5. DESCRIPTION OF THE PROJECT

5.1 THE PROPOSAL – PUKE KAPO HAU

In order to maximise the efficient use of the wind resource at Puke Kapo Hau, and to provide greater flexibility in the turbines available to be installed due to advances in turbine technology, TWP is seeking to vary the conditions of LUC RM 1409 to increase the blade tip height limit for the turbines from the current maximum of 145 m (condition 17) to 165 m.

TWP is also proposing to reduce the maximum number of turbines within the wind farm from 100 (as per condition 12) to 56 (i.e. 12 existing plus 44 proposed). It is proposed that the 44 additional turbines be constructed within 54 potential locations within the project site.

Although the maximum number of consented turbines will be reduced considerably, due to advances in efficiency of wind turbines since Stage 1 of Puke Kapo Hau was consented, the installed maximum generation capacity will increase from 200MW to 226MW.

In addition to the variation to the existing land use consent, TWP is also seeking to construct a new 110 kV transmission line (and associated infrastructure including a substation and access tracks) to connect to the National Grid, a BESS, and a new O&M Facility for the wind farm.

5.2 DRIVERS FOR ELECTRICITY

5.2.1 Electricity Supply and Demand

Electricity generation in New Zealand includes a mix of hydro, thermal, geothermal, wind, solar and biogas electricity generation.

The North Island has a diverse range of generation sources, with a cluster of gas generation plants in the Taranaki Region; hydro generation concentrated in the Waikato, Bay of Plenty, Poverty Bay and Taranaki Regions; and geothermal plants within the Taupo Volcanic Zone. In addition, wind generation has been increasingly developed in the Manawatu, Wellington, Waikato and South Taranaki Regions over the past decade.

Most of the generation capacity and output for the Southland and Otago region is provided by a small number of large hydro-electric power schemes – Manapouri, Clyde and Roxburgh. The remaining output is provided by smaller scale hydro-electric power schemes, wind generation and to a lesser extent, solar. Aside from an upgrade to the Roxburgh Hydro-Electric Power Scheme, most of the new generation capacity is from the construction of wind farms.

New Zealand's installed generation capacity in 2024 was 11,025 MW, which generated 43,872 GWh of electricity.[15] Approximately 8.9% of this electricity generation came from wind farms. Stage 2 of Puke Kapo Hau would increase New Zealand's installed wind generation capacity by approximately 15% and increase the annual wind generation output by approximately 14%.

Stage 2 of Puke Kapo Hau will deliver a material contribution to new renewable generation of the required 1 TWh per year increase in renewable generation output recommended by the Climate Change Commission.[16] The increase in generation is required to achieve the Government's objective, as set out in the second Emissions Reduction Plan, for the decarbonisation of the economy through electrification of light vehicle transport and industrial process heat.[17]

With an additional 190 MW of capacity and an expected annual output of 549 GWh, Stage 2 would meet nearly 55% of one year's recommended renewable generation increment. This represents a significant contribution toward the national renewable capacity targets set to support emissions reduction.

Regionally, TWP understands Southland and Otago currently have approximately 154 MW of installed wind capacity, generating about 340 GWh per year.[18] Stage 2 of Puke Kapo Hau would increase this installed capacity by 120% and the expected generation output by 160%.

5.2.2 Future Supply Considerations

The reliance on hydro sources for electricity generation makes New Zealand vulnerable to sharp increases in wholesale prices in dry years when low hydro storage levels in the autumn and winter coincide with peak electricity demand. Dry year events that have affected wholesale prices occurred in 2001, 2003, 2006, 2008 and most recently 2024. As such, providing additional electricity generation capacity from wind technology will improve

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15 MBIE Electricity data tables: Annual GWh, Electricity Balance and Plant type (MW Downloaded from https://www.mbie.govt.nz/assets/Data-Files/Energy/nz-energy-quarterly-and-energy-in-nz/electricity-june-2025-q2.xlsx on 15 September 2025.

16 https://www.climatecommission.govt.nz/assets/Advice-to-govt-docs/ERP2/final-erp2/Executive-Summary-2023-Advice-to-inform-the-strategic-direction-of-the-Governments-second-emissions-reduction-plan.pdf

17 https://environment.govt.nz/publications/new-zealands-second-emissions-reduction-plan/

18 Transpower 'Transmission Planning Report 2023, Table 19-2: Existing and committed generation capacity at Otago-Southland grid injection points', page 358. Company websites, 'Generation trends, Date range: 01 Jan 2020 - 31 Dec 2024, Region type: Node, Timescale: Day' downloaded from www.emi.ea.govt.nz on 13 March 2025.

the diversity of the national electricity generation capacity and strengthen resilience against dry year events.

The direction from the Climate Change Response (Zero Carbon) Amendment Act 2019, and the Climate Change Commission, has sharply increased the need for additional renewable electricity generation in New Zealand. This is reflected in the Government's Emissions Reduction Plan, the first of which was issued in 2022, and sets a path toward meeting the long-term emissions reduction targets - including reaching net-zero emissions by 2050.

In December 2024 the Government released New Zealand's second Emissions Reduction Plan for the period from 2026 to 2030. This identifies a number of key policies that have the greatest potential to lower emissions to meet the 2026 - 2030 targets, including "Electrify NZ" which seeks to double renewable energy generation. The Electrify NZ Plan includes a series of reforms aimed at increasing investment in renewable energy supply, transmission and distribution. This signals a clear national direction toward prioritising and accelerating development of renewable energy generation, as well as ensuring electricity infrastructure can support growth and variability of supply and demand.

A draft of the revised National Policy Statement for Renewable Energy Generation has also been issued for consultation.

Transpower, in its Security of Supply Assessment 2023,[19] identifies that New Zealand is tracking towards an 'accelerated electrification' scenario - signifying an increase in national electricity demand of 68% by 2050. This can be directly attributed to:

> Forecasted increases in process heat conversion to electricity; and

> The increase in electricity vehicle usage around the country.

Transpower projects that 28% of the energy generation capacity of New Zealand will be via wind developments by 2050, even when accounting for significant changes in demand.

The Ministry of Business, Innovation and Employment reports that New Zealand imported over 1 million tonnes of coal in 2019, 2020, 2021 and 2024 in order to meet electricity demand.[20] This demand could not be met by existing hydro and gas sources due to dry conditions and inconsistent natural gas supply. This approach of importing coal to meet demand is not aligned with the national direction towards the reduction in emissions noted

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[19] https://static.transpower.co.nz/public/bulk-upload/documents/2023%20SOSA%20-%20Final%20Report%20-%20Final%20Version.pdf?VersionId=3VV75p2zXTR_3kxn3HZPixEiiq9ipiJX

[20] https://www.mbie.govt.nz/building-and-energy/energy-and-natural-resources/energy-statistics-and-modelling/energy-statistics/coal-statistics

above and signals the need for significant investment in renewable energy generation that can increase the overall supply of electricity.

Stage 2 of Puke Kapo Hau will significantly contribute to the national supply of electricity in a manner that provides a secure alternative to hydro and gas generation, while also reducing the reliance on fossil-fuels in accordance with Government targets for reduced emissions and doubling the amount of renewable energy generation.

5.3 DESIGN APPROACH AND PROJECT SHAPING

5.3.1 Wind Farm Layout

As noted above, up to 100 turbines are provided for within a 200MW installed capacity cap (i.e. 100 x 2 MW turbines) as part of the existing land use consent. While 2 MW turbines were considered realistic and appropriate at the time the consent was granted, significant advancements in wind turbine technology since that time means it is no longer practical to proceed with a layout for Stage 2 of Puke Kapo Hau comprising 82 2MW turbines. A 2 MW turbine model is now an inefficient use of resources and has since become largely outdated internationally, and continuing to rely on that configuration does not reflect current industry standards or the availability of modern turbine technology.

Although 82 2 MW turbines could be constructed within the 200 MW provided for in condition 11 (factoring in the 36 MW installed capacity for Stage 1), a more conservative but technically realistic 'real world' consented layout has been adopted for assessment and comparative purposes as part of this application. This scenario assumes a layout of:

<u>'Real World' Consented Stage 2 Layout</u>

> 47 turbines - each with a tip height of 145 m, a rotor diameter of 136 m and a ground clearance of 9 m;

> Each turbine would have an installed generated capacity of 3.45 MW; and

> Each turbine could be located within any of the 82 remaining consented turbine locations.

This 'real world' scenario has provided a consistent and credible basis for the expert assessments. Although indicative only, it reflects what could realistically be constructed in today's market and has enabled the experts to evaluate the likely effects of a modern turbine layout.

Using this scenario as a basis for assessing the effect of the change or cancellation in consent conditions, the technical experts have then assessed the actual proposed layout as follows:

Proposed Layout:

> 44 turbines - each with a tip height of 165 m and a rotor diameter of 136 m and a minimum ground clearance of 20 m; and

> Retaining some flexibility to locate the 44 turbines within a possible 54 turbine and contingency zone("**CZ**") locations.

This approach ensures the effects of the proposed changes are appropriately and accurately assessed within the context of the existing consented framework.

The main differences between the 'real world' consented layout for Stage 2 and the proposed layout for Stage 2 of Puke Kapo Hau are summarised in Table 5.1:

Table 5.1: 'Real World' Consented Layout v Proposed Variation Layout

Attribute	Consented Layout	Real World Consented Layout – Stage 2	Proposed Layout - Stage 2
Turbine locations	100	82 (plus Stage 1)	54 (plus Stage 1)
Turbines	100 (Stage 1 with 12 existing)	47 (plus Stage 1)	44 (plus Stage 1)
Maximum tip height	145 m	145 m	165 m
Indicative turbine capacity for assessments[21]	2 MW or 3 MW	3.45 MW	4.3 MW
Ground clearance for assessments[22]	Not specified	9 m	20 m
Rotor diameter for assessments[23]	90 m	136 m	136 m

[21] Not specified in consent – used purely for assessment purposes.

[22] ibid.

[23] ibid.

Attribute	Consented Layout	Real World Consented Layout – Stage 2	Proposed Layout - Stage 2
Maximum installed generation capacity	200 MW	200 MW	No maximum installed generation capacity
Thomas Block (identified in Layout Plan BMP W07190 as development within high-quality tussock)	Included	Included	Excluded

5.3.2 Modified Contingency Zones and Turbine Locations

Due to the increase in turbine size, in most cases the turbine platforms cannot practicably be fully accommodated within the consented CZ of up to 100 m in radius. Therefore, modified CZ are required to:

> Accommodate the increased turbine hardstand areas (permanent hardstand area for the turbines and temporary hardstand areas for crane and blade support platforms and/or associated works); and

> Accommodate the access track geometric requirements of the oversized turbine component delivery vehicles – which are significantly larger than the components considered for the original consent. The alignment of the tracks influences the position of the turbines and hardstands.

Drawing from the ecological, landscape and civil engineering assessments, the location and shape of the modified CZ have been defined based on the following criteria:

> Draw 100 m radius from the proposed turbine coordinates;

> Avoid wetland 10 m buffers;

> Avoid gullies (identified based on ground contours and/or change in vegetation as observed from aerials);

> Avoid road reserve (Eldorado Track);

> Avoid the QEII covenant area;

> Avoid the areas identified as Environment Court exclusion areas (See Figure 7);

- Trim to the consented Wind Farm Site Boundary; and
- Trim to the consented Windfarm Development Area – except where that is not practicable for Turbines 39 and 52.

In most cases the centre of the CZ (nominal turbine location) has not changed from the consented layout for the wind farm. Changes have been made so that the CZ will follow the rim edge of the gullies and a minimum 10m buffer from wetlands, while continuing to comply with the boundary of the Windfarm Development Area.

In total, 13 CZ have shifted - ranging from 10 – 160 m. These are Turbine 5 (30m southeast), Turbine 18 (30 m east), Turbine 20 (50 m east), Turbine 23 (35 m south), Turbine 39 (100 m north), Turbine 40 (160 m north), Turbine 42 (10 m west), Turbine 43 (15 m south), Turbine 45 (80 m north), Turbine 47 (80 m southwest), Turbine 50 (90 m north), Turbine 51 (30 m south east) and Turbine 52 (60 m north).

The various changes to the CZ are shown in Figure 5.1 below.

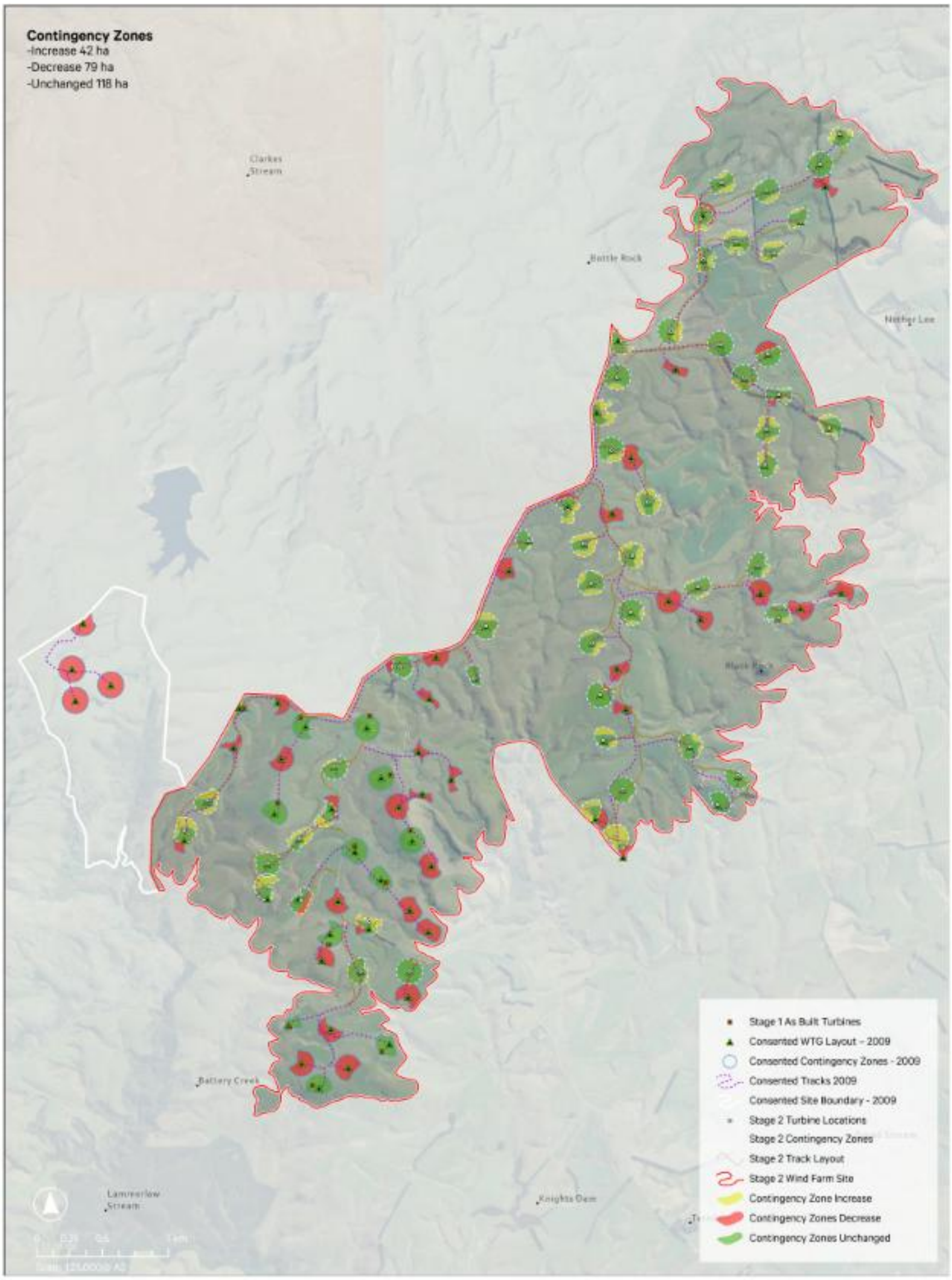

Figure 5.1: Contingency Zone changes

5.3.3 Windfarm Development Area

The Windfarm Development Area is approximately 700 ha and is the land that is available for works and was shaped to respond to the preferred areas for the development across the entire project site.

There are five[24] instances where it is not practicable to locate all works within the consented Windfarm Development Area boundary, due to:

> The existing sloping terrain and the ability to achieve the necessary access track vertical and horizontal geometry;

> Repositioning of a turbine to avoid blade overhang on the adjacent road reserve and QEII covenant areas to the south and north;

> Access track encroachment due topographical constraints, and limitations of curve radii; and

> Insufficient space to locate the blade and crane boom assembly areas (and associated earthworks batters).

The proposed changes would result in an additional 15 ha of land being utilised. However, overall, the Windfarm Development Area would decrease by 364 hectares (excluding Environment Court Exclusion Areas), or by 510 hectares if those areas are included.

These changes, including the revised Wind Farm Development Area for Stage 2 of Puke Kapo Hau are shown in the figure below.

[24] Turbines 7, 39 and 52 and turbine tracks from turbine 36 and to 50.

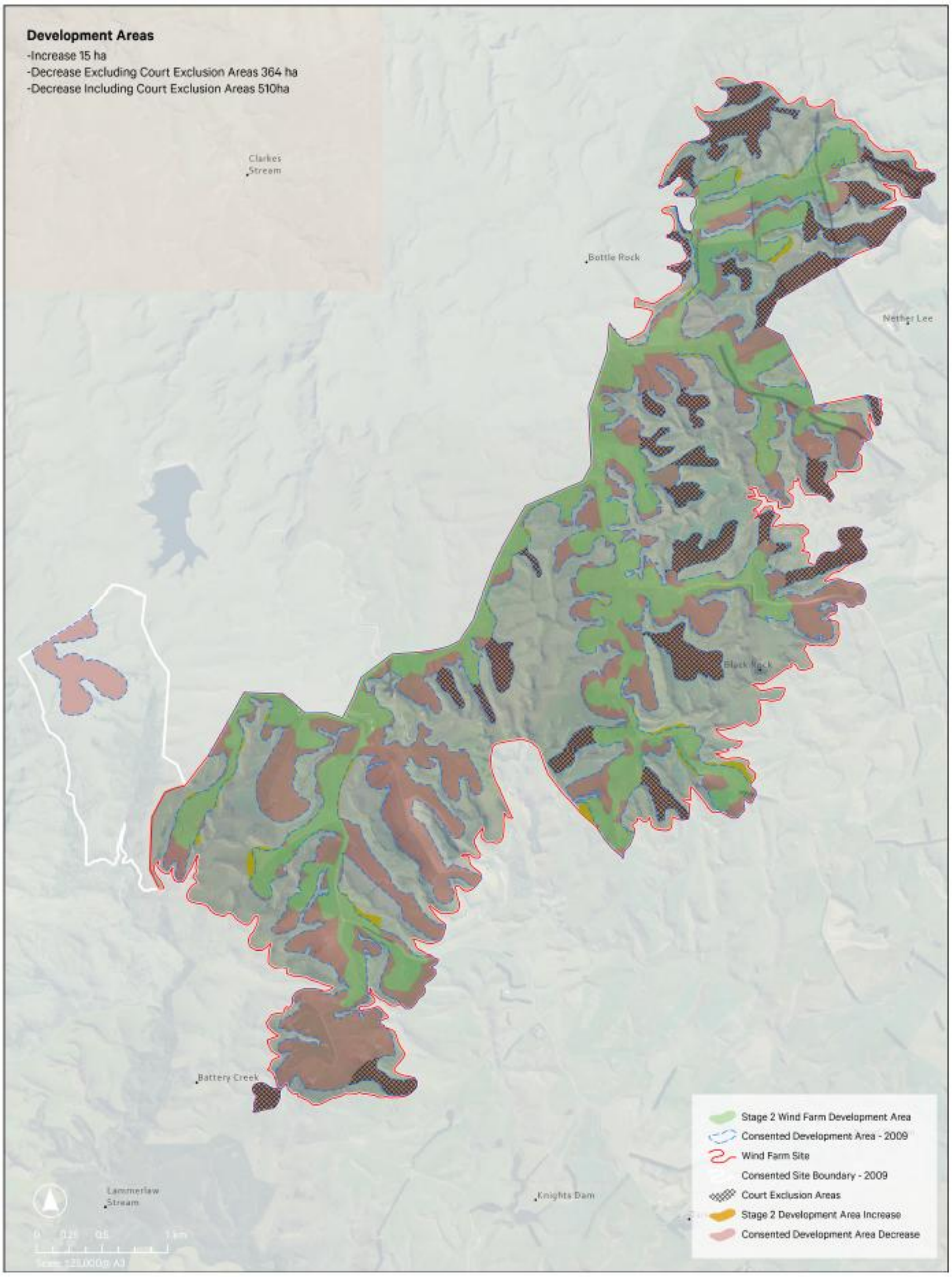

Figure 5.2: Changes to Windfarm Development Area

5.3.4 Other Changes

One potential turbine location, hardstand area and associated roading will be removed from the QEII covenant area (depicted as C on Plan BMPW07190/1) and four turbine locations, hardstand area and associated roads will be removed from the Thomas Block (depicted as area T on Plan BMPW07190/1).

The indicative layout of Stage 2 of Puke Kapo Hau is shown in Figure 5.3 below.

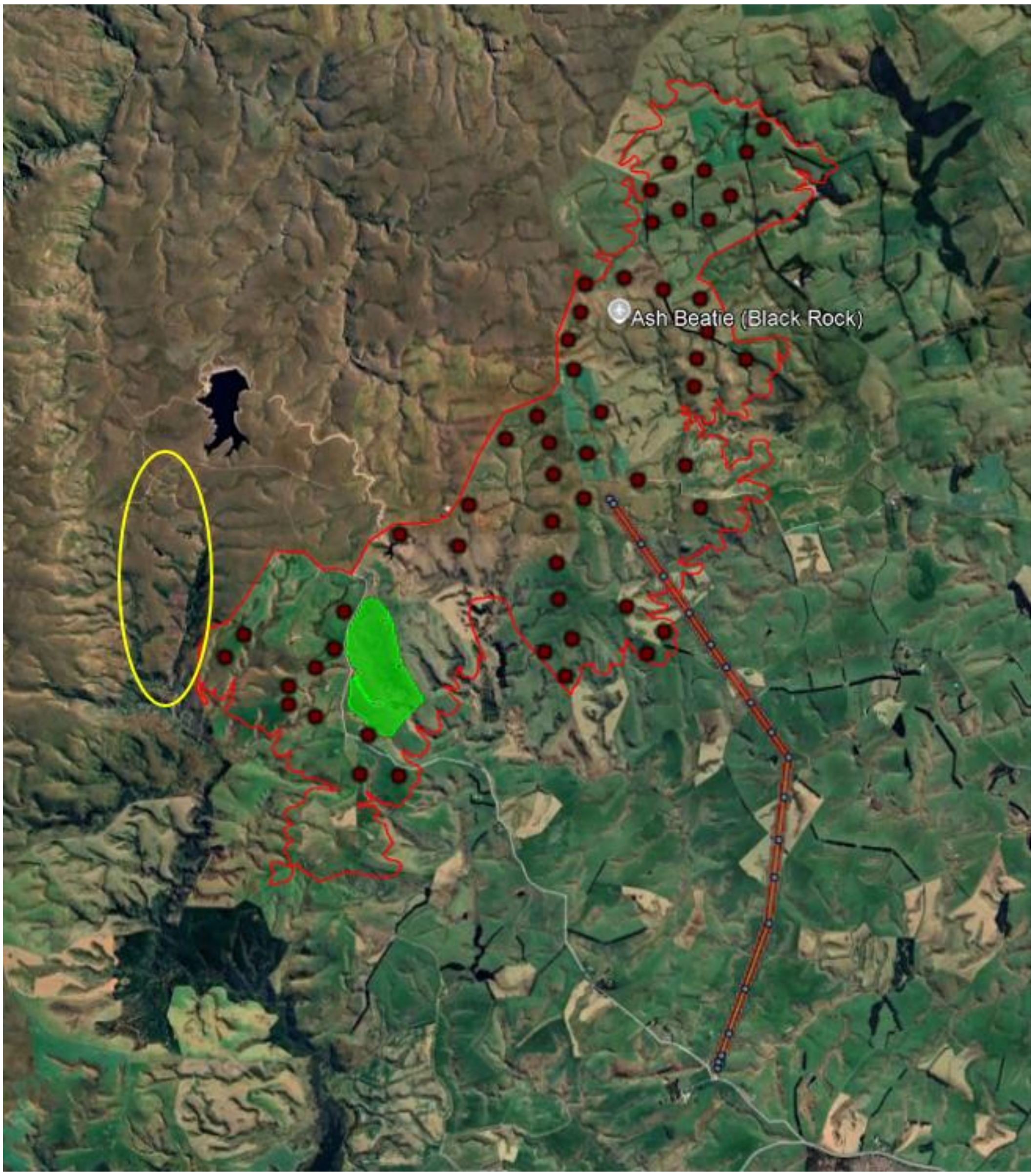

Figure 5.3: **Indicative Stage 2 Layout - 54 turbine locations, turbines removed from QEII Covenant Area C (green), removal of Thomas Block (yellow oval) and the new 110 kV transmission line connecting to National Grid**

5.4 PROJECT OVERVIEW

A summary of the activities and works associated with the construction, operation and maintenance of the Stage 2 of Puke Kapo Hau are as follows:

5.4.1 Variation Overview

> The installation of up to 44 turbines across 54 potential locations within an amended Wind Farm Development Area;

> Each turbine will be a maximum height of 165 m above ground level (to the blade tip);

> Modify the consented CZs to enable the larger turbines noted above;

> Removal of the Thomas Block form the Wind Farm Development Area and Project Site boundaries and remaining CZ within the Scrappy Pines Block QEII covenant area;

> The installation of aviation obstacle lighting on the nacelles of some of the turbines in order to mark the perimeter of the wind farm;

> Reduction in the internal access road network to approximately 31 km in length;

> A total earthworks area of 55.2 ha associated with the establishment of turbine foundations, hardstand platforms, internal access roads and site compounds;

> Reduction in the disposal of surplus cut material of approximately 365,000 m^3 within the Wind Farm Development Area;

> The introduction of new compensation sites; and

> Site rehabilitation works, including land contouring and reseeding of pasture and relocation of dense snow tussock subject to disturbance.

5.4.2 New Land Use Consents – Overview

> The establishment of a concrete batching plant and other temporary buildings, structures, signage and construction equipment within the Wind Farm Development Area;

> A BESS located at the start of the above ground transmission line;

> The establishment of a 6,750 m^2 substation within the Wind Farm Layout;

> Establishment of a 2,200 m^2 O&M Facility (including approximately 700 m^2 of buildings) within the Wind Farm Layout;

> Establishment of a new transmission line connection to the National Grid; and

> An internal access road network of approximately 8.8 km in length.

5.4.3 New Regional Consents - Overview

- Land use consents to construct a culvert within a waterbody;
- Water permits to allow for dewatering, diversion of water and alteration to the bed of a river during construction works;
- Construction related discharges;
- Sediment and stormwater control measures;
- Stormwater control and fire suppressant measures (and storage) associated with the BESS; and
- Establishment of new wetland and aquatic compensation sites.

5.4.4 New Consent Under the National Environmental Standards for Freshwater 2020

- A land use consent for works within or within 10 m of a natural inland wetland.

5.4.5 Puke Kapo Hau - Stage 2 Wind Turbines

Stage 2 of Puke Kapo Hau will involve the construction and operation of up to 44 additional turbines.

The individual turbines consist of a tower, nacelle, hub, and a rotor. Each of these elements will be painted the same colour - which will be in the off-white or light grey colour palette. The turbines will have a maximum height above ground level of 165 m (to the blade tip) and a minimum ground clearance of 20 m.

Due to the increase in turbine size, a permanent hardstand area of approximately 1,855 m^2 is required. The permanent hardstand area will be established adjacent to each of the turbines within the amended CZ to enable assembly and erection of the tower, nacelle and blade components by a specialist crane on a flat surface. An example of the permanent hardstand area is shown in Figure 5.4 below.

Temporary cleared areas and laydown areas of approximately 1,770 m^2 are also required for the main crane boom assembly, support cranes, and blade laydown area. The temporary laydown areas will be rehabilitated with contouring, topsoil and vegetation and therefore are not considered part of the turbine hardstand that must be located in the CZ.

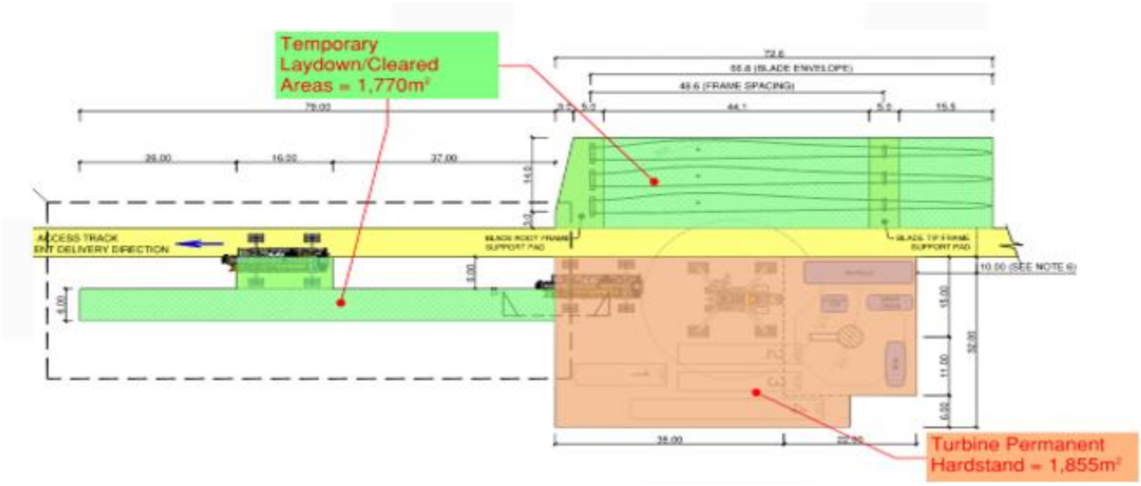

Figure 5.4: Example of Permanent Turbine Hardstand

5.4.5.1 Internal Access Road Network - Wind Farm

An internal access road network will be required within the revised Wind Farm Development Area as part of the construction and operation of Stage 2 of Puke Kapo Hau. The existing consent provides for 12 m wide carriage way during construction, which is to be reduced to 5 m in width once the wind farm is commissioned. The 12 m consented road width allowed for flexibility for potential tracking of crawler cranes between the various turbine sites.

However, based on experience from other recently constructed wind farms, crawler crane access is not required between sites. Therefore, a minimum 5.5 m wide carriageway width will be required for access tracks, plus additional widening at bends (up to a total carriageway width of 9.5 m) to accommodate oversized component delivery vehicles.

These internal access roads will provide an all-weather access between each turbine, the substation and the O&M Facility. The internal access roads will be designed to accommodate oversized vehicles, cranes and machinery during the construction of the wind farm.

Overall, the maximum overall length of new internal access roads / tracks will be reduced from 37 km to approximately 31 km.

The internal access roads / tracks will be specifically designed for the development layout and anticipated subgrade of the heavy construction vehicles as necessary. Aggregate will be sourced and transported to the wind farm from offsite. If suitable aggregate is discovered and otherwise bound for spoil areas it will be used on site where practical.

The drainage system for all access tracks will be designed to manage stormwater effectively using a combination of graded surfaces, roadside swales, cross culverts, and strategically placed erosion control measures such as riprap lining, planting, and check dams. The drainage system will ensure that water is directed efficiently off the tracks, maintaining their durability and reducing maintenance needs while ensuring surface runoff follows existing flow paths and maintains delivery of these flows to gullies and associated wetlands.

Further detail on the design of the internal access roads is provided in Riley – Civil (2025).

5.4.5.2 Concrete Batching Plant

Two temporary concrete batching plants will be established on a 10,600 m^2 batching platform to support the construction of turbine foundations and platforms. Dual batching plants are required to supply the volume of concrete at the rates needed.

The concrete batching plants will receive raw materials from offsite. The volume of cement and aggregate potentially required for the construction of the wind farm is detailed in Riley – Civil (2025).

Raw materials for concrete batching will be stored in separate bays or tanks adjacent to the batching plants. The cementitious materials will be stored in silos or tanks adjacent to the batching process machinery.

Specific perimeter controls will be implemented at the concrete batching plant facility to capture surface water and sediment/contaminant runoff during the operational life of the facility. The batching plants shall have a stabilised earth bund constructed around its perimeter to divert clean water runoff and contain sediment laden runoff.

A containment area such as a sediment pond shall be constructed to capture runoff and provide sufficient settlement of sediments prior to discharge to the downstream environment. The containment area shall be lined to prevent any water seepage into the natural ground. The outlet from the pond shall be controlled by a manually operated valve; if there is spilling of cement in the concrete batching plant area, the valve will be temporarily shut until the spillage is removed.

Once the construction is completed, the concrete batching plants will be removed.

5.4.5.3 Water Supplies for Construction

Water supplies for concrete batching, dust suppression and other construction activities will be required throughout the construction of Stage 2 of Puke Kapo Hau.

In this regard, water tankers will be required to cart water to site for concrete batching and other construction related activities (e.g. dust suppression). Approximately 400 m^3 per day will be required for the following elements:

- Up to 50 m^3 per day for pavement and earthworks conditioning;
- Up to 250 m^3 per day for dust suppression; and
- Up to 80 m^3 per day for concrete production.

5.4.5.4 New Culvert Installation

One culvert is required within a permanent watercourse – being the Lee Stream tributary crossing located between Turbines 9 and 10 (and 25 m to the northwest of an existing farm track crossing). This will involve the replacement of an existing culvert with a larger culvert embedded in the tributary bed.

The new culvert is approximately 40 m long to preserve the current grade of the tributary. During culvert construction, Lee Stream will be temporarily diverted and fish salvage undertaken. Fish passage will be provided for as part of the new culvert design.

Many other culverts will be required where the roads and platforms intersect overland flow paths, to conserve flow to wetlands. The installation of culverts will include (bed) preparation, laying of pipe culverts, construction of headwall and backfilling/ compaction.

5.4.5.5 Temporary Site Compound

A 10,350 m^2 temporary hardstand area for the site compound will be located near the site entrance off Eldorado Track. The site compound will be used for the contractor site offices, parking area, and storage yard.

Up to 200 contractors will be required during construction.

5.4.5.6 Estimated Earthwork Volumes

It is estimated that total earthworks area for Stage 2 of the wind farm will be 55.2 ha. The list below provides a breakdown of the key earthworks for the project:

- Cut volume: -530,000 m^3
- Fill volume: 189,000 m^3
- Turbine foundation excavation volume: -66,000 m^3
- Turbine foundation backfill volume: 44,000 m^3
- Surplus fill volume: -363,000 m^3

5.4.5.7 Surplus Fill Disposal

The earthworks required to form the access tracks, platforms, and turbine foundations, will result in a fill surplus. The estimated surplus volume for the proposal is less than the volume authorised by condition 25(e) of the existing land use consent.

Surplus fill will be deposited as blanket fills at identified locations within Stage 1 and Stage 2. The locations consider the original consented SFD locations but are redesigned to better suit the layout of Stage 2 of the wind farm.

SFD sites will be located on broad ridgeline features with gently to moderately sloping ground <15% gradient, with relatively easy access for construction vehicles. All topsoil shall be removed from each SFD site and stockpiled and may also be used to rehabilitate construction areas and construction access tracks within the Wind Farm Development Area.

Key points to note include:

> No disposal shall take place within gullies / wetlands and SFDs will maintain a minimum 10 m setback from wetland extents;

> No disposal shall take place into any permanent or intermittent rivers or streams;

> The relocation of the SFDs have avoided other ecological sensitive areas such as snow tussock grassland where practicable to do so;

> SFD sites will not be located on area subject to historic land slips;

> SFD sites shall be contoured in such a way that they do not impound water nor divert runoff to adjacent wetland catchments; and

> SFD sites shall be rehabilitated/stabilised as soon as possible to minimise the potential for sediment loss.

The SFD sites are shown in Figure 5.5 below:

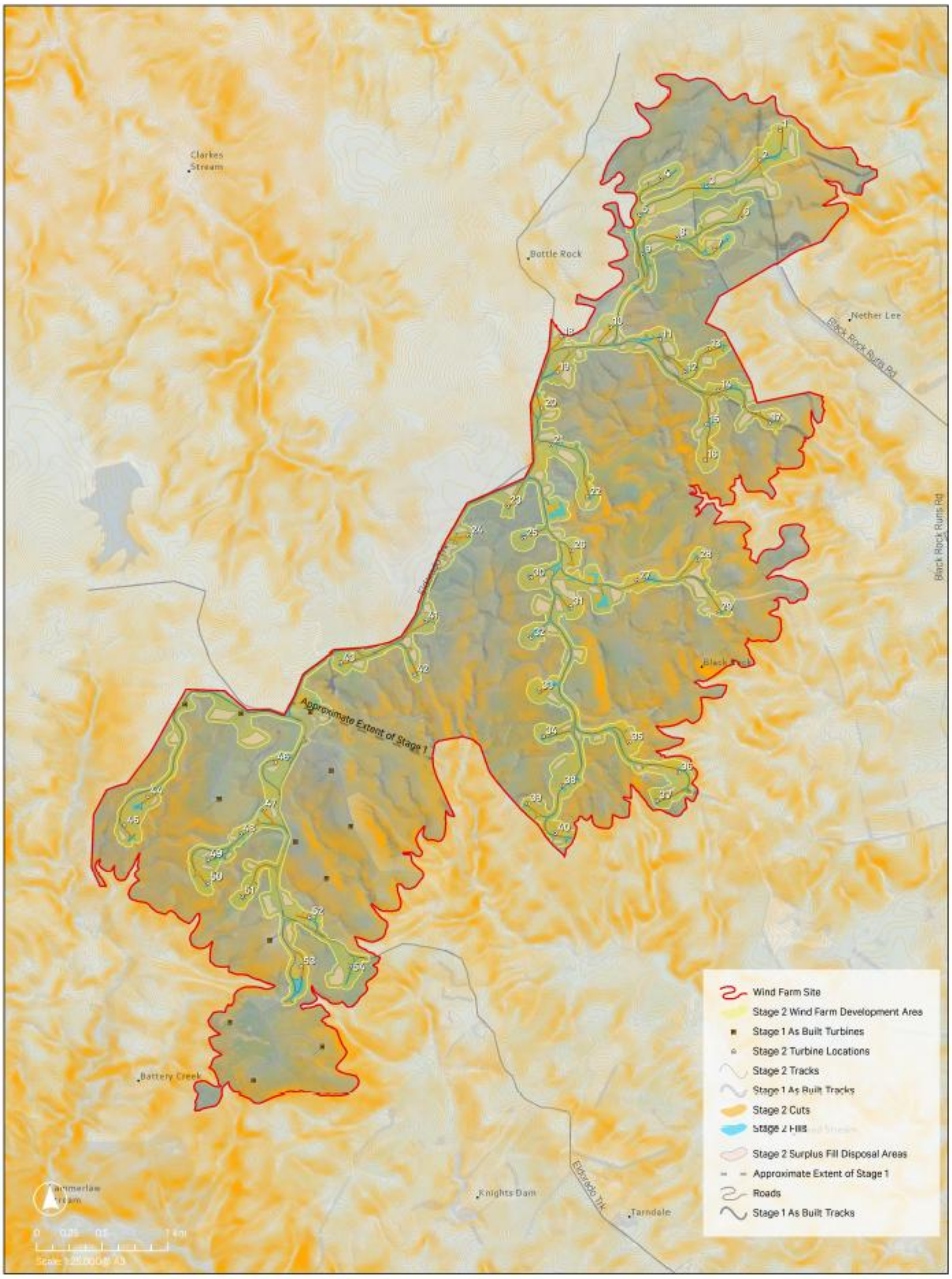

Figure 5.5: Surplus Fill Disposal Sites

5.4.5.8 Erosion and Sediment Control

Riley (refer to Part B.11 – Civil Engineering Assessment) details the general principles for sediment control during the construction of Stage 2 of Puke Kapo Hau which will be implemented through the Earthworks Management Plan ("**EMP**"), provided in Part C.02.

The method and techniques for sediment control will be in accordance with the Erosion and Sediment Control Guide for Land Disturbing Activities in the Auckland Region (Guideline Document 2016/005).

5.4.5.9 Underground Cable Network

Each of the additional 44 turbines will be connected to the proposed substation via an underground 33 kV electricity network. The 33 kV electricity network will be located in trenches generally between 800 mm and 1.2 m deep generally running parallel to the formed access roads / tracks.

The 33 kV electricity network will also include a fibre optic network that will connect the turbines to the substation and the SCADA system in the O&M Facility. This will ensure TWP can remotely monitor and control each of the individual turbines.

5.4.6 Transmission Infrastructure

5.4.6.1 Substation

An electricity substation will be established centrally within the Wind Farm Development Area - between Turbines 27 and 31. The location is flat, in pasture and adjoins an access road - minimising the earthworks required to form a platform.

The substation will be used to transform the voltage of the electricity generated by the turbines (i.e. 33 kV) to the transmission voltage of 110 kV. In addition, the substation will contain the equipment to control the connection to the transmission line.

The substation will comprise a security-fenced hard-stand platform of approximately 70 m x 55 m (3,850 m^2). It will contain gantries and electrical 'bus-work', ground mounted 33 kV/110 kV transformers, and ancillary equipment. All other equipment will be housed inside a building that contains a control room and two switch rooms. The building will be approximately 250 m^2 and 5 m in height.

The substation will have a bunded oil containment system.

5.4.6.2 Battery Energy Storage System

The BESS contains batteries that enable electricity from the wind farm to be stored and then dispatched. The BESS will enable the supply of up to 60MW for a two hour period.

The BESS location is on the crest of the plateau, in the centre of the wind farm, and adjacent to the substation and O&M Facility. The location is unobtrusive, on flat terrain, in an area of pasture, and is well separated from public roads.

The BESS will be security-fenced hard stand platform containing 32 battery containers mounted on concrete foundation pads. The impervious platform will be approximately 70 m x 60 m (4,200 m^2). The battery containers are roughly similar in size to shipping containers (up to approximately 3 m high) and are typically coloured white to reflect heat from the sun.

A visual depiction of a BESS is provided in Figure 5.6 below.

Stormwater will be managed through conveying site runoff via sumps and pipes to a stormwater detention basin located next to the platform. The detention basin will attenuate runoff from the platform to pre-development levels, up to the 10-year 24 hr rainfall event. Discharge from the basin is to the adjacent land via an outlet pipe and energy dissipation structure.

Provision for fire suppression water will be accommodated through onsite storage tanks with stored volume of 288 m^3, supplying two hydrants located on the BESS platform which can supply a minimum of 20 L/s for 4 hours for fire suppression and cooling. The fire water runoff will be captured and stored in the stormwater channels and/or lined stormwater detention basin to avoid contaminated discharges to the environment. For this reason, the basin will be lined to prevent soakage to ground and will be equipped with an emergency gate valve at the outlet which can be shut off in the event of a fire.

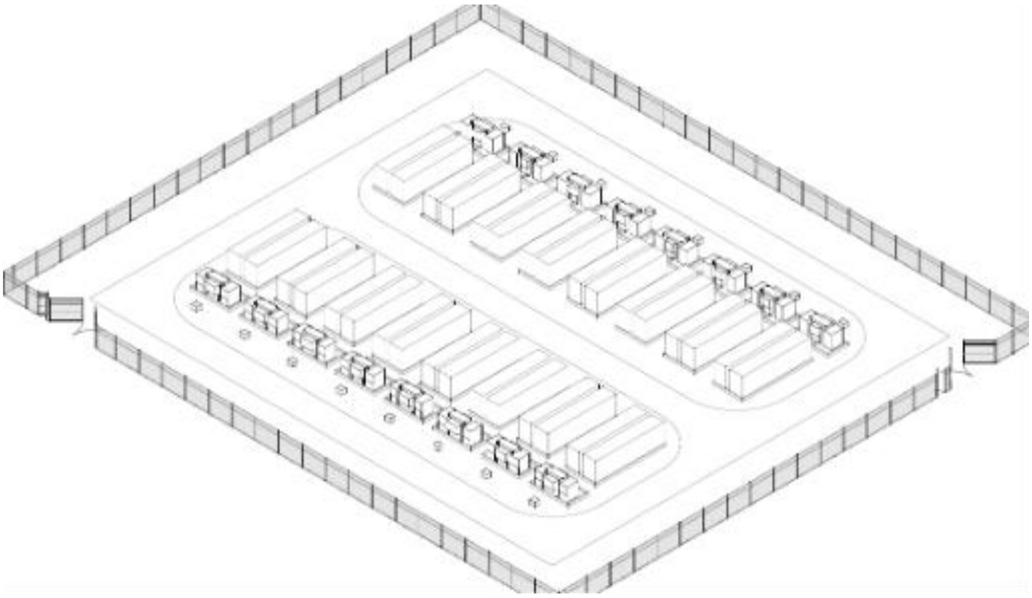

Figure 5.6: A visual depiction of a BESS

5.4.6.3 Operations and Maintenance Facility

The O&M Facility will consist of a 700 m^2 building and a sealed parking area of 830 m^2 - which will be built on a 2,200 m^2 hardstand area.

Full time staff will be based at the wind fam once it is operational (with contractors also on site for various maintenance tasks as required). The staff will be responsible for the monitoring and maintenance of the wind farm and will operate from a new permanent O&M Facility.

The stormwater run-off from roofed areas within the O&M Facility and the sealed parking area, will be conveyed to a rainwater collection system and discharged to ground. Water supplies will be provided via a rainwater collection system and wastewater generated from the facility will be treated on-site.

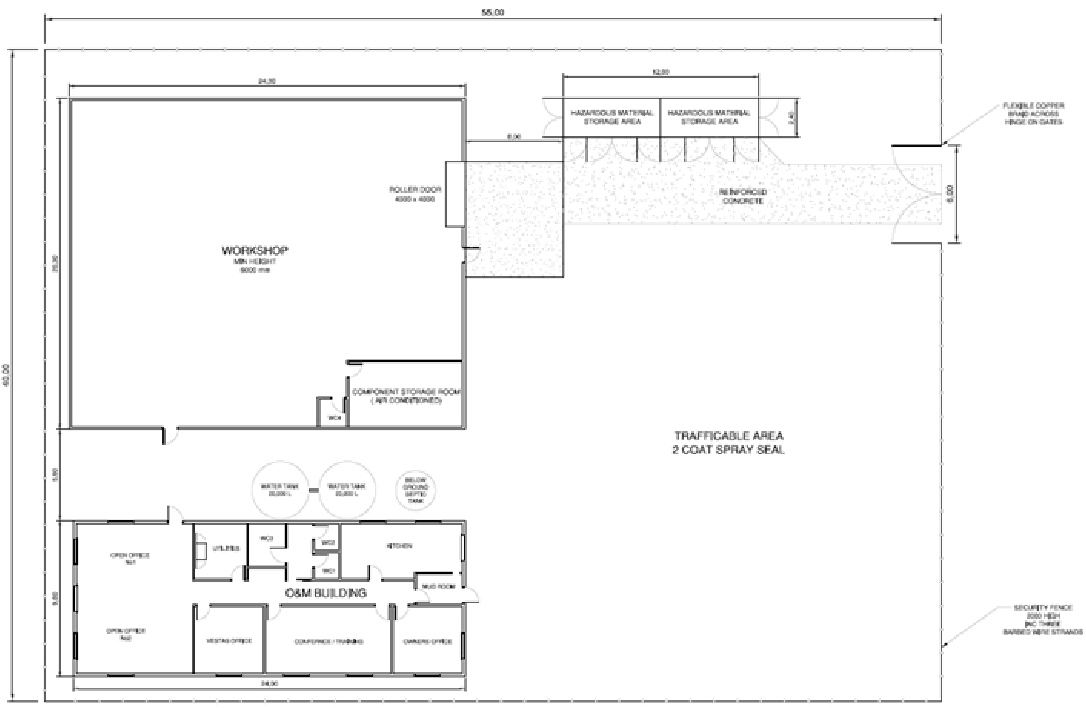

Figure 5.7: O&M Facility Depiction

An important aspect of monitoring the performance of Puke Kapo Hau will be the Supervisory Control and Data Acquisition (“**SCADA**”) system which connects each of the turbines to a central computer system. This computer and associated communication system enables TWP to supervise operations at the wind farm as a whole. The O&M Facility will house the central computer associated with the SCADA system.

5.4.6.4 110 kV Transmission Line and Poles

A double circuit 110 kV above ground line is proposed from the substation site south to and across the Eldorado Track to the existing Transpower 110 kV Half Way Bush line, near where it crosses North West Creek. Two pole structures of up to 45 m in height above ground level are required where the line initiates near the substation.

Twenty five pole structures of up to 45 m in height above ground level are required to support the double-circuit 110 kV transmission line and its connection points. The poles will be drilled 12 m deep and established over a distance of approximately 6 km, with intervals of 300 - 600 m between them. A visual depiction of the poles is provided in Figure 5.8.

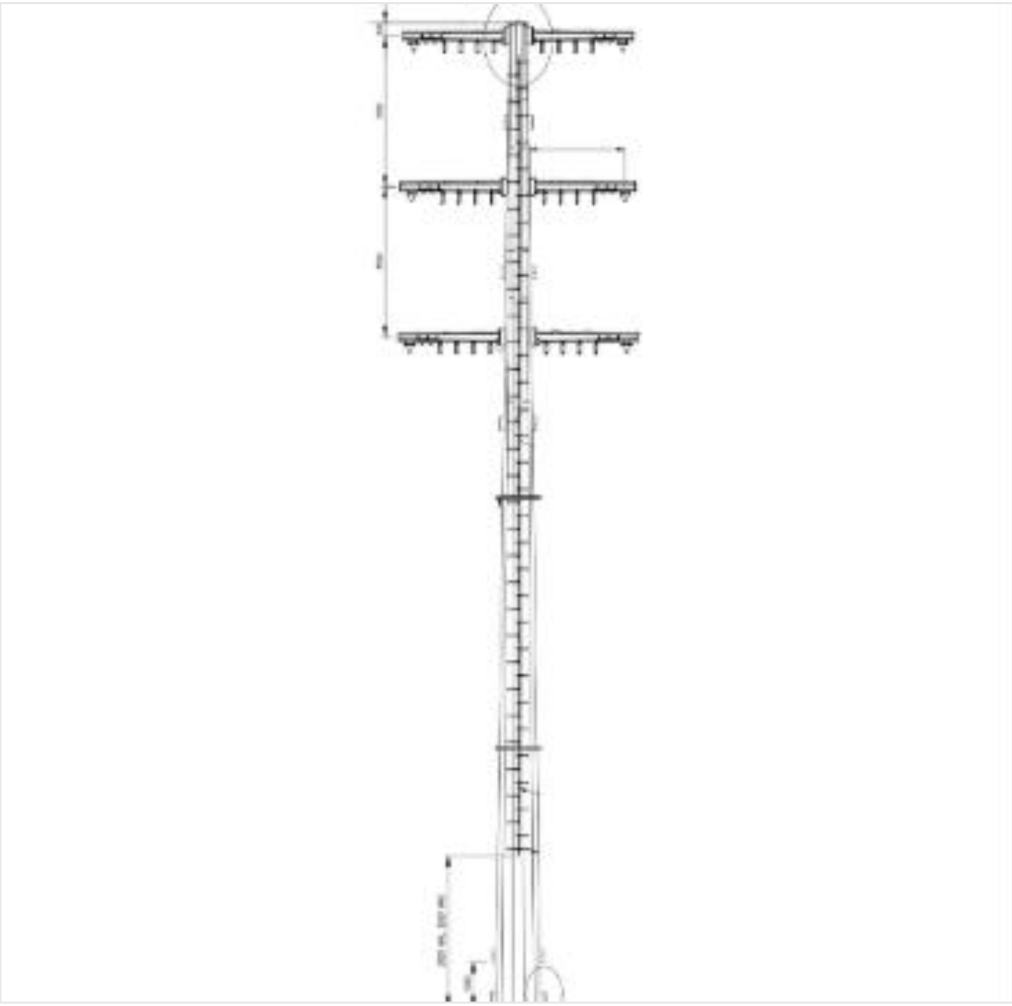

Figure 5.8: Visual Depiction of the Pole Structures

The 100 m transmission line corridor is aligned on spurs immediately to the south of the substation crossing a tributary gully of the Black Rock Stream, and then is aligned southeast along the plateau that forms the watershed between Black Rock Stream and Broad Stream. The corridor then turns southwest across the Broad Stream valley and along a spur to the grid access point adjacent to Eldorado Track.

The transmission line corridor is partly located across land within the wind farm boundaries and on neighbouring participating properties.

The connection to the National Grid line involves the installation of a Double Hard Tee (rather than a switching station) using up to 8 pole structures up to 45 m in height. This will be located adjacent to Thornicroft Farm on the Eldorado Track.

5.4.6.5 Internal Access Road Network - Transmission Line Corridor

An access road network will be required to support the transmission line corridor.

The access road will be approximately 8.8 km in length and will be accessed by an existing farm track and utilise existing farm tracks where possible. The proposed route will follow existing fence lines and avoid wetlands and ecologically sensitive vegetation where practicable.

A track of 4.5 m in width will be formed to the transmission line poles. Temporary hardstands will be formed adjacent to the poles. The tracks will be designed for construction vehicles – including a mobile crane and component deliveries.

5.4.6.6 Estimated Earthwork Volumes for Transmission Line Corridor

It is estimated that total earthworks area for the transmission line corridor will be 6.7 ha. It is estimated that the following earthwork quantities will be required to be undertaken within the transmission line corridor (including power pole hardstands and internal access).

> Cut volume: -9,900 m^3

> Fill volume: -8,200 m^3

> Surplus Fill Volume: -1,700 m^3

5.5 STAGING AND TIMEFRAME OF CONSTRUCTION ACTIVITIES

The construction of Stage 2 of Puke Kapo Hau is expected to take approximately two years. The construction will involve a series of defined stages, many of which will progress concurrently to maintain programme efficiency.

The BESS will likely be constructed separate to the wind farm and transmission line.

Each stage is outlined below.

Stage 1: Site Establishment and Enabling Works (Months 1-12)

This stage provides the foundation for all subsequent construction activities and includes all preparatory activities required to enable safe and efficient access to the site, particularly for the oversize components and large cranes needed for turbine erection.

Critical construction involves vegetation clearance, substantial bulk earthworks, installation of drainage and erosion control measures and construction of internal access roads.

Other works required at this stage include:

> Construction of the Lee Stream tributary culvert;
> Stock proof fencing of the Lee Stream tributary compensation area; and
> Concrete batching plants establishment.

Temporary construction facilities such as the site compound, laydown areas and truck wash areas will also be established.

Stage 2: Foundation Construction (Months 7-16)

Following site establishment, the turbine foundations will be constructed. This involves excavation, installation of steel reinforcement, concrete pouring and curing. Due to the number of turbines involved in Stage 2, foundation works will typically be sequenced in different parts of the wind farm to allow multiple construction crews to operate concurrently. This stage will overlap with other construction activities / stages.

Stage 3: Transmission Line and Grid Connection Works (Months 3–18)

Construction of the transmission infrastructure will proceed in parallel with turbine and site construction works.

> Construction of the substation;
> Access track construction;
> Foundation works for pole structures;
> Erection of pole structures; and
> Conductor stringing.

These works must be timed to ensure grid readiness ahead of final commissioning.

Stage 4: Electrical Reticulation and Internal Cabling (Months 6–20)

Internal electrical works involve the installation of underground 33 kV cables connecting turbines to the substation, as well as fibre-optic and earthing systems. These works will be staged in parallel with foundation construction and continue across the site as each turbine location becomes accessible.

Stage 5: Turbine Delivery and Installation (Months 10–20)

Turbine components, including tower sections, nacelles, hubs, and blades, will be progressively delivered and installed as foundations are completed. Assembly will be undertaken using large cranes and specialist installation crews. Multiple turbines may be installed simultaneously, with each unit typically requiring one to three weeks to erect. This stage is expected to span around ten months.

The O&M Facility will also be constructed at this time to ensure that it is ready prior to turbine commissioning and operational handover.

Stage 6: Commissioning and Grid Integration (Months 18–22)

Commissioning involves detailed testing of each turbine and the associated electrical and control systems. Grid synchronisation will be carried out during this phase, along with performance verification and compliance testing. The transmission line will also be energised and commissioned to enable export of electricity to the grid.

Stage 7: Site Restoration and Demobilisation (Months 22–24)

Final construction activities include the removal of all temporary facilities, machinery, temporary fencing and signs, debris and other materials before site rehabilitation works commence.

Site rehabilitation works will involve recontouring, erosion control, revegetation and completion of permanent access infrastructure. As per the conditions of consent, the site will be handed over for operational use in a stable and environmentally appropriate condition.