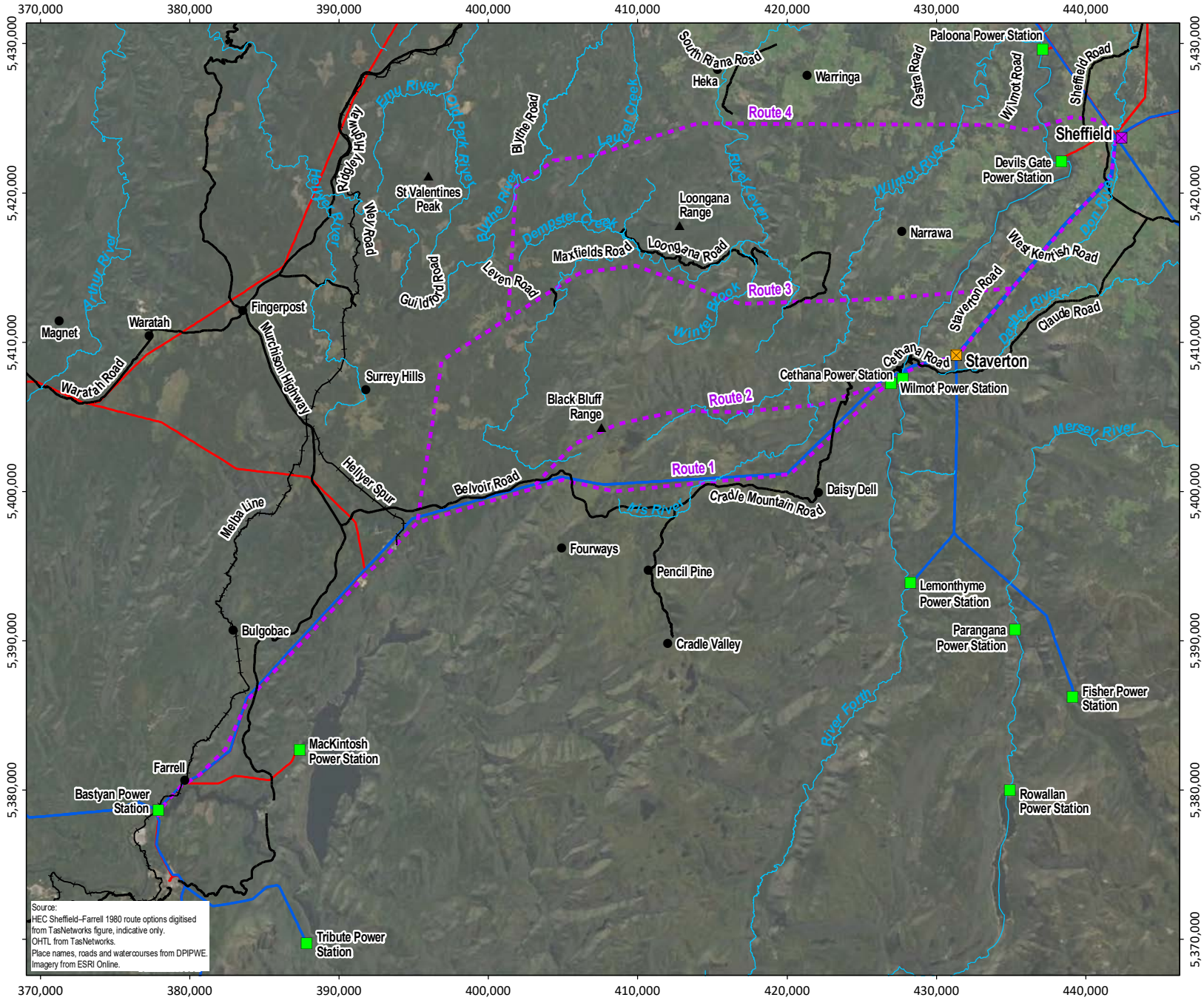
- length in conservation area is 2.3 km
- length in reserve is 2.8 km.

Table A4-1 presents key statistics for the proposed new double circuit 220 kV OHTL through the conservation area and reserve.

Table A4-1 Key statistics for overhead transmission line route through the Vale of Belvoir Conservation Area and Vale of Belvoir Reserve

Statistic	Vale of Belvoir Conservation Area	Vale of Belvoir Reserve (conservation covenant)
Double-circuit 220 kV OHTL length	2.5 km	1.9 km
Nominal 30-m-wide easement widening area	7.8 ha	5.5 ha
Number of towers	5	4
Area of disturbance towers	1.25 ha	1 ha
Access track length	2.3 km	2.8 km
Area of disturbance access tracks	1.4 ha	1.7 ha
Area of native vegetation in nominal easement in conservation area and reserve	12.9 ha	
Area of potential old growth forest in nominal easement in conservation area and reserve	3 ha	
Area of threatened native vegetation communities in nominal easement in conservation area and reserve	5.2 ha	

Figure A4-1
HEC Sheffield–Farrell 1980 route options



Legend

- Existing substation
- Proposed switching station
- Power station
- Major road
- Railway
- Major watercourse
- Existing 220 kV OHTL
- Existing 110 kV OHTL
- Route options

N

Scale: 1:375,000

7.5 3.75 0 7.5 km

Coordinate System: GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994

Date: 7/08/2020 11:59:49 AM
Prepared by: Helen Unkovich

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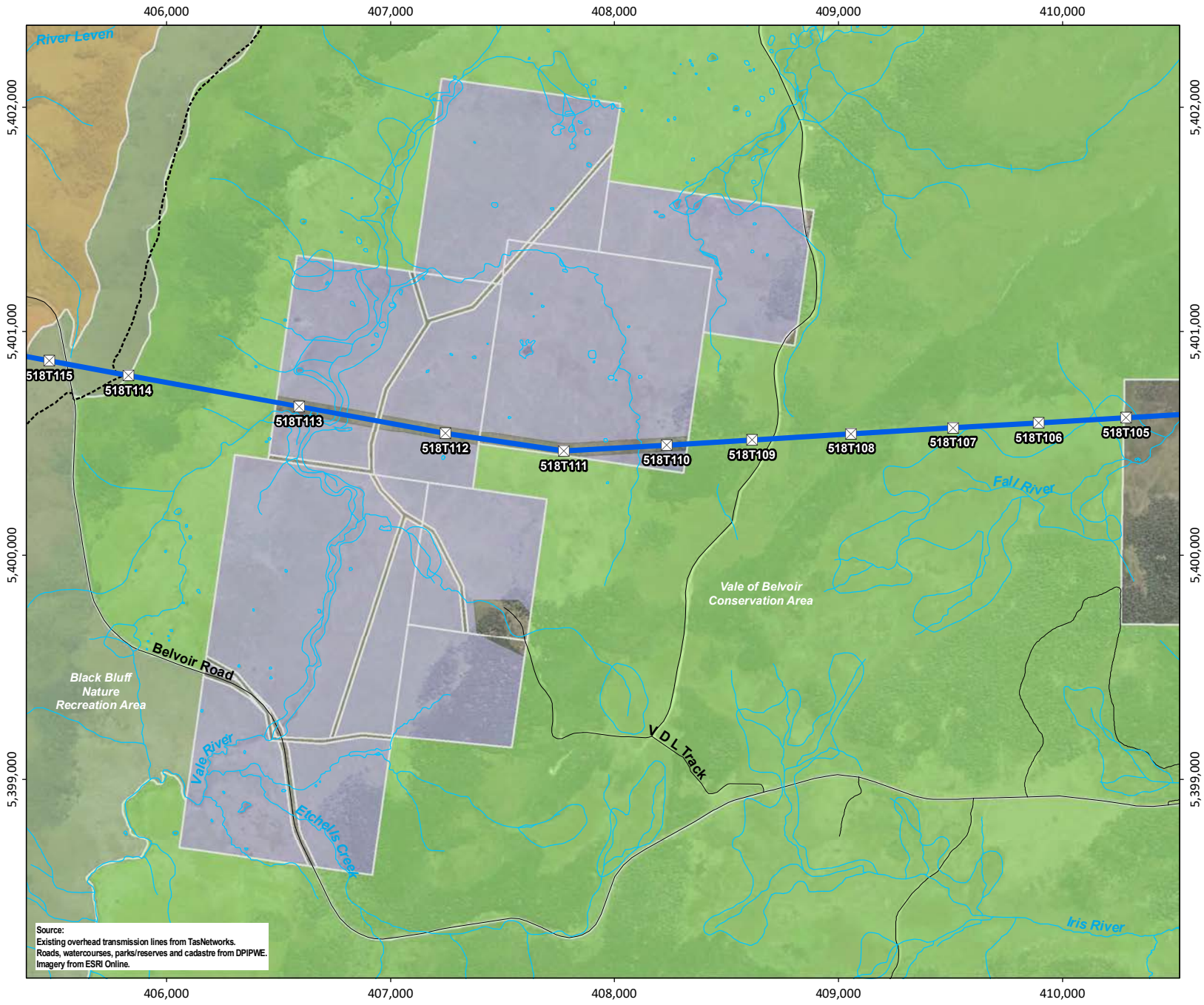
Figure A4-2
Vale of Belvoir
existing transmission line



Legend

- Transmission tower
- Existing 220 kV OHTL
- Watercourse
- Road
- Vehicular track
- Cadastre

Reserve class

- Conservation Area
- Conservation Covenant (NCA)
- Future Potential Production Forest
- Nature Recreation Area

N

Scale: 1:25,000

0.5 0.25 0 0.5 km

Coordinate System: GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994

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Prepared by: Xavier Allison

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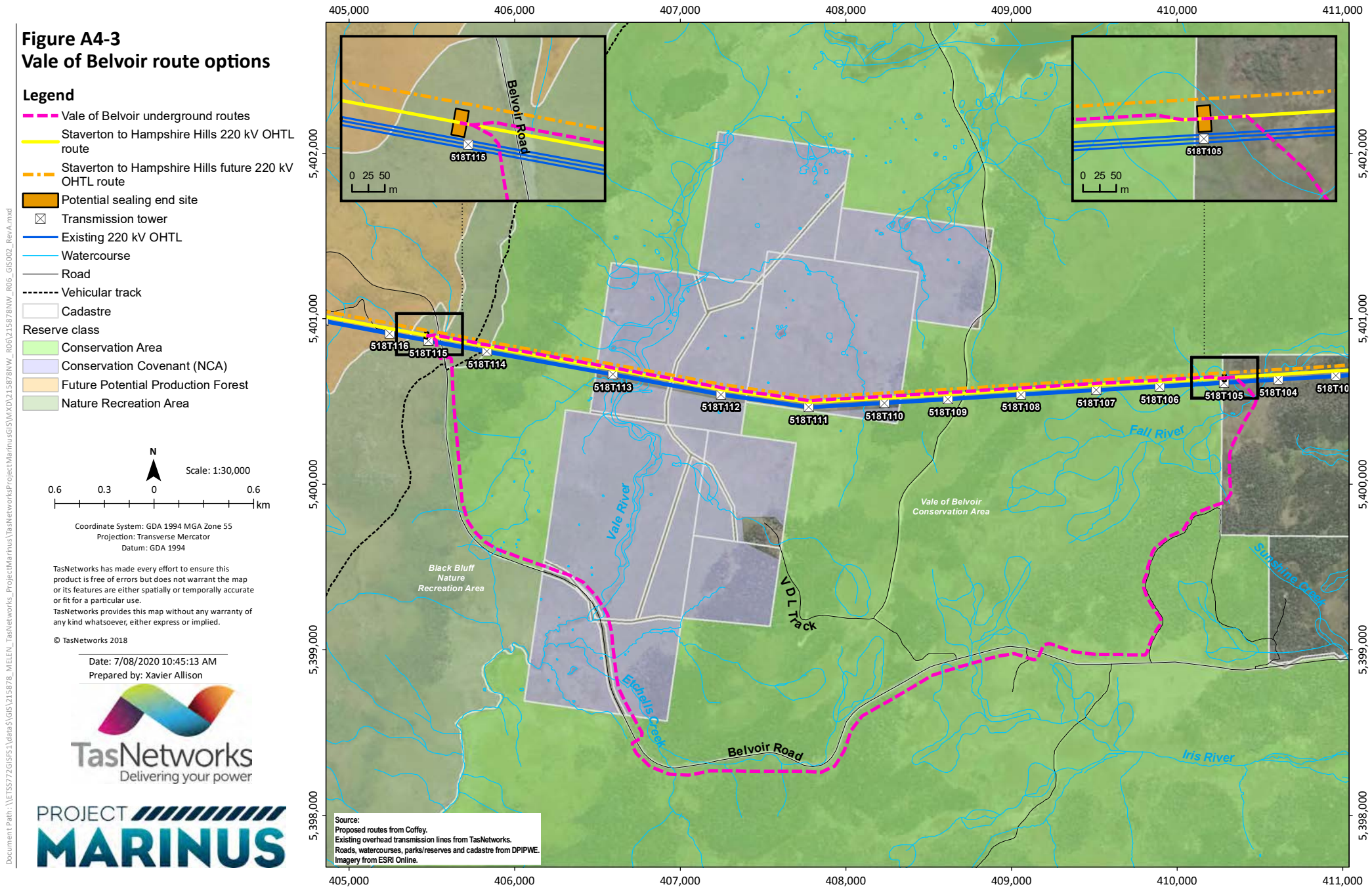
Figure A4-3
Vale of Belvoir route options



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Potential old-growth forest will be cleared in the proposed easement to provide the required electrical safety clearances. Native grasslands and sedgelands will be overflown except at tower sites. The extent of impacts on threatened native vegetation communities (native grasslands and sedgelands) will depend on the location of access tracks and towers.

Underground cable route

Undergrounding through the Vale of Belvoir would involve constructing overhead to underground sealing end installations adjacent tower 518T105 and tower 518T115, just outside the conservation area and reserve (see Figure A4-2). Tower 518T115 is within the Black Bluff Nature Recreation Area. Tower 518T114 is located on a prominent point on the Black Bluff Range, 150 m above the Vale of Belvoir. This point is referred to as the Belvoir Lookout and is accessible to tourists (Plate A4-1) and walkers on the Penguin to Cradle Walking Trail. It is assumed construction of the sealing end installation will require a 40 m by 20 m secure workspace, with new strain tower, earth mat, perimeter security fence and gates, ancillary supplies (power VT), protection and control. A typical sealing end installation is shown in Plate A4-2.

Source: Google Earth Pro (Street view) Image capture 2020 Picasa © 2020 R Bush

Plate A4-1 View from Belvoir Lookout (adjacent to tower 518T114) across Vale of Belvoir to Cradle Mountain and Barn Bluff

Source: TasNetworks

Plate A4-2 Example sealing end installation

A nominal 15-m to 20-m-wide easement is required to accommodate two 220 kV circuits, i.e., six extra high voltage (EHV) cables for each circuit (two cables per phase) that match the capability of a 220 kV OHTL utilising twin conductor bundles. A 20-m-wide easement was assumed for the purposes of the assessment. It is assumed access would be along the easement from intersecting roads.

Three options are available for laying underground cables through the Vale of Belvoir. They are:

- adjacent to Belvoir Road (Cradle Mountain Link Road) (indirect route),
- within the existing 60-m-wide OHTL easement (direct route), or
- adjacent the existing OHTL easement (direct route).

If the cable easement is within the existing 60-m-wide OHTL easement, the alignment and excavation activities must not disturb the existing TL518 tower foundations. The indirect route via Belvoir Road is more favourable due to difficulty excavating the steep slope off the Black Bluff Range, controlling backfill and erosion due to high rainfall and run-off. Belvoir Road provides a linear access road for construction vehicles.

As noted, the values protected by the conservation area and reserve exist on the existing easement and hence there is no benefit in constraining the route to the existing easement, except for reduced clearing of

potential old growth forest. Consequently, for ease of construction, an underground option within the existing easement was discounted, and two options for the underground cable route were considered:

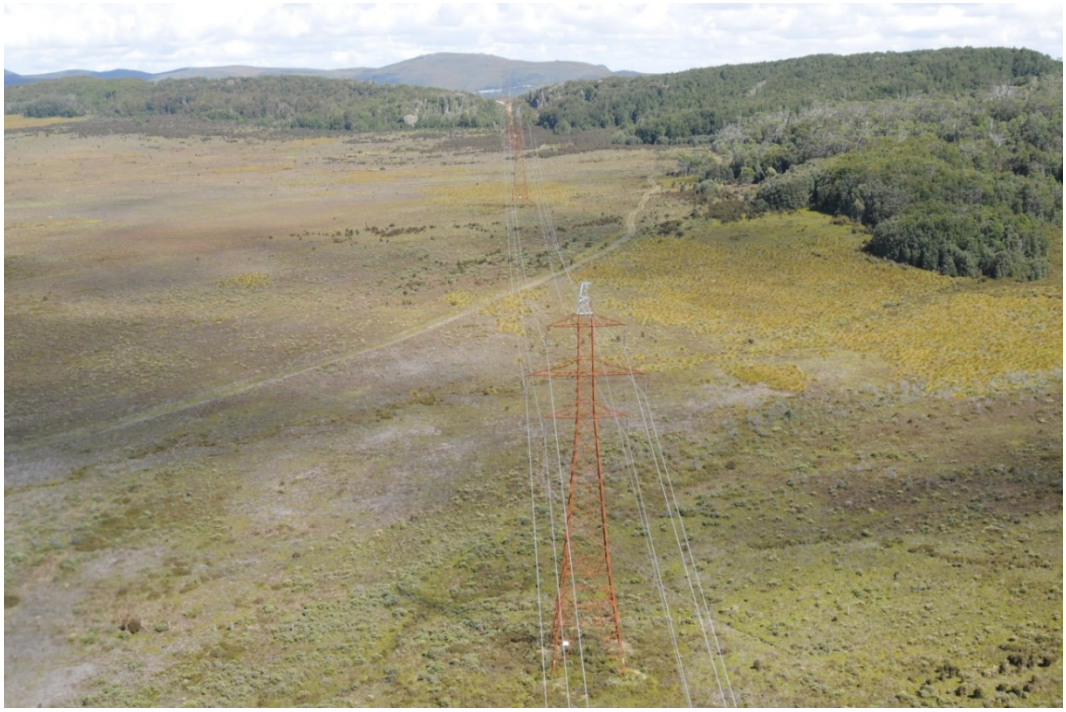
- an underground cable route adjacent to Belvoir Road (indirect route), and
- a route abutting the existing OHTL easement, i.e. worst-case direct route.

Direct route adjacent to existing easement

The direct route is parallel to and north of the Sheffield–Farrell 220 kV OHTL. The 20-m-wide underground cable easement abuts the 60-m-wide OHTL easement. The route is visible in a series of photographs of the Sheffield–Farrell 220 kV OHTL through the Vale of Belvoir (plates A4-3 to A4-8).

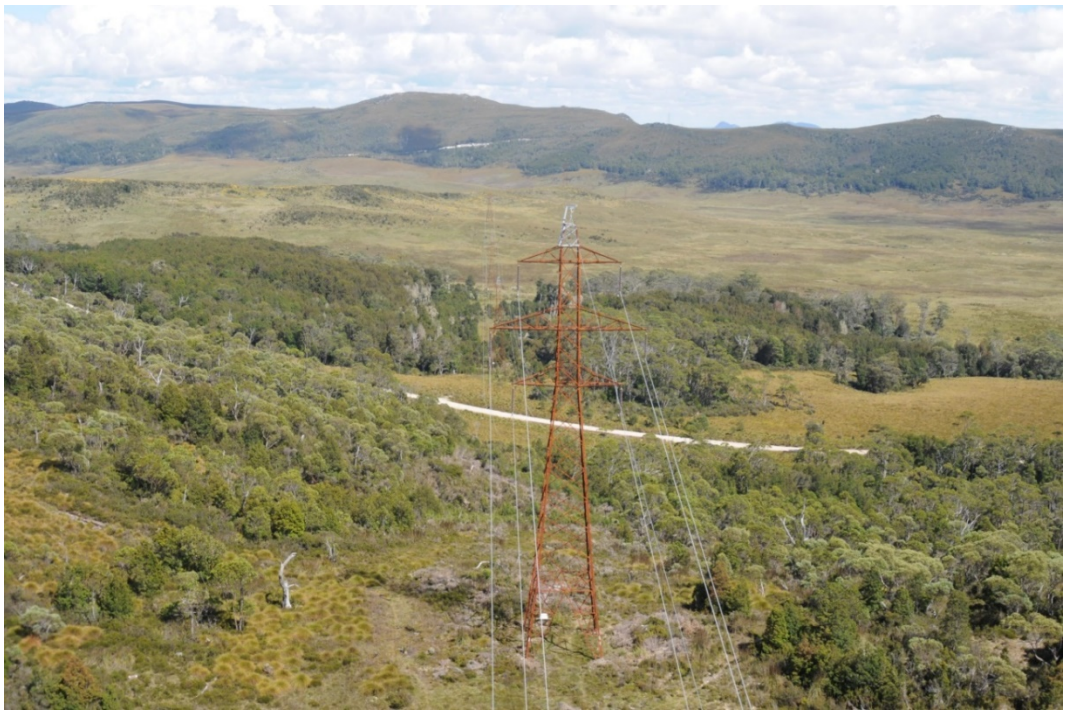
Construction of the underground section (tower 518T105 to tower 518T115) would require:

- Access to tower 518T105 to construct the overhead to underground sealing ends; access assumed along easement (and construction right of way).
- Access to tower 518T115 to construct overhead to underground sealing ends; access via a new access track from the crest of Belvoir Road.
- Sealing ends, with associated equipment and perimeter security fence.
- Clearing vegetation on nominal 20-m-wide easement/construction right of way.
- Excavating two trenches; each nominally 4 m wide and 1.5 m deep, with a linear construction access track adjacent the trenches for excavation and transport, involving topsoil, subsoil and backfill handling. Bedding sand, in addition to other bulk material and consumables, will need to be brought in from another location.
- Installation of six extra high voltage (EHV) cables within each trench at 0.5 m centres, together with two optical fibre underground cables, within conduits.
- Constructing joint pits at nominally 1.2 km intervals, with link boxes for cross-bonding of cable sheaths.
- Rehabilitating the construction right of way, material handling, cable and plant storage sites, together with spoil disposal.
- Maintaining permanent access to sealing end installations, link boxes and joint pits.



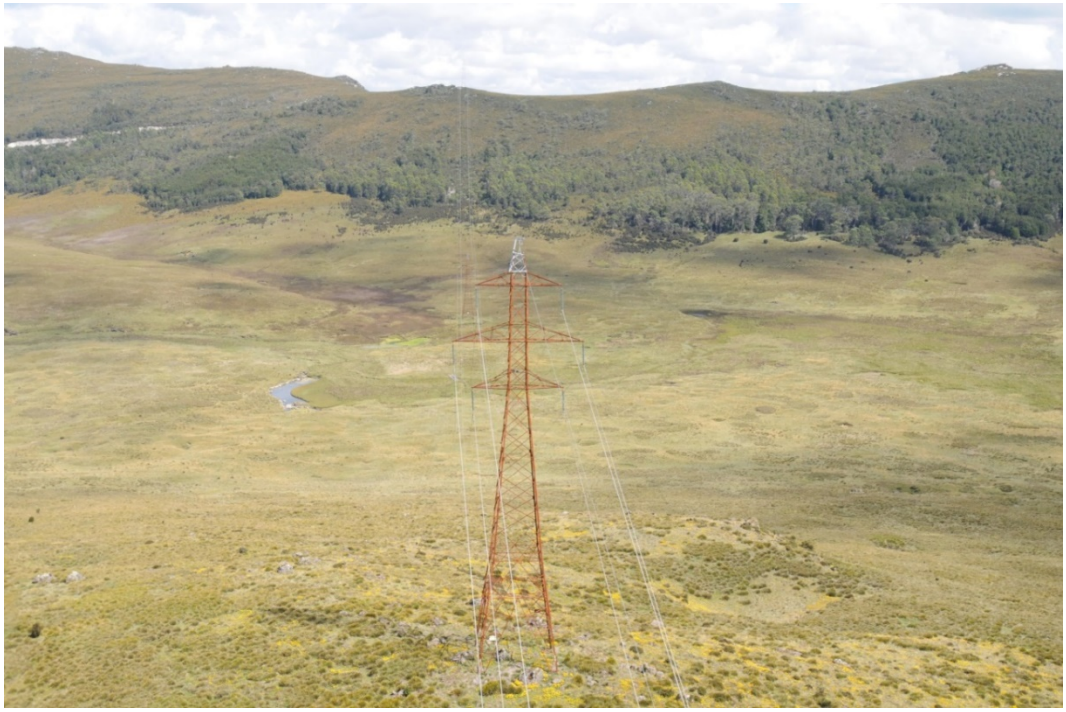
Source: TasNetworks

Plate A4-3 Looking west along Sheffield–Farrell 220 kV OHTL from tower 518T105; potential underground cable route to right of OHTL



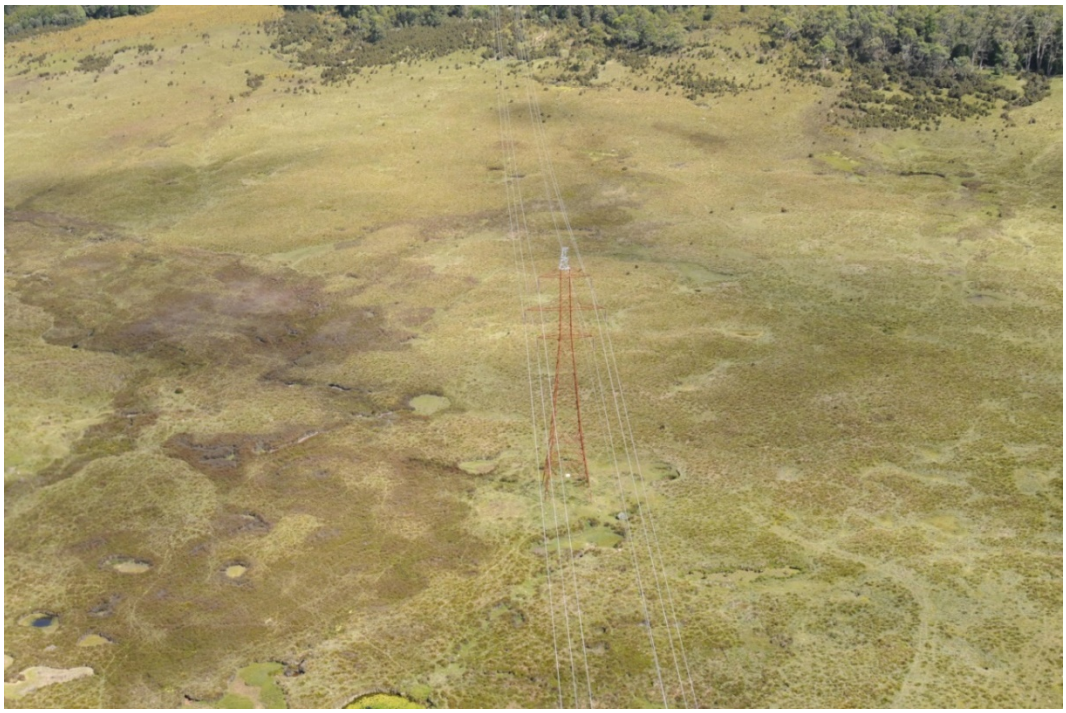
Source: TasNetworks

Plate A4-4 Looking west along Sheffield–Farrell 220 kV OHTL from tower 518T108; potential underground cable route to right of OHTL



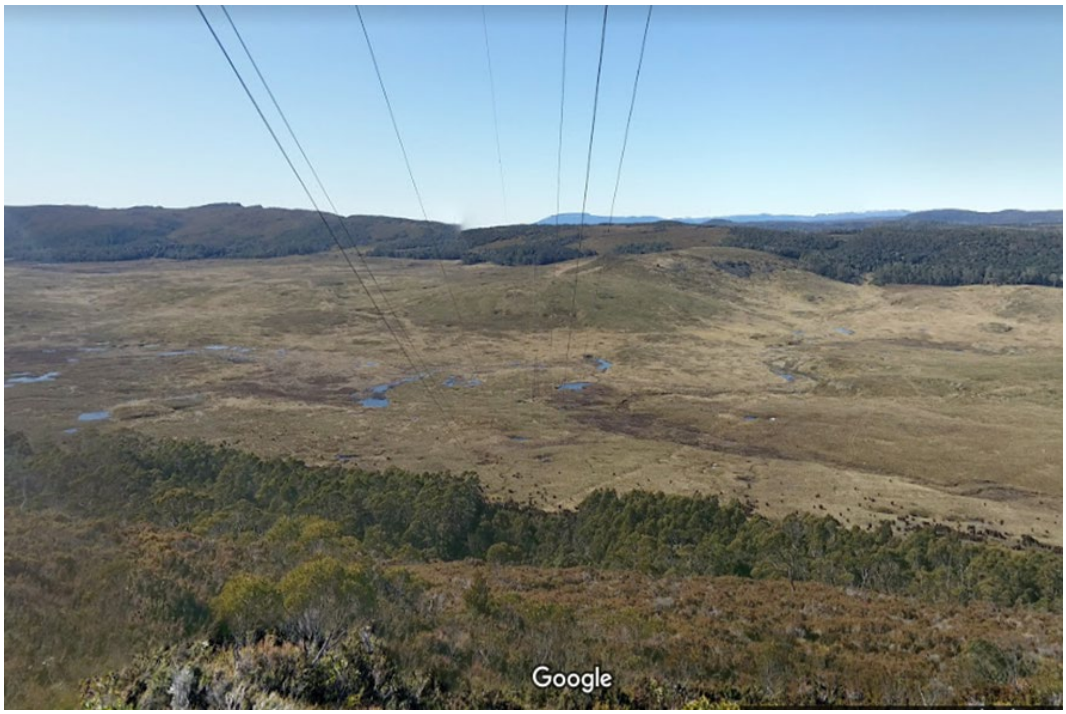
Source: TasNetworks

Plate A4-5 Looking west along Sheffield–Farrell 220 kV OHTL from tower 518T112 over Vale River; potential underground cable route to right of OHTL



Source: TasNetworks

Plate A4-6 Looking west along Sheffield–Farrell 220 kV OHTL from tower 518T113; Vale River in left of image; potential underground cable route to right of OHTL



Source: TasNetworks

Plate A4-7 Looking east along Sheffield–Farrell 220 kV OHTL from tower 518T114 over Vale of Belvoir; potential underground cable route to left of OHTL

Source: TasNetworks

Plate A4-8 Looking west along Sheffield–Farrell 220 kV OHTL from tower 518T114 to tower 518T115; potential sealing end compound would be right of tower on ridge

Indirect route via Belvoir Road

Belvoir Road is partly within a government road reserve (casement) and mostly in Crown land protected by nature recreation and conservation areas. It passes through the conservation area and part of the reserve. Belvoir Road is in the casement through the reserve. The casement is nominally 30 m wide.

The terrain along the road necessitates three crossings of Belvoir Road. The indirect underground cable route commences at the sealing ends adjacent to tower 518T105. The route runs southeast to the existing access track, which it joins and follows south-southwest to Belvoir Road. The route runs parallel and north of Belvoir Road for approximately 700 m before crossing the road to run parallel to and south of the road to avoid the steep side slope, as the road descends to the Vale of Belvoir.

A watercourse adjacent to the road forces the route further south in this section. At the base of the rise, west of the cattle grid, the route crosses back over Belvoir Road to run parallel to and north of the road across Vale River and its floodplain. At the toe of the Black Bluff Range, the route leaves Belvoir Road to join and follow the existing fence to the saddle between towers 518T114 and 518T115, as side slope adjacent to the road is severe and unsuitable for underground cable installation. The route crosses Belvoir Road to the proposed sealing ends compound adjacent to tower 518T115. Plates A4-9 to A4-14 show key features along the indirect underground cable route.

Installation of the underground cables on this route would involve similar activities to that described for the direct route. A linear access track is not required for this option as Belvoir Road provides construction and operation and maintenance access.

Source: Google Maps (Street view) Image capture February 2010 © 2020 Google

Plate A4-9 Looking west along Belvoir Road from access track to tower 518T105; underground cable route to right of road

Source: Google Maps (Street view) Image capture February 2010 © 2020 Google

Plate A4-10 Steep side slope in cutting as Belvoir Road descends to Vale of Belvoir; potential underground cable route to left of road, south of watercourse adjacent to road

Source: Google Maps (Street view) Image capture February 2010 © 2020 Google

Plate A4-11 Looking west along Belvoir Road through Vale of Belvoir to Black Bluff Range at point where potential route crosses to north of road (end of Armco railing); potential underground cable route to right of road

Source: Google Maps (Street view) Image capture February 2010 © 2020 Google

Plate A4-12 Looking west along Belvoir Road to Vale River crossing; potential underground cable route to right of road

Source: Google Maps (Street view) Image capture February 2010 © 2020 Google

Plate A4-13 Looking west along Belvoir Road as it climbs Black Bluff Range; potential underground cable route to right of road adjacent to fence to avoid steep side slope along road

Source: Google Maps (Street view) Image capture February 2010 © 2020 Google

Plate A4-14 Looking west along Belvoir Road to crest on Black Bluff Range; potential underground cable route to right of road crosses road to tower 518T115 in front of parked car to avoid side slopes

Table A4-2 presents key statistics for the potential direct underground cable route through the conservation area and reserve. Key statistics for the potential indirect underground cable route through the conservation area and reserve are provided in Table A4-3.

Table A4-2 Key statistics for the potential direct underground cable route through the Vale of Belvoir Conservation Area and Vale of Belvoir Reserve

Parameter	Vale of Belvoir Conservation Area	Vale of Belvoir Reserve (conservation covenant))
Underground cable length	2.6 km	1.9 km
Nominal 20-m-wide easement area	5.2 ha	3.7 ha
Number of sealing end installations	2	-
Area of disturbance sealing ends	0.2 ha	-
Access track length*	2.6 km	1.9 km
Area of disturbance access tracks*	-	-

Parameter	Vale of Belvoir Conservation Area	Vale of Belvoir Reserve (conservation covenant))
Area of native vegetation in nominal easement in conservation area and reserve		9.3 ha
Area of potential old growth forest in nominal easement in conservation area and reserve		1.9 ha
Area of threatened ecological communities in nominal easement in conservation area and reserve		3.4 ha

* Assumes access track within proposed easement/construction right of way

Table A4-3 Key statistics for the potential indirect underground cable route through the Vale of Belvoir Conservation Area and Vale of Belvoir Reserve

Parameter	Vale of Belvoir Conservation Area	Vale of Belvoir Reserve (conservation covenant)
Underground cable length	6.4 km	1.1 km
Nominal 20-m-wide easement area	12.8 ha	2.1 ha
Number of sealing end installations	2	-
Area of disturbance sealing ends	0.2 ha	-
Access track length	1.3 km	-
Area of disturbance access tracks*	<0.50 ha	-
Area of native vegetation in nominal easement in conservation area and reserve		16.4 ha
Area of potential old growth forest in nominal easement in conservation area and reserve		6.7 ha
Area of threatened ecological communities in nominal easement in conservation area and reserve		6.4 ha

* Assumes upgrade of existing access track to 518T105

Environmental impacts

The direct and indirect underground cable routes traverse the Vale of Belvoir Conservation Area and Vale of Belvoir Reserve. The properties cannot be avoided without introducing significant distance and substantially increasing environmental impacts.

Undergrounding the Staverton–Hampshire 220 kV circuits through the Vale of Belvoir Conservation Area and Vale of Belvoir Reserve will have significant impacts on the protected values, as the direct and indirect routes involve complete disturbance of threatened ecological communities and threatened species habitat. Subalpine native grasslands and sedgelands are particularly sensitive to disturbance. Excavating trenches through the sedgelands and wetlands could affect these systems' hydrology leading to desiccation of vegetation and consequential degradation or loss of habitat. The overhead to underground sealing end compounds will increase the visual impact of the existing OHTL in the landscape, particularly at tower 518T115, which is adjacent to Belvoir Lookout.

An OHTL will have less impact due to the ability to overfly sensitive vegetation and habitat. Impacts from constructing and upgrading access tracks would be potentially significant due to disturbance of sensitive subalpine native grasslands and sedgelands.

All options impact on state and federally listed threatened species and state-listed threatened ecological communities (Figure A4-4).

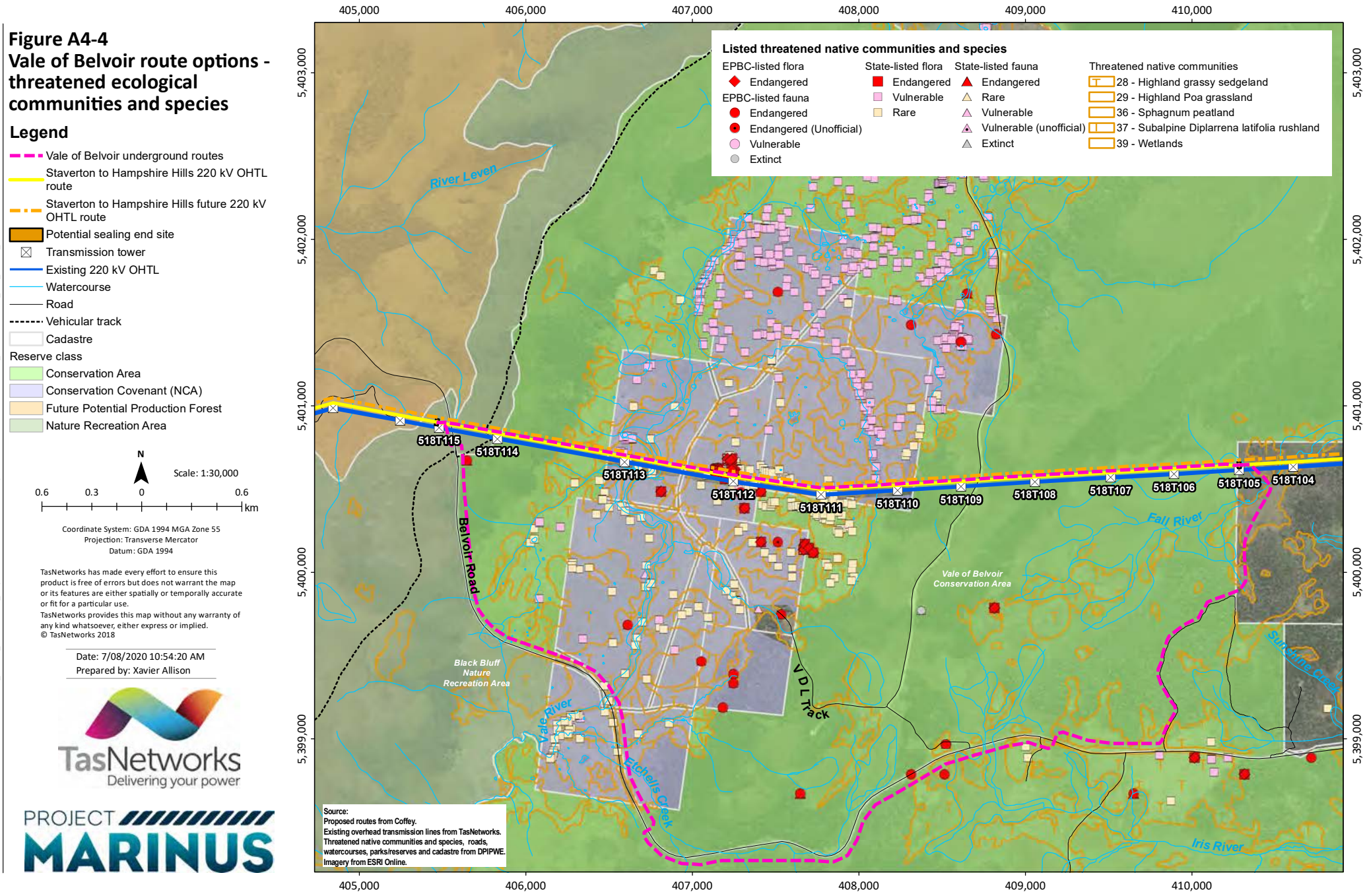
Transmission network implications

Transmission network planning considers geographical diversity, network topology, route diversity and economic prudence. These factors and their implications for routes in the southern corridor are discussed below.

Geographical diversity

Existing generation projects in North West Tasmania are connected to the Tasmanian transmission network by radial OHTLs including Sheffield–Burnie–Smithton 220/110 kV OHTLs and Sheffield–Farrell 220 kV OHTL. These OHTLs are constrained and not ideally located to facilitate connection of proposed and prospective renewable generation projects.

Figure A4-4
Vale of Belvoir route options - threatened ecological communities and species



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Network topology

TasNetworks is obligated under the National Electricity Rules to develop and maintain a safe and secure transmission network. The core design of the network needs to be sufficiently robust and resilient to enable connection of new generation projects and manage faults respectively. Development of the rectangle recommended in the North West Tasmania Strategic Transmission Plan (TasNetworks 2019) will overcome the issues posed the long radial OHTLs. The rectangle will create the backbone necessary to enable connection of Marinus Link and renewable generation projects in the North West Tasmania REZ.

Route diversity

As jurisdictional planner, TasNetworks is required to plan and design transmission augmentation and upgrades to meet reliability standards. One of the conditions is route diversity, such that a single asset failure will not result in a system black event. Consolidating transmission infrastructure in the Sheffield–Farrell corridor exposes the system to such events. The proposed Staverton–Hampshire Hills 220 kV OHTL provides the necessary geographic diversity.

Economic prudency

TasNetworks, as jurisdictional planner, is required by the National Electricity Rules to plan and develop the transmission network in a way that balances overall costs and benefits. Long connections between generators and users of power (load centres) increase construction costs, increase network losses and increase resistance in transmission circuits affecting power transfer capacity. A key objective of transmission network planning is to improve overall system stability and performance by addressing the above issues in a cost-effective manner.

Cost implications

Given the remote location, the environmental constraints and seasonal effects on construction timing, it is anticipated that the cost of undergrounding the high-capacity 220 kV double circuit within the Vale of Belvoir would be significantly more than an equivalent capacity OHTL.

The Mt Pearse west route is 93 km; up to 57% longer than the proposed route. Assuming a nominal $1.4 million per kilometre for a double circuit OHTL in a remote highland area, with rough terrain in parts, the additional cost is up to $48 million more than the proposed route.

Undergrounding in the Vale of Belvoir Conservation Area and Vale of Belvoir Reserve would incur additional costs. The direct underground route is estimated to add at least an additional $40 million, comprising:

- $6 million for both circuits' sealing ends, including new strain towers, together with associated ancillary protection and control equipment.
- $34 million for 4.9 km of underground cables (two circuits) assuming a direct route is utilised, with underground cable installation significantly more expensive than OHTL construction for the equivalent distance.

The indirect underground cables route would cost $74 million, increasing overall cost by $68 million. These costs are indicative and do not include level of accuracy, contingency amounts or any provision for cost escalation.

Conclusion

Compared to a more direct route between Staverton and Hampshire Hills, a longer OHTL will increase landscape and visual impacts, and will impact threatened native vegetation and listed threatened species and their habitat, primarily through construction and upgrade of access tracks to transmission towers. Adopting overhead routes through the Vale of Belvoir would increase the cost of the proposed Staverton–Hampshire Hills 220 kV OHTL by up to $48 million.

Underground cables through the Vale of Belvoir will significantly impact sensitive native grasslands and sedgelands which support listed threatened native vegetation communities and listed threatened species and their habitat. Sedgeland and wetland hydrology (drainage), including karst systems, could be affected by excavating trenches leading to impacts on these ecosystems. Potential old-growth forests could be cleared for construction of the OHTL and laying of underground cables, causing loss of habitat. Undergrounding the Vale of Belvoir is estimated to increase costs by at least a further $40 million for the direct route, and at least a further $68 million for the indirect route.

Constructing transmission circuits through the Vale of Belvoir to achieve transmission capacity between Staverton and Hampshire Hills has been previously discounted due to:

- Impacts on Vale of Belvoir Conservation Area (threatened ecological communities and threatened species and their habitat).
- Impacts on Vale of Belvoir Reserve (threatened ecological communities and threatened species and their habitat).
- Additional cost (between $48 million and $115 million depending on technology option and route through the Vale of Belvoir).

In addition to impacts on the Vale of Belvoir conservation area and reserve, the routes in the southern corridor impact threatened ecological communities and species and their habitat in:

- Iris Farm Private Nature Reserve (and conservation covenant). This reserve was declared in 2003 and conservation covenant registered in 2003. The reserve protects subalpine vegetation communities including highland *Poa* grasslands and wet eucalypt forests and woodlands, endangered grassland paperdaisy (*Leucochrysum albicans*) and listed threatened fauna species including Tasmanian devils and quolls.
- Daisy Dell Reserve. This property was acquired by the Tasmanian Land Conservancy in 2017 and registered as a conservation covenant in 2020. The reserve protects subalpine grasslands, sedgelands, eucalypt forests, woodlands and rainforest. These native vegetation communities provide habitat for the endangered grassland paperdaisy (*Leucochrysum albicans*), rare mountain purplepea (*Hovea montana*), rare spotted-tailed quoll (*Dasyurus maculatus*), endangered Tasmanian devil (*Sarcophilus harrisii*) and endangered wedge-tailed eagle (*Aquila audax subsp. fleayi)*. Suitable habitat for the endangered eastern quoll (*Dasyurus viverrinus*) exists within the reserve.
- Romney Marsh conservation covenant was declared in 2010. The covenant protects threatened subalpine vegetation communities including highland *Poa* grasslands, subalpine *Diplarrena latifolia* rushland, highland grassy sedgeland, sphagnum peatland and *Eucalyptus brookeriana* wet forest. The marsh provides habitat for the endangered ptunarra brown butterfly and endangered Tasmanian devil (*Sarcophilus harrisii*) and endangered crowded leek-orchid (*Prasophyllum crebriflorum*)
- Hatfield Plain conservation covenant was declared in 2010. The covenant protects threatened subalpine highland *Poa* grasslands which provide habitat for the endangered ptunarra brown butterfly.

This assessment confirms the results of the evaluation of prudent and feasible routes that routes in the southern corridor through the Vale of Belvoir are highly constrained, significantly more costly and would impact on conservation values protected in other private nature reserves and conservation covenants.

Notwithstanding the outcome of this assessment, TasNetworks consulted the Tasmanian Land Conservancy on its views of a route through the Vale of Belvoir. The organisation expressed considerable concern about a route through the Vale of Belvoir noting their considerable efforts in protecting the Vale of Belvoir's threatened ecological communities and species since declaration of the conservation area in 2000 and registration of the conservation covenant in 2008.

Appendix 5 - Key Statistics – 2019 proposed route and alternatives

Key statistics for the identified prudent and feasible routes derived by intersecting the route options with layers in the project GIS are set out in Table A5-1.

Table A5-1 Key statistics for 2019 proposed route and alternative routes

	Eastern Section			Central Section		Western Section	
	2019 Proposed Route	North of Bell Mount	South of Bell Mount	2019 Proposed Route	Alternative	2019 Proposed Route	Alternative
Length (km)	15.5	15.8	16.9	12.1	11.9	13.6	15.4
Number of roads and access tracks intersected	28	22	21	14	5	14	14
Land tenure							
Number of freehold parcels intersected	11	9	4	15	6	2	2
Number of Crown land parcels intersected	5	8	13	2	4	0	0
Number of reserve parcels intersected	10	9	5	7	6	10	9
Length in conservation covenants registered under *Nature Conservation Act 2002* (Tas) (km)	0.4	0	0	0	0	0	0
Length in conservation areas declared under *Nature Conservation Act 2002* (Tas) (km)	0	0	0	0	0	0	0

	Eastern Section			Central Section		Western Section	
	2019 Proposed Route	North of Bell Mount	South of Bell Mount	2019 Proposed Route	Alternative	2019 Proposed Route	Alternative
Length in private nature reserves (km)	0	0	0	0	0	0	0
Length in regional reserves (km)	0.5	0.5	0.8	0	0	0	0
Length in nature recreation area (km)	0	0	0	0	0	0	0
Length in Informal reserves on permanent timber production zone land (km)	0.7	1.1	0.3	0.6	1.7	0	0
Length in future potential production forest (km)	0	0.3	3.8	0	0	0	0
Length in other private reserves and management agreements (km)	0.5	0.2	0	0.3	0.2	1.7	1.7
Occupation							
Number of buildings within 300 m	1	3	1	10	0	0	0
Land use							
Length in cropping land (km)	0	0	0	0	0	0	0
Length in grazing land (km)	0	0	0	0	0	0	0
Length in hardwood and softwood plantations (km)	8.1	7.6	1.7	8.1	3.6	11.6	13.2

	Eastern Section			Central Section		Western Section	
	2019 Proposed Route	North of Bell Mount	South of Bell Mount	2019 Proposed Route	Alternative	2019 Proposed Route	Alternative
Length in production native forest and plantation forest (km)	5.0	5.7	8.8	2.1	6.5	0.4	0.8
Length in residual native vegetation (km)	0.6	0.5	1.6	0.7	0	0	0
Length in conservation area (km)	1.1	1.4	3.9	0.8	1.8	1.7	1.4
Length in other land uses (km)	0.7	0.7	1.0	0.4	0	0	0
Planning*							
Length in 26.0 Rural Resource zone (km)	11.7	11.9	10.8	12.1	11.9	13.6	15.4
Length in 28.0 Utilities zone (km)	0	0	0	0	0	0	0
Length in 29.0 Environmental Management zone (km)	3.9	3.9	6.1	0	0	0	0
Length in Landslip Hazard overlay (km)	4.6	5.3	8.3	1.5	4.9	0.1	0.2
Native vegetation (TASVEG)							
Length in agricultural, urban and exotic vegetation (km)	9.9	8.6	1.7	8.9	3.9	12.1	13.7
Length in native grassland (km)	0.3	0.1	0	0	0.1	0.1	0.1

	Eastern Section			Central Section		Western Section	
	2019 Proposed Route	North of Bell Mount	South of Bell Mount	2019 Proposed Route	Alternative	2019 Proposed Route	Alternative
Length in native forest and woodland (km)	5.1	6.8	13.4	2.5	1.7	0.8	0.7
Length in scrub, heathland, highland and coastal complexes (km)	0	0	0.4	0	0.1	0	0.3
Length in other natural environments (km)	0.1	0.1	0.1	0	0	0	0
Threatened ecological communities							
Length in threatened ecological communities (km)	0	0	0.1	0	0	0.2	0
Threatened species							
Number of EPBC-listed flora species within 500 m	1	1	1	0	0	4	0
Number of EPBC-listed fauna species within 500 m	5	4	3	0	0	1	0
Number of NC Act-listed flora species within 500 m	1	1	1	0	0	4	0
Number of NC Act -listed fauna species within 500 m	5	4	3	0	0	1	0
Number of raptor nests within 500 m[†]	2	2	0	1	0	0	0
Cultural heritage							

	Eastern Section			Central Section		Western Section	
	2019 Proposed Route	North of Bell Mount	South of Bell Mount	2019 Proposed Route	Alternative	2019 Proposed Route	Alternative
Historic cultural heritage sites within 500 m‡	0	0	0	0	0	0	0
Aboriginal cultural heritage site within 500 m§	1	1	0	6	1	6	41

* Only zones and overlays intersected by the route options are listed in this table.

† TasNetworks conducted aerial surveys for eagle nests in the middle corridor in June 2019 and May 2020 to verify Natural Values Atlas records. Eagle nest records for the northern and southern corridors are from the Natural Values Atlas.

‡ Registered historic cultural heritage sites protected by planning scheme overlays.

§ Preliminary tower spotting for the preferred route has avoided the scattered artefact cluster adjacent to Old Park River, which is the high number of sites on the Rabbit Plain realignment.

Appendix 6 - Evaluation of alternative routes against the 2019 route

Table A6-1 Eastern section - Evaluation of alternative routes against 2019 proposed route between Cethana and River Leven

	North of Bell Mount route		South of Bell Mount route	
Criterion	**Qualitative assessment compared to 2019 proposed route**	**Justification**	**Qualitative assessment**	**Justification**
Construction cost	No change	This route has 38 towers; same as proposed route. Watercourse crossings are the same except for Winter Brook. The route overflies alluvial deposits at Jean Brook. It has shorter spans across Winter Brook. The route benefits from good access with spur tracks required. No material change over proposed route.	Moderate detriment	This route is challenging in some areas, particularly the River Forth and Wilmot River crossings. Towers on the Mt Jacob cirque will be difficult to construct if not on ridgeline. Geology and slope indicate costly foundations. No significant constraints noted west of Mt Jacob. Up to four additional towers required. Additional tracks west of Winter Brook. Longer route costing an additional $2 million to $3 million.
Operation and maintenance cost	No change	Operation and maintenance costs similar for proposed route.	Moderate detriment	Operation and maintenance costs will be higher due to access track maintenance and vegetation management.

Criterion	North of Bell Mount route		South of Bell Mount route	
	Qualitative assessment compared to 2019 proposed route	Justification	Qualitative assessment	Justification
Native vegetation	Small detriment	Route intersects more native vegetation and potential threatened species habitat than proposed route.	Moderate detriment	Route intersects more native vegetation and potential threatened species habitat than proposed route.
Listed threatened ecological communities and species	No change	Available desktop information does not identify a material difference between the routes.	No change	Available desktop information does not identify a material difference between the routes.
Listed threatened species – wedge-tailed eagle nests within 1 km	No change	Route is within 500 m of one wedge-tailed eagle nest and within 1,000 m of another wedge-tailed eagle nest.	Small improvement	Route is within 1,000 m of two wedge-tailed eagle nests.
Declared reserves	No change	The proposed and alternative routes traverse Mt Roland Regional Reserve.	Small detriment	The proposed and alternative routes traverse Mt Roland Regional Reserve. This route traverses Future Potential Production Forest.
Informal and other private reserves	No change	The proposed and alternative routes cross numerous private reserves managed by forestry companies and several informal reserves on permanent timber production land.	No change	The proposed and alternative routes cross numerous private reserves managed by forestry companies and several informal reserves on permanent timber production land.

Criterion	North of Bell Mount route		South of Bell Mount route	
	Qualitative assessment compared to 2019 proposed route	Justification	Qualitative assessment	Justification
Landholdings (small private properties)	Moderate improvement	The route avoids a small landholding and increases separation to another small landholding.	Moderate improvement	The route avoids a small landholding and increases separation to another small landholding.
Landholdings (commercial properties)	No change	The route does not materially increase the impact on commercial properties, as it moves within those properties.	Large improvement	The route has moved from current production forest into future potential production forest. Reduces impacts on current forestry operations subject to the Regional Forest Agreement not constraining routes through this tenure.
Cultural heritage	No change	Desktop studies did not identify a material difference between the proposed route and this alternative route. The full extent of Aboriginal cultural heritage will only be understood following field surveys.	No change	Desktop studies did not identify a material difference between the proposed route and this alternative route. The full extent of Aboriginal cultural heritage will only be understood following field surveys.
Visual amenity	No change	This route does not provide any real improvement for neighbouring properties in the Erriba area. The route reduces the visual impact from Cruickshanks Lookout at Leven Canyon. Located further south in Smiths Plains, the route is closer to the Winter Brook Falls access road and walk. While current visitation is low compared to Leven Canyon, TasNetworks was	Small improvement	The route significantly increases separation to neighbouring properties in the Erriba area but introduces the OHTL into views from properties around Lake Gairdner. The route reduces the visual impact from Cruickshanks Lookout at Leven Canyon. Located further south in Smiths Plains, the route is closer to the Winter Brook Falls access road and walk. While

Criterion	North of Bell Mount route		South of Bell Mount route	
	Qualitative assessment compared to 2019 proposed route	Justification	Qualitative assessment	Justification
		advised of plans to develop facilities and upgrade the walk.		current visitation is low compared to Leven Canyon, TasNetworks was advised by community members of plans to develop facilities and upgrade the walk.
Network security	No change	The route is in more native vegetation exposing the OHTL to increased bushfire and hazard tree risks.	Small detriment	This route is exposed to more native vegetation with bushfire and hazard tree risks and higher elevations potentially exposing the route to icing. The route is exposed to steep side slopes and unfavourable geology on the Mt Jacob cirque.
Constructability	No change	Longer access tracks will be required for this route potentially impacting travel times and construction timeframes.	Small detriment	This route is geotechnically challenging on the Mt Jacob cirque. Micro-siting of towers on the cirque to address local constraints may reduce geotechnical risks and the routes exposure to landslips.

Table A6-2 Central section - Evaluation of alternative route against 2019 proposed route between River Leven and Blythe Road

Criterion	Qualitative assessment	Justification
Construction cost	Small detriment	Additional towers required. Higher proportion of strain towers than proposed route. Additional access track length.
Operation and maintenance cost	Small detriment	Higher cost due to tall trees and longer access tracks. More variation in relief.
Native vegetation	Moderate detriment	Alternative route is largely in native vegetation increasing exposure to habitat and threatened species.
Listed threatened ecological communities and species	Not assessed	Species records are sparse and provide no real indication of potential for encountering listed species. Similarly, listed native vegetation community location and extent may vary once vegetation mapping is confirmed.
Listed threatened species – wedge-tailed eagle nests within 1 km	Moderate improvement	A remnant wedge-tailed eagle nest is located less than 200 m from the proposed route. No wedge-tailed eagle nests were identified along the alternative route. The remnant eagle's nest is over 1,600 m from the alternative route.
Declared reserves	Small improvement	The alternative route avoids the conservation covenant on the Loongana property.
Informal and other private reserves	No change	The route crosses numerous forestry company managed private reserves and several informal reserves on permanent timber production land.
Landholdings (small private properties)	Large improvement	The alternative route avoids all but one small private property.
Landholdings (commercial properties)	No change	The alternative route does not change the overall impact on commercial properties; only the length of route in different landownership.
Cultural heritage	No change	The Loongana area is not well surveyed, as reflected by the small number of registered Aboriginal cultural heritage sites on both the proposed and alternative routes.

Criterion	Qualitative assessment	Justification
Visual amenity	Small improvement	The alternative route will still be visible but more remote from all but one small private landholding. Views to Loongana Range from Maxfields Road will still be affected. Located higher on the Loongana Range the route will be visible from Black Bluff. The alternative route removes the OHTL from residents' views to Black Bluff and the River Leven. Moving the route to Crane Road and the Dempster Creek valley results in a small improvement.
Network security	Small detriment	The route is exposed to more native vegetation with bushfire and hazard tree risks.
Constructability	Small detriment	The alternative route is in managed plantation land and native vegetation. More difficult terrain in native vegetation sections, requiring longer access tracks and vegetation management including removal of hazard trees.

Table A6-3 Western section - Evaluation of alternative route against 2019 proposed route between Blythe Road and Wey River

Criterion	Qualitative assessment	Justification
Construction cost	Small detriment	The alternative route has two additional towers, with cost potentially partially or wholly offset by reduction in compensation. Reduces impacts on plantation coupes and forestry operations.
Operation and maintenance cost	No change	Similar length of access tracks with less variation in relief.
Native vegetation	No change	Similar length in native vegetation, which is mostly in riparian corridors.
Listed threatened ecological communities and species	Not assessed	Species records are sparse and provide no real indication of potential for encountering listed species. Similarly, listed native vegetation community location and extent may vary once vegetation mapping is confirmed.
Listed threatened species – wedge-tailed eagle nests within 1 km	No change	No wedge-tailed eagle nests were identified in the Surrey Hills area.

Criterion	Qualitative assessment	Justification
Declared reserves	No change	No declared reserves are traversed by the route.
Informal and other private reserves	No change	The route crosses numerous forestry company managed private reserves associated with watercourses in the Surrey Hills area.
Landholdings (small private properties)	No change	No small private properties are crossed in this section.
Landholdings (commercial properties)	Moderate improvement	Alternative route reduces impacts on plantation coupes and forestry operations, as it avoids prime plantation land.
Cultural heritage	Small detriment	A large cluster of artefact scatters has been found adjacent to Old Park River on terraces and small rises. The isolated artefacts and scatters are avoidable.
Visual amenity	No change	The alternative route is still within plantations not accessible by the public. The proposed and alternative routes will be visible from St Valentines Peak.
Network security	No change	The proposed and alternative routes provide opportunities for third-party connections at the future Hampshire Hills switching station site and potentially elsewhere along the route.
Constructability	No change	The alternative route is in managed plantation land with good access.