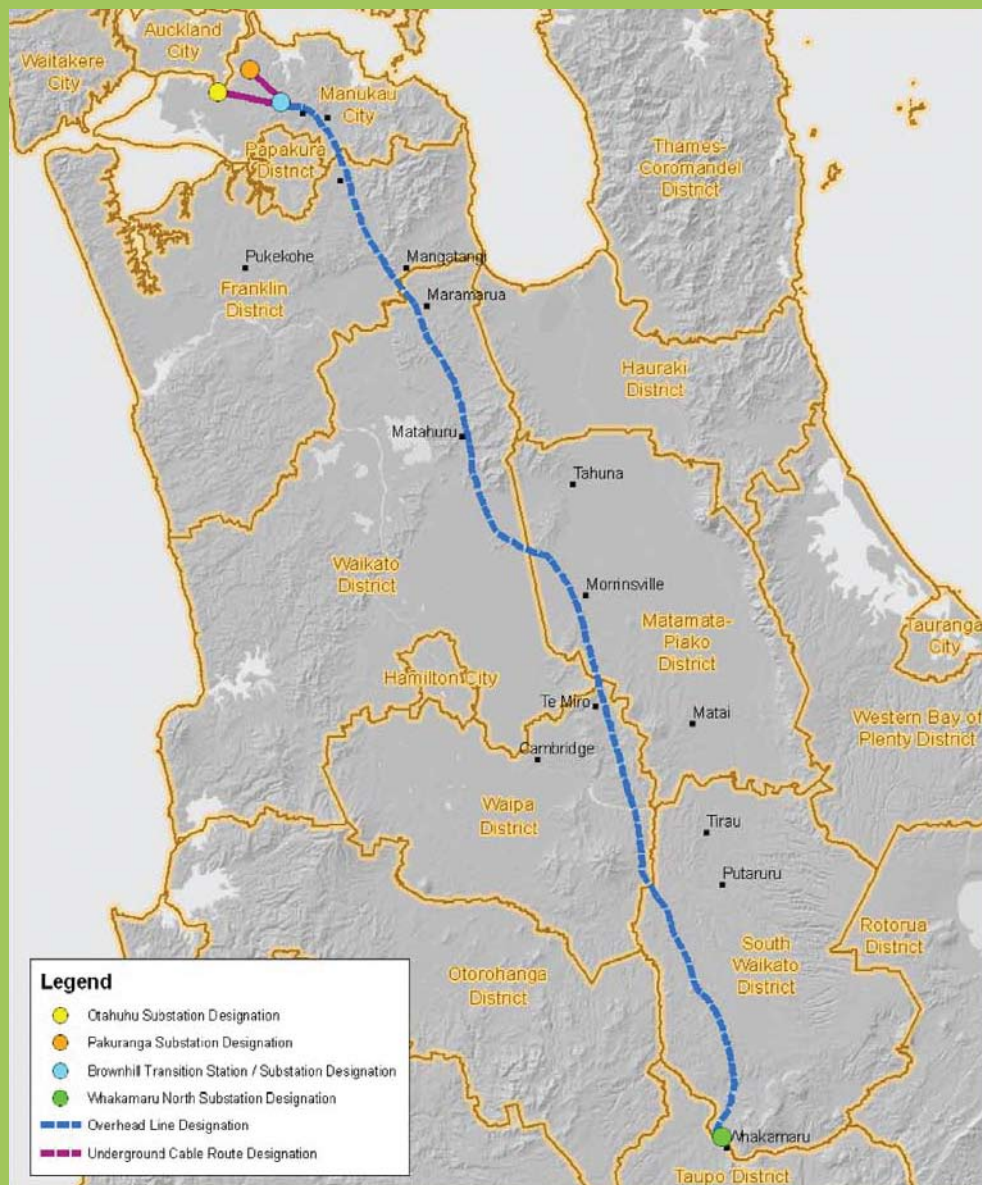


# Transpower New Zealand Ltd North Island Grid Upgrade Project

## Notices of Requirement Documentation

### Part IV



# **PART IV**

## **INFORMATION, DESCRIPTION AND ASSESSMENT OF EFFECTS ON THE ENVIRONMENT**

### **OTAHUHU SUBSTATION**

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# Transpower NZ Ltd

## North Island Grid Upgrade Project

### Otahuhu Substation

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## 1. Introduction

### 1.1 Purpose of this document

This report has been prepared to support Transpower's Notice of Requirement (NOR) to Manukau City Council (MCC) to designate the Otahuhu Substation site. The designation is required to provide for the installation of new 220kV equipment at the Otahuhu Substation and for the continued operation, maintenance and upgrading of the existing Otahuhu equipment and existing and proposed activities. These works are part of the North Island Grid Upgrade Project involving the construction of a new power line from Whakamaru, north of Taupo, via a new substation and transition station at Brownhill Road to Otahuhu and Pakuranga.

This report has been prepared in accordance with section 168 of the Resource Management Act 1991 (RMA). It includes a description of the existing Otahuhu Substation and the works associated with the proposed extension. It describes the existing environment and the changes to the environment that will result from the proposed substation extensions. It also includes measures to avoid remedy or mitigate adverse effects on the environment and an evaluation of alternatives.

The NOR does not include an outline plan. This will be prepared and submitted to MCC once detailed designs have been completed and prior to commencement of construction.

### 1.2 Transpower's objectives

The common objective for the North Island Grid Upgrade Project is as follows:

*To ensure the continued security and certainty of electricity supply to Auckland, Northland, and parts of the Coromandel and Waikato, by constructing and operating a new transmission link (including substations and ancillary facilities) and to upgrade existing assets, in a manner that is safe, efficient, and consistent with maintaining current grid reliability standards and which provides flexibility to address future changes in supply.*

The specific objectives for the NOR for the Otahuhu Substation are as follows:

*To provide for the development, expansion and operation of a secure facility which enables the transformation and transmission of electricity within the Auckland region and beyond.*

*To enable operational flexibility of the facility to meet growing demand for electricity and requirements for security and diversity of electricity supply.*

These objectives are self-explanatory and cover the variety of activities existing or proposed to be undertaken on the site. The work and designation is considered by Transpower to be reasonably necessary for achieving its objectives, for the following reasons:

- The new substations, being one of the two northern termination points, form integral parts of the Grid Upgrade Project and cannot be considered in isolation from the remainder of the project, thereby assisting in meeting the common objective;

- A new 220kV substation is reasonably necessary to enable the transformation and subsequent transmission of electricity to and beyond Auckland, and is also considered necessary to deal with growing electricity demand in Auckland and beyond;
- The new substation equipment at Otahuhu is considered reasonably necessary to ensure security and diversity of electricity supply because the existing Otahuhu Substation is the core substation at which power arrives into Auckland from the south, and has strong connections to all major substations in Auckland;
- The use of the designation technique is reasonably necessary to ensure that Transpower has the flexibility to undertake the proposed works and to connect to existing infrastructure in the vicinity in an integrated manner, while at the same time allowing for upgrading and modernisation of the existing substation infrastructure;
- The use of the designation technique for both the existing and new substations allows for operational flexibility and certainty with regard to the existing and future activities on the site, which its current legal status and other RMA mechanisms would not provide; and
- The size and scope of the designation will provide sufficient land and separation distances from adjoining activities to enable adverse construction and operational effects to be avoided or mitigated.

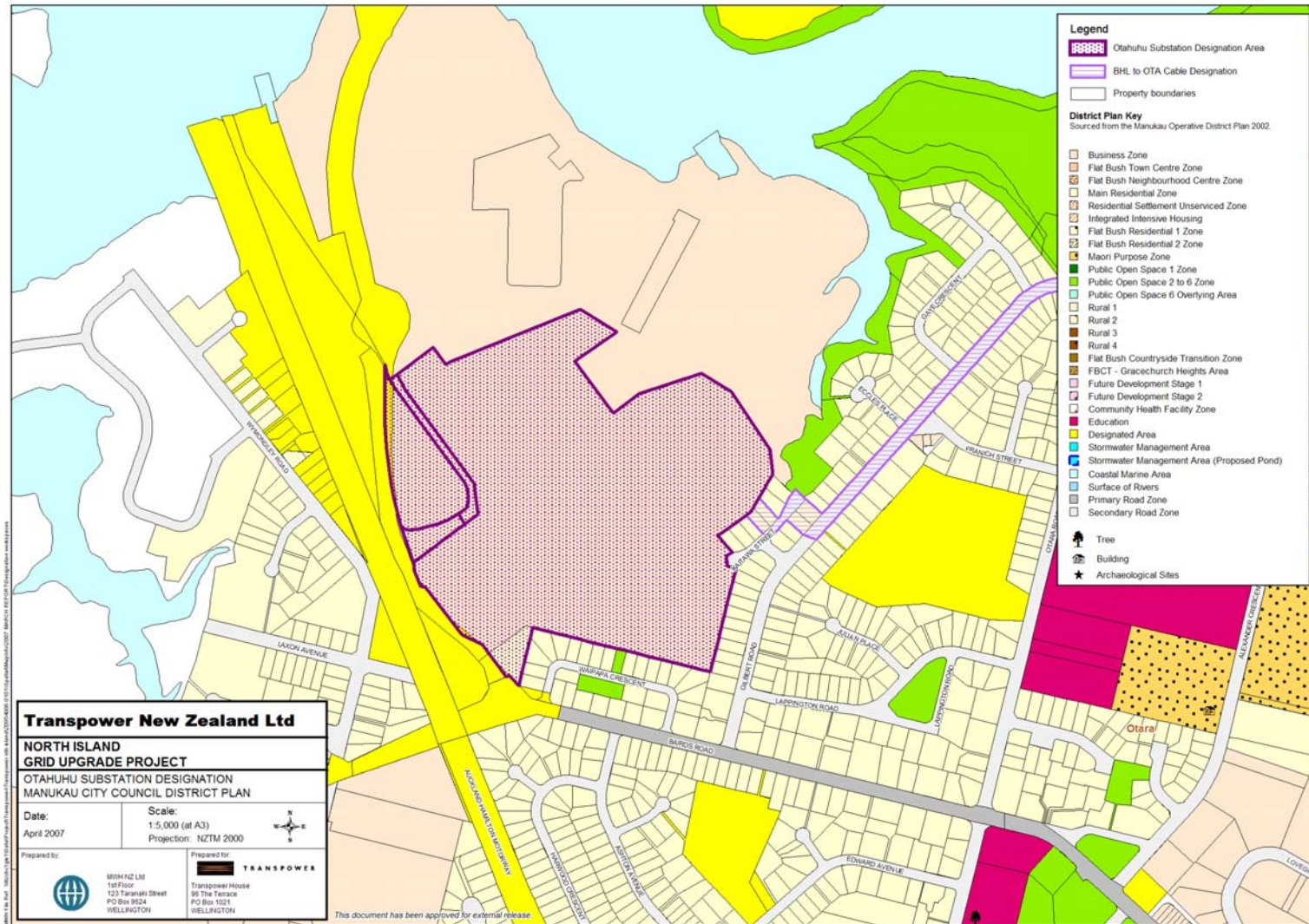
## 2. Project description

### 2.1 Introduction

Part of the North Island Grid Upgrade Project involves extensions to the existing substation at Otahuhu, which include the installation of new 220kV equipment. To provide for these new works, associated changes to the existing substation and its ongoing operation, maintenance and future upgrades, Transpower is proposing to designate all of the site that is in its ownership plus an additional area of land between the Southern Motorway and the western boundary of the existing substation site. This land is currently owned by MCC and is designated by MCC for proposed road and construction area, including stormwater management. Transpower has entered into discussions to explore purchasing this land and MCC has agreed in principle to Transpower designating the site.

Figure 1 shows the extent of the land to be designated.

Figure 1: Otahuhu Substation Designation



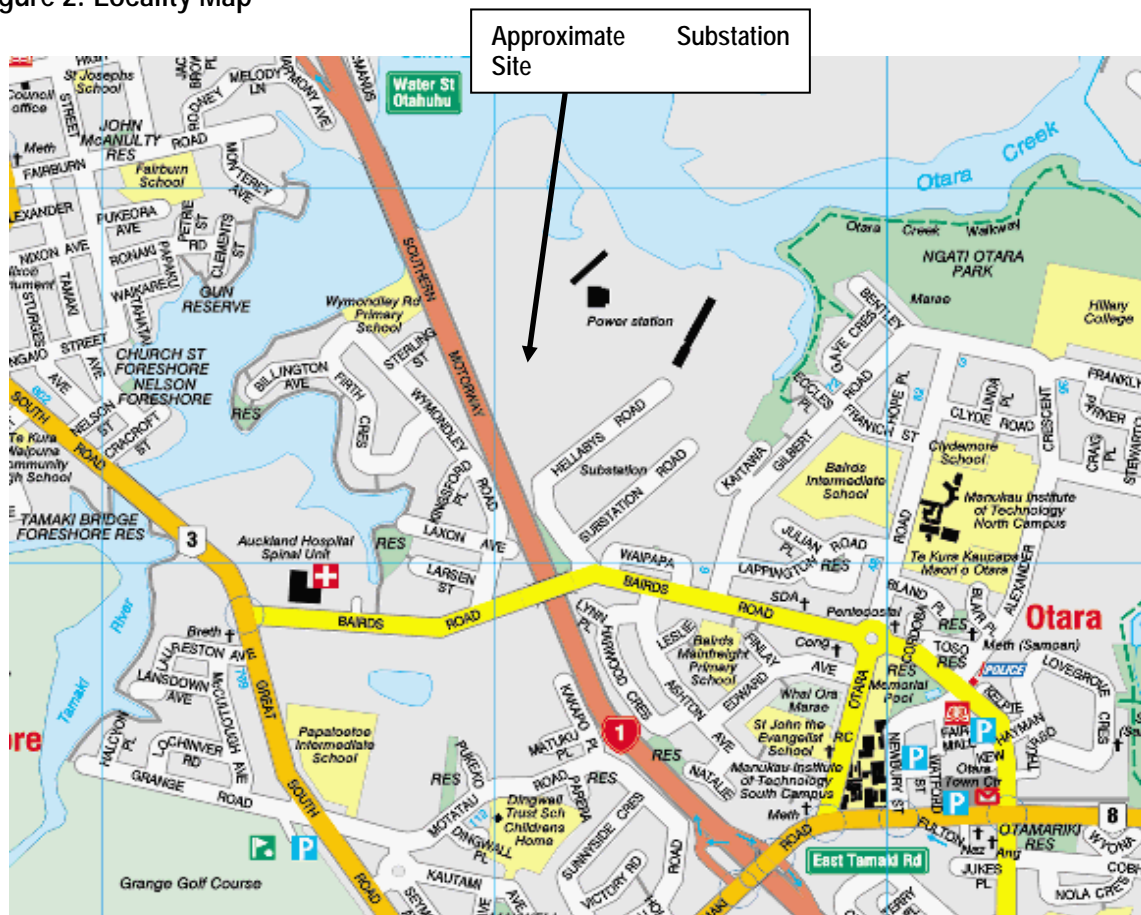
The existing Otahuhu Substation is located on the northern edge of the suburb of Otara in Manukau City near to Bairds Road. It occupies part of a large site (22.5 hectares) which is owned by Transpower. Otara is an area with a large number of Housing New Zealand properties. These and privately owned residential properties in the area are predominantly well established and at relatively low density. Such properties are located on the southern and part of the eastern boundary of the existing substation site.

The Contact Energy combined cycle power station (Otahuhu B), along with the older Otahuhu A power station, are located the northern boundary of the substation site. The eastern corner of the site is within 100 metres of a tributary of Otara Creek. Contact Energy land separates the Substation site from the tributary. The western boundary of the site adjoins the construction site of the Waiouru Interchange which is part of the Transit New Zealand and Manukau City Council East Tamaki connection to the Southern Motorway. These works are substantially completed.

Within the surrounding residential area, a number of educational, cultural and community facilities are located. These include Bairds Road Primary School, Sir Edmund Hillary Collegiate and the Manukau Institute of Technology.

The Otara Town Centre is located about 1 kilometre south of the site. The town centre is located on a main arterial link from State Highway 1. It provides community and recreation facilities, local business/services, and food and takeaway outlets for the Otara community. Some distance from the substation within the western area of the Town Centre (Lovegrove Road) there are a number of light/medium sized industrial businesses. Figure 2 shows the location of the Otahuhu Substation.

Figure 2: Locality Map



## 2.2 Existing substation

The existing Otahuhu Substation is located on the northern edge of the suburb Otara in Manukau City on Substation and Hellabys Roads, which are accessed off Bairds Road. Substation Road, Sparky Road, and Hellabys Road are private roads generally contained within the Substation site. The Substation was established on the site in 1946. The total area of the site comprises approximately 22.5 hectares. Adjacent land uses include residential properties, two power stations (Contact Energy), the Southern Motorway, the Waiouru Interchange and Expressway (under construction) and the Coastal Marine Area (Tamaki River and Otara Creek)

The primary purpose of a substation is to connect the ends of two or more transmission lines together and change the power from one voltage to another e.g. 220kV to 110kV and 220kV to 22kV. The main components are circuit breakers (to switch lines and transformers into and out of service), power transformers, and busbars (to connect the circuit breakers together). Buildings are required to accommodate the electrical control and protection equipment (for the circuit breakers and transformers) and substation auxiliary systems (power supplies, metering, communications, etc).

Otahuhu is the core substation at which power arrives into Auckland from the south. The Otahuhu Substation has strong connections to all major substations in Auckland. It connects major transmission circuits to provide a secure network in the Auckland Region and it transforms (i.e. changes) the voltage of the power transferred from Whakamaru and Huntly from 220kV down to 110kV to supply the Auckland load. The existing 220kV line from Otahuhu to Henderson transfers bulk power to the North Isthmus, without the need for it to flow through intermediate substations.

The existing Otahuhu Substation comprises:

- A combined 220 and 110kV switchyard of about four hectares
- Transformer oil containment facilities
- 220 and 110kV overhead transmission lines
- A 36 x 22 x 9 metre high two-storey control, relay and indoor switchgear building
- A 44 x 20 x 16 metre high two-storey crane room and workshop
- Two steel portal framed warehouses with a combined area of 3,800metres and associated minor structures
- Various prefabricated offices, a 850metres workshop, storage facilitates and a depot (these facilities are leased to Transfield)
- 22kV switchgear and associated building cabling (these facilities are owned by Vector)
- An Area Control Building comprising a 25 x 11 x 9 metre high two-storey Control Building plus a 46 x 11 x 6 metre high Administration Block
- Minor equipment and machinery storage structures
- Access roads (Hellabys Road, Sparky Road, and Substation Road)
- A 60 metre high communications tower
- Cable ducts

The security fence at the southwestern end of the existing switchyard area is on the substation boundary adjacent to Hellabys Road at the motorway end of the site. The existing switchyard includes circuit breakers

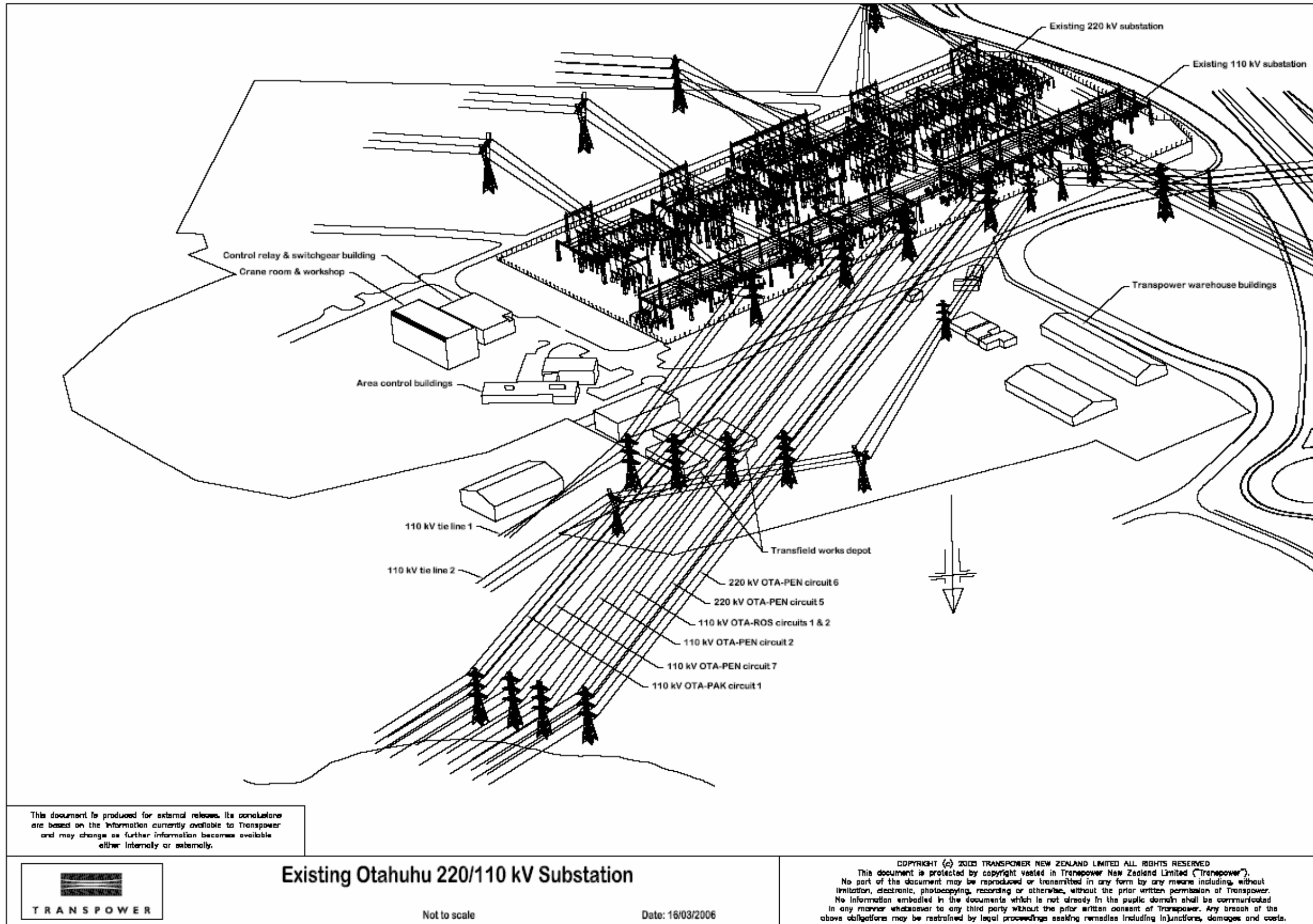
and associated switchgear and instrument transformers, power transformers, capacitor banks, support structures for terminating incoming lines and overhead buswork and a security fence.

An internal roading network comprising Hellabys Road, Substation Road and Sparky Road serves the site. Hellabys Road provides access to the site from Bairds Road and runs roughly parallel to the western boundary of the site and then extends in an easterly direction once it reaches the northern end of the 110kV switchyard. Sparky Road extends off Hellabys Road on the northern side of the 110kV switchyard and runs in a northwesterly direction parallel to the Transpower warehouse buildings. Substation Road extends off Hellabys.

Existing onsite facilities provide for the management and discharge of stormwater and the containment of oil in the event of a spill.

Figure 3 is an indicative isometric, showing the activities (including the location of existing lines and towers) comprising the existing Otahuhu Substation.

Figure 3: Existing Otahuhu Substation



## 2.3 Proposed substation extensions

It is proposed to extend the existing Otahuhu Substation by installing new 220kV equipment to strengthen Transpower's existing 220kV lines that supply Auckland and areas further north. The new 220kV equipment will connect to the existing substation. The exact nature and location of the 220kV equipment is subject to the Electricity Commission's approval of Transpower's North Island Grid Upgrade Project submission dated December 2006. The submission proposes three development options for the 220kV equipment at Otahuhu and until the North Island Grid Upgrade Project is approved, details of the substation extensions cannot be finalised.

The three proposed options are generally as outlined below.

### Option 1

- Extend the existing substation with an outdoor air insulated switchgear (AIS) substation for terminating and switching key transmission circuits. The new substation extensions would be located in the area southeast of the existing substation; and
- Construct a new outdoor AIS substation in the area northwest of the substation for transformers and equipment to provide voltage support (capacitor banks, static var compensators (SVCs)).

### Option 2

- Construct a new outdoor AIS substation in the area northwest of the substation for terminating and switching key transmission circuits; and
- Extend the existing substation with an outdoor AIS substation for transformers and equipment to provide voltage support (capacitor banks, SVCs). The new substation extensions would be located in the area southeast of the substation.

### Option 3

- Construct a new indoor gas insulated switchgear (GIS) substation in the area northwest of the substation for terminating and switching key transmission circuits;
- Associated with the new GIS substation, construct a new outdoor AIS substation for transformers and voltage support equipment; and
- In the medium to long-term, extend the existing substation with an outdoor AIS substation located in the area southeast of the existing substation for voltage support equipment.

New substations in the area northwest of the existing substation will be physically separate from the existing Otahuhu Substation equipment to provide for diversity of supply.

New outdoor AIS substations and substation extensions may include all or some of the following:

- 220kV circuit breakers and associated switchgear and instrument transformers. Low level buswork will be approximately 9 metres in height.
- Lightning protection masts.
- Transformers.
- Capacitor banks and SVCs.

- Control and relay building(s).

A new indoor GIS substation would include:

- GIS building for housing the circuit breakers, associated switchgear and instrument transformers.
- 220kV circuit breakers and associated switchgear and instrument transformers (located in the GIS building).
- Line termination gantries next to the GIS building.
- Control and relay building(s).

Connections between a new GIS or AIS 220kV substation in the area northwest of the existing substation and the existing substation will be via underground cable.

The existing Henderson - Otahuhu and Otahuhu - Southdown 220kV lines which cross the land currently owned by MCC will be reconnected to eliminate bus crossovers. In addition, the Henderson - Otahuhu line will be reconnected from the existing 220kV substation to the new 220kV substation. The realignment of lines will be located on land adjacent to Sparky Road. Depending on the option approved by the Electricity Commission, either a new tower will be constructed to support the lines or a cable transition station and associated underground cables will be required. These activities will be located on the land currently owned by MCC.

The existing Otahuhu - Penrose 220kV line which crosses the substation site will need to be deviated. It is possible the realignment of this line will be located on land adjacent to Sparky Road. New towers may be constructed to support the line and these will be located on land currently owned by MCC. Alternatively, the line may be undergrounded. This will be dependent on the option approved by the Electricity Commission.

As previously set out, Transpower has entered into discussions to explore purchasing the land currently owned by MCC, and this land has been included in the area to be designated and subject to this Notice of Requirement.

To make space available for a new 220kV substation at Otahuhu, a number of existing 220kV and 110kV overhead transmission lines will be deviated and/or cabled and new transmission line towers will be required. The extent of this will depend on which option is approved by the Electricity Commission. The overhead line deviations and new towers will be located on land owned by Transpower and to be designated. At least one new tower will be located on land presently owned by MCC, but subject to this designation. It is possible that sections of the new underground cables may be located on this MCC land. Some existing buildings and storage areas may be relocated.

The Otahuhu Substation will be connected to the Brownhill Substation/transition Station via an underground cable link, the designation for which is partially shown on Figure 1.

Figures 4a, 4b and 4c are indicative isometrics, showing the activities comprising each of the options and the location of existing structures, lines and towers)

## 2.4 Programme of Works

The proposed works will comprise a series of ongoing upgrades to the existing Substation. As each stage is subject to Electricity Commission approval, and load growth, it is only possible to outline the works in their likely chronological order. Commencing from 2009, until the installation of the Brownhill-Otahuhu cable circuits in approximately 2020, the anticipated works are as follows:

- New capacitor banks (approximately 2009).
- New 220kV switchyard equipment installed (as described in section 2.3 previously, approximately 2010)
- Substation works associated with the increased operating voltage of the existing Otahuhu-Pakuranga line from 110kV to 220kV (approximately 2011).
- New SVC's installed (approximately 2015).
- Substation works associated with the underground cable circuits from Brownhill Road (approximately 2020).

Throughout the above phases, it is likely that some new transformers will also be required, and replacement of existing transformers may occur.

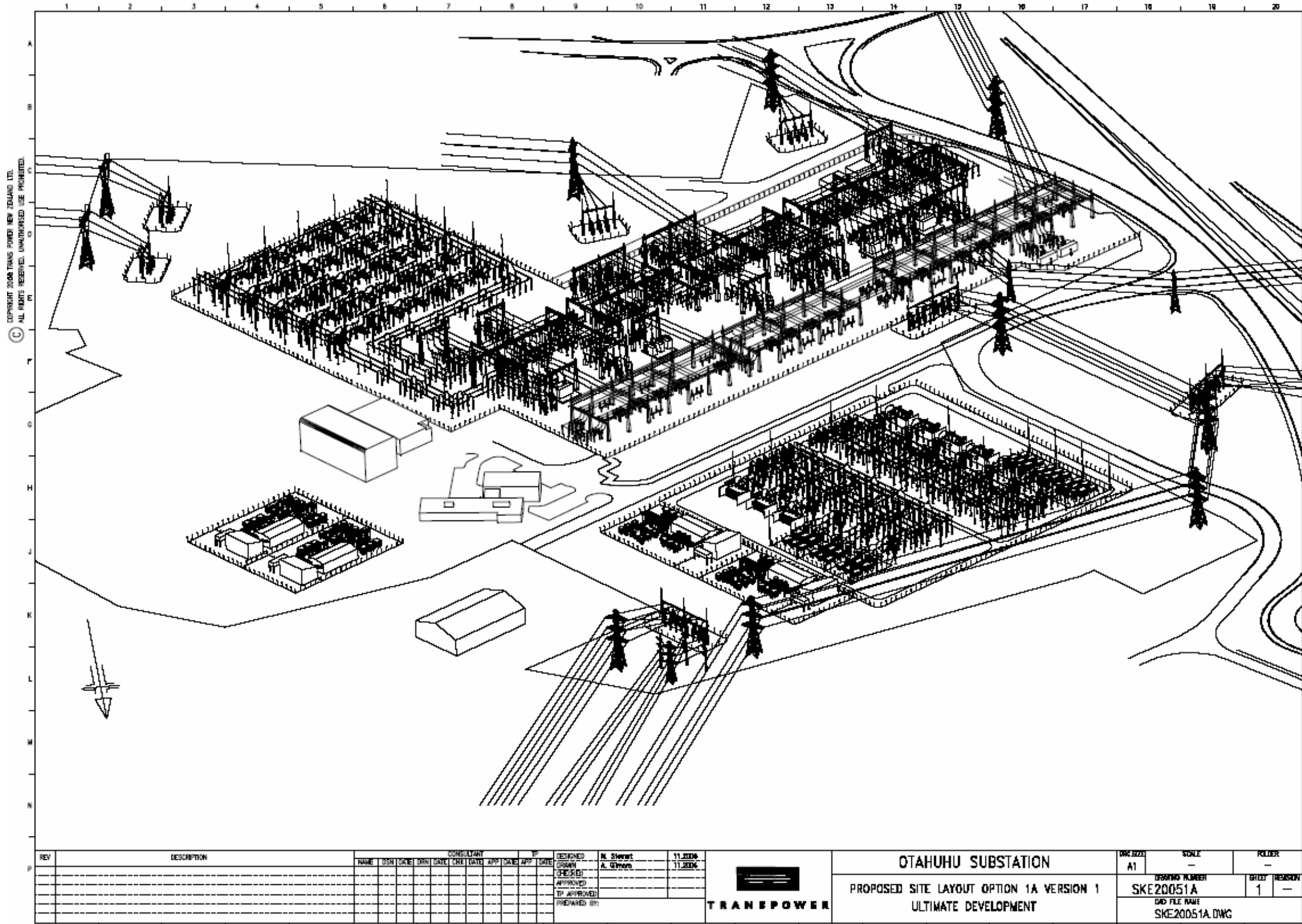


Figure 4a: Option 1 - Proposed Extensions to the Otahuhu Substation

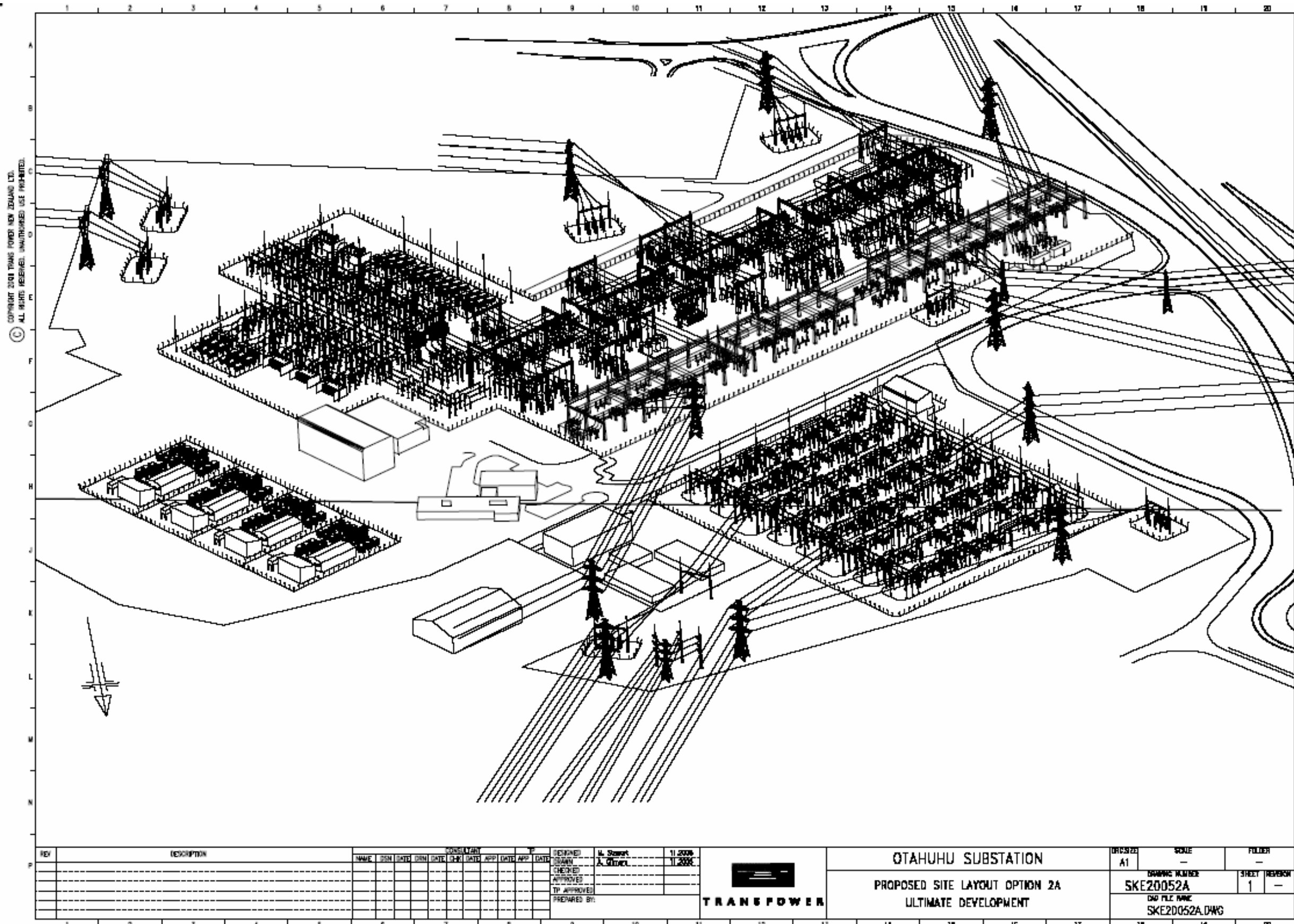


Figure 4b: Option 2 - Proposed Extensions to the Otahuhu Substation

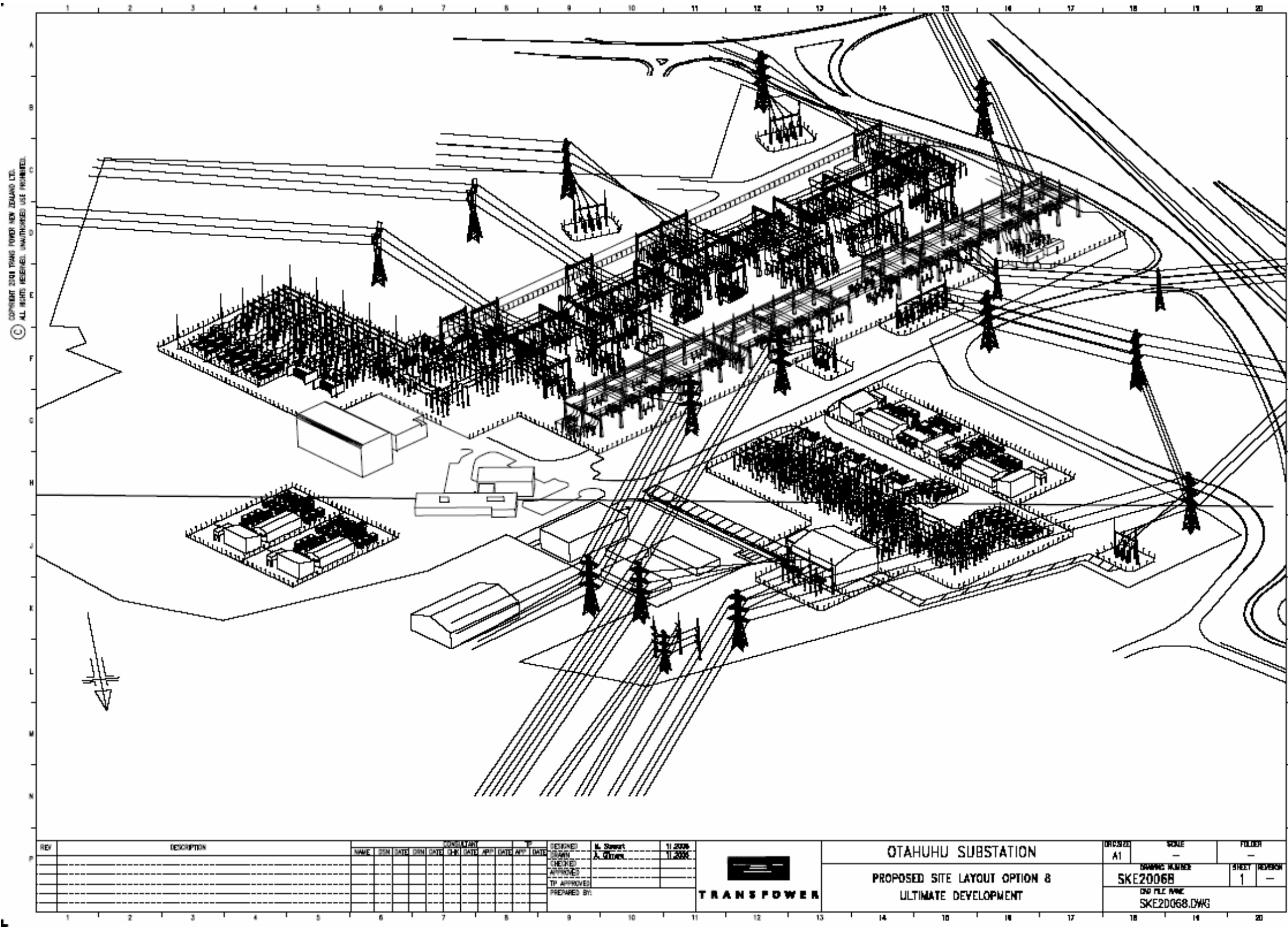


Figure 4c: Option 3 - Proposed Extensions to the Otahuhu Substation

## 2.5 Construction methodology

Depending on the option approved by the Electricity Commission, it is likely the new 220kV substation and substation extensions at Otahuhu will be constructed under a design-build contract. This will require the contractor to carry out the detailed design of the substations in accordance with the preliminary designs prepared by Transpower.

Overall, the construction period for the new 220kV equipment at the Otahuhu Substation site is anticipated to be approximately 18 to 24 months.

Site levelling and earthworks will take place prior to the construction of the concrete foundations for the substation equipment items. These items will, in the main, be manufactured overseas. Following the installation of the substation equipment items on to their foundations and making of electrical connections, the new substations will be progressively commissioned.

All construction vehicles will access the site via the existing access from Bairds Road.

It is anticipated that all construction activities including the storage of plant, materials and equipment will be accommodated on the Otahuhu Substation site.

Construction effects are assessed in section 6 of this report.

## 2.6 Construction management

Mitigation of most construction impacts will be achieved through a Construction Management Plan, which will be submitted to MCC at the outline plan stage.

Transpower will include contractual requirements in the design/build construction contract for the contractor to manage construction impacts.

Construction Management Plans will be implemented by the contractor and will address such matters as:

- Storage and reuse of top soil
- On and off site disposal of spoil
- Silt and dust control during site levelling and earthwork stages
- Temporary equipment storage on site in specified areas
- Contractor car parking on the site in specified areas
- Traffic management for road movement of heavy equipment to the site
- Site security and lighting during construction
- Contaminated land management procedures
- Handling of insulation oil
- Construction noise and vibration
- Hours of work

- Light design assessment plan
- Landscape plan
- Community information and liaison

The design/build contractor will be required to comply with all designation and resource consent conditions relevant to the scope of work.

## 2.7 Operational requirements

### 2.7.1 Access

The ongoing operation and maintenance of the Otahuhu Substation will involve minimal traffic movements as the Substation will not be permanently staffed. Vehicle parking for the ongoing operation and maintenance of the existing and new substation can be accommodated on site.

A Regional Operating Centre and Transfield's works depot are presently located on the Otahuhu site and will be retained. These activities are permanently staffed. The Operating Centre is manned by about 15 people. The number of staff employed by Transfield and based at Otahuhu is about 160, but not all staff are on site at the same time as many go direct to other remote work sites. Vehicle parking for the Operating Centre and Transfield's activities is accommodated on site.

The existing access from Bairds Road will continue to be used.

### 2.7.2 Maintenance and repairs

The Substation assets will be maintained at regular intervals to ensure they are in a serviceable condition. Routine maintenance intervals vary depending on the equipment type and can vary from every four years to every 10 years. Non routine maintenance is carried out to rectify minor repairs. This is normally scheduled to be carried out in conjunction with routine (scheduled) maintenance but, in cases of emergency, this may not be practical.

## 3. Statutory context

### 3.1 Introduction

The statutory context of the RMA is set out in Part II of the documentation for the Notices of Requirement. It includes consideration of the relevant sections of the RMA, Transpower's objectives for the Project and an explanation of the need for the Project.

## 3.2 Relevant planning instruments

The Manukau District Plan (MDP), operative 2002, is the main planning instrument to be considered when assessing the Notice of Requirement for the designation for the Otahuhu Substation. The other relevant planning instrument to be considered is the Auckland Regional Policy Statement.

## 3.3 Auckland Regional Policy Statement

The Auckland Regional Policy Statement became operative in August 1999. It is a statement about managing the use, development and protection of the natural and physical resources of the Auckland Region. The key objectives and policies that are of relevance in assessing the Notice of Requirement are contained in Part X section 4.

It is considered that the proposal is generally in accordance with the objectives and policies in the Regional Policy Statement, the most relevant being those that relate to the provision of national and regional infrastructure, in the interest of the economic and social wellbeing of people and communities in the region.

## 3.4 Manukau District Plan

While it is intended to provide for the development, operation and maintenance of the existing and new substation facilities by way of the designation process, the provisions of the MDP provide useful guidelines in terms of anticipated environmental effects and outcomes when assessing the Notice of Requirement.

The existing Otahuhu 220kV Substation is not designated in the MDP and the site is zoned Business 5 (Mixed) Zone. As provision has not been made in the MDP for network utilities of such a character and scale, the Substation is reliant on existing use rights for its ongoing operation and maintenance.

The key provisions of the MDP that are considered relevant in considering the NOR are Chapter 7 - Network Utility Services, and Chapter 14 - Business 5 (Mixed) Zone.

### 3.4.1 Network Utility Services

The Otahuhu Substation falls within the definition of "Network Utility Services" as these activities include "*distribution or transmission of electricity*". Provisions in respect of Network Utility Services are contained in Chapter 7 of the MDP. These provisions apply on a district wide basis and override the provisions of individual zones.

Due to its scale, the existing Otahuhu Substation and proposed extensions would not comply with the rules for permitted, controlled or restricted discretionary activities. Therefore, the activities would fall under the categories in Rule 7.8.2.1 of:

*"Buildings, equipment or structures, or any mast, aerial, tower, pole, antenna or support structure for a network utility service throughout the City not being permitted or controlled or restricted discretionary activities",*

or

*“Any activity for Network Utility Services which cannot meet the Development and Performance Standards of Rule 7.9”,*

and as such would be a discretionary activity.

Chapter 7 of the MDP contains specific assessment criteria for Network Utility Services considered to be discretionary activities. These criteria are contained in Rule 7.14.1.2. The overarching assessment criterion is *“Effects on existing character of the locality and amenity values”*. The specific relevant criteria that under-pin this criterion are summarised as follows and cross referenced to the particular section of this report that addresses these matters.

- Effects on amenity values of any sensitive activities in the vicinity including residential neighbourhoods. (Sections 6.1, 6.2, 6.3, 6.4, 7.3, 7.4, 7.6, and 7.7 evaluate these effects).
- Effects on landforms, landscapes, or areas of visual or scenic worth which contribute to the amenity values of the City, particularly where these areas are located on the coast. (Section 6.4, 7.7, and 7.8 evaluates these effects).
- Effects on native bush, bird or wildlife habitats. (Section 6.11 evaluates these effects).
- Effects on landforms or areas with scientific, cultural or archaeological value. (Section 6.10 evaluates these effects).
- Whether alternative technologies and design have been considered and included in the proposal, which would avoid, remedy or mitigate adverse effects on the environment. (Section 4 addresses alternative technologies).
- Effects on amenity values of properties from noise, dust and vibration. (Sections 6.1, 6.2, 6.3 and 7.3 and 7.4 evaluate these effects).
- Whether the proposed location of the Network Utility Service will improve the operational efficiency of the network utility service, and the extent or impacts of such effects. (Section 2 evaluates these effects).
- Any discharge of fumes, smoke or gases that cause a nuisance or effect amenity values. (Sections 7.8 and 7.9 evaluate these effects).
- Effects of dust in terms of nuisance and detraction from visual amenity values. (Section 6.3 evaluates these effects).
- Whether conditions are required to address adverse effects on health and safety. (Sections 7.1, 7.2 and 7.8 evaluate these effects).

The key objectives and policies contained in Chapter 7 of the MDP in respect of Network Utility Services that are relevant in considering the Notice of Requirement are contained in Part X, section 5. It is considered that the proposal is generally consistent with the policy framework for network utilities.

### 3.4.2 Business 5 (Mixed) Zone

The site is located within the Business 5 (Mixed) Zone in the MDP. The provisions of the Business 5 Zone could be used as guidelines in terms of anticipated environmental effects and outcomes when assessing the Notice of Requirement.

The Business 5 Zone applies to mixed areas of light and medium industry, offices, and a limited range of retailing activity. Where the Zone is at the interface with residential or other sensitive areas, a number of controls such as yards, traffic and parking and noise standards are incorporated, to maintain or enhance the environmental and amenity values of these areas.

A wide range of activities are permitted in the Business 5 Zone, subject to meeting performance standards and other criteria. Activities within the Business 5 Zone and within 30 metres of residential zones are controlled activities to enable control of site layout to ensure that any potential adverse effects are minimised.

There are a number of General Development and Performance Standards that assist in determining the amenity values of the area and against which the effects of the substation activities can be assessed. A summary of the relevant standards is set out below along with a cross - reference to the section of this report that demonstrates the consistency of the proposed activities with these standards.

### Height and Yards

To maintain and enhance amenity levels in the Business 5 Zone and in particular adjoining residential areas, the zone provisions include rules in respect of height and yards. Rule 14.11.1 sets out that there is no maximum height limit in the Business 5 Zone. However, there is a height in relation to boundary provision that requires that buildings must be contained within a prescribed building envelope. The existing substation complies with this rule, as will the proposed extensions (see section 7.7 of this report).

Rule 14.11.2 requires that activities in the Business 5 Zone provide a front yard with a minimum 7.5 metres and that 50% of the yard must be landscaped. Where any part of a site abuts a site zoned residential, a yard having a minimum width of 5 metres is required. All of the area of this yard must be planted and maintained in grass, trees and shrubs and outdoor storage areas must be screened. The existing substation complies with this rule, as will the proposed extensions (see section 7.7 of this report).

### Noise

To ensure that noise generated by activities in the Business 5 Zone does not cause significant nuisance, Rule 14.11.7 requires that activities comply with specified noise levels. Section 7.3 of this report sets out the noise levels and evaluates the noise effects of the existing and proposed substation activities.

Rule 14.11.7 requires that noise from construction work (including maintenance and demolition works) must be measured, assessed and controlled in accordance with procedures and limits set out in NZS 6803:1999, being the New Zealand Standard for Acoustics – Construction Noise. Section 6.1 of this report proposes that compliance with this standard be adopted as a condition of the designation.

### Hazardous Facilities and Substances

Rule 14.11.8 sets out the MDP's requirements in respect of Hazardous Substances. The Hazardous Facility Screening Procedure (HFSP) is a mechanism to ensure that hazardous facilities or activities are safely located, designed and built and also that they continue to operate safely throughout their life. An assessment has been done of the hazardous substances that will be stored on the Substation site.

The Quantity Ratios for the site have been calculated using the criteria for the Hazardous Facility Screening Procedure set out in the recently revised document "Land Use Planning for Hazardous Facilities" (Ministry for the Environment, 2005).

The Quantity Ratios (QR) so derived for the site are, for the three Effect Types, 0.139 (Fire/Explosion); 0.582 (Human Health); and 1.71 (Environment).

Comparison of these QR values with the Quantity Ratio ranges for the Business 5 Zone in the MDP shows that the activities involving hazardous substances at the site would fall within the category of a discretionary activity. This is because for the “Environment Effect Type”, the Quantity Ratio total calculated using the HFSP criteria is greater than the 1.5 trigger threshold which the MDP stipulates.

### Dust

Rule 14.11.9 requires that activities shall not create a dust, fume or smoke nuisance. A dust, fume or smoke nuisance will be deemed to have occurred if:

- there is visible evidence of suspended solids / particulate matter in the air beyond the site boundary; and / or
- there is visible evidence of deposited particulate matter traceable from a dust source, settling on the ground, building or structure on an adjoining site or waterbody.

Section 6.3 of this report demonstrates how the construction activities associated with the extensions to the Substation will comply with this rule.

### Lighting

To minimise the impacts of light spill, especially in respect of residential areas, Rule 14.11.11 requires that all exterior lighting must be designed, located and at all times directed, screened, adjusted and maintained to meet specified standards. Section 7.4 of this report assesses the effects of light spill on the surrounding environment.

The key objectives and policies contained in Chapter 14 in respect of the Business 5 (Mixed Zone) that are relevant in considering the Notice of Requirement are contained in Part X, section 5. It is considered that the proposal is generally consistent with the policy framework for the Business 5 Zone.

## **3.5 Other legislation**

### **3.5.1 Hauraki Gulf Marine Park Act**

The Hauraki Gulf Marine Park Act 2000 created the Hauraki Gulf Marine Park and is also intended to achieve integrated management of the Gulf. The Hauraki Gulf and its catchments fall under the jurisdiction of a number of local authorities including Auckland Regional Council and Manukau City Council. The Act applies not just to the waters and islands of the Gulf, but also to its catchment.

Section 10 of the Hauraki Gulf Marine Park Act requires that for the coastal environment of the Hauraki Gulf, Sections 7 (Recognition of National Significance of the Hauraki Gulf) and 8 (Management of Hauraki Gulf) of the Act must be treated as a NZ Coastal Policy Statement issued under the Resource Management Act, and where there are any conflicts between the two, the NZ Coastal Policy Statement prevails.

Given the nature of the proposed works associated with the extensions to the Otahuhu Substation and the mitigation measures proposed, it is considered that the Act has no particular relevance in terms of the designation.

### 3.5.2 Coastal Policy Statement

The New Zealand Coastal Policy Statement (NZCPS) became operative in May 1994. It was prepared and issued by the Minister of Conservation. The purpose of the NZCPS is to promote the sustainable management of natural and physical resources in relation to the coastal environment of New Zealand.

It focuses on preservation of natural character, and the integrity and functioning of the coastal environment. The policy places a certain amount of emphasis on the avoidance of adverse effects and, where this is not practicable, the effects should be mitigated and/or provision made for remedying those effects.

Given that the Substation is located in a highly modified environment, on land that is zoned for business and industrial activities and that it is separated from the Coastal Marine Area by the Contact Energy Power Stations, it is considered that the NZCPS has no particular relevance in terms of the designation.

## 3.6 Resource consents required

A preliminary analysis of the proposed activities indicates that the following resource consents may be required from the Auckland Regional Council:

- Land use consents for earthworks associated with foundation excavations, undergrounding of cables and other excavations.
- Discharge permit to discharge contaminants to land from ancillary activities that such as the washing of vehicles, plant or machinery, drilling activities, dust suppression, concrete or asphalt laying or works, associated with the installation of the underground cable.
- Water permit for the diversion of groundwater (dewatering during trenching if required, to enable dry working conditions).
- Discharge permit to discharge contaminants to land from an industrial or trade process associated with the use of the site by a high risk activity (Electrical Substation > 5000m<sup>2</sup>).
- Discharge permit to discharge stormwater from a site with an impervious areas greater than 5000m<sup>2</sup>.

It is intended to seek appropriate consents once design details for the new works have been finalised.

## 4. Alternatives considered

### 4.1 Introduction

As the demand for electricity is largely driven from within Auckland, the project seeks to ensure the continued security and certainty of electricity supply for Auckland, Northland, and parts of the Coromandel and Waikato. It is therefore essential for the new transmission link to connect to existing Auckland transmission nodes.

The southern and northern terminal stations are required to provide connection of the new transmission link to the existing 220kV national grid. Over time, power transformers at Whakamaru and Brownhill will transform the transmission voltage from 220kV to 400kV for transmission of power over the 400kV transmission lines.

The proposed substations at Brownhill and Whakamaru North will be designed to accommodate future 400/220kV operation required for any of the identified future generation and demand scenarios. The 220kV substations at Otahuhu and Pakuranga will be designed to accommodate future local 220kV connections.

In terms of consideration of alternatives for a northern termination point, Transpower considered using existing substations, and also separately considered alternative locations in the event that a 'greenfield' substation option was selected. These processes are summarised below.<sup>1</sup>

## 4.2 Substation alternatives

Transpower, in its report entitled "Security of Supply into Auckland, Assessment of Alternative Solutions" dated October 2004,<sup>2</sup> considered a number of locations for the northern terminal stations for the 400kV transmission link. Key factors in these considerations were:

- System Security
- Technical Feasibility
- Economics
- Environmental Impact

A range of existing Transpower substation sites in Auckland including Otahuhu, Pakuranga and Penrose were considered for the northern terminal station. The then proposed 400kV overhead transmission line was assumed to be connected to the terminal station by underground cables.

At the time that this analysis was undertaken, Otahuhu was the preferred site based on the existing and committed transmission and generation investment in Auckland.

The proposal to terminate the line at Otahuhu was suspended in late May 2006. Transpower then worked closely with the Electricity Commission to clarify aspects of the Grid Investment Test. While this work was underway, a failure at Transpower's Otahuhu Substation on 12 June 2006 highlighted the vulnerability of Otahuhu and the need for greater diversity of supply to the Auckland Region and further north. The need for diversity was also emphasised in a Government Policy Statement on Electricity Governance.

With this heightened emphasis on grid security/diversity, as well as using Otahuhu as a termination point, Transpower decided to take the new line from Whakamaru, via a new substation at Brownhill Road, into the existing Pakuranga Substation to add another major transmission route into the Auckland Grid (complementing the Otahuhu – Whakamaru and Otahuhu - Huntly links). Under this scenario, the links from Pakuranga to Otahuhu and Penrose can also be upgraded to strengthen the security of supply. The connection to Otahuhu will follow at a later stage, during which time a series of upgrades to the existing Otahuhu Substation is also likely to occur (as outlined in section 2.3), to ensure security of supply to the Auckland and Northland regions.

Additional factors that make the proposed works essential at the existing substation site at Otahuhu are:

- Otahuhu is currently the core substation at which power arrives into Auckland from the south. The existing 220kV lines into Otahuhu are the critical transmission constraints that need to be alleviated by a new transmission line.

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<sup>1</sup> Note that the initial process related to the 400kV project with a single termination point in South Auckland. From mid 2006 Transpower sought a configuration in South Auckland which allowed for greater diversity and security.

<sup>2</sup> See references in section 16 of Part II of this documentation.

- Otahuhu has strong connections to all major substations in Auckland. Transmission connections to all other substations in Auckland originate from Otahuhu and therefore it is the best location to distribute power throughout Auckland.
- The existing 220kV line from Otahuhu to Henderson transfers bulk power to the North Isthmus, therefore, a new line terminating at Otahuhu can directly transfer power to the North Isthmus without the need for it to flow through intermediate substations.

From a grid planning and risk management perspective it is generally desirable to limit the concentration of transmission capacity at grid nodal points. The preliminary design of a new terminal station has taken common mode failure risks into consideration.

In practice, both the system and environmental studies strongly favoured a location at Otahuhu existing substation as a termination point for the North Island Grid Upgrade Project.

### 4.3 Location alternatives

As part of Transpower's ACRE process for the identification of routes for major lines,<sup>3</sup> preliminary environmental and planning investigations of a range of possible alternative locations for a substation in south Auckland were undertaken at the Area and Corridor stages.

An early stage in the environmental investigations included identifying and reviewing possible substation sites at or in the vicinity of the existing Otahuhu Substation, and within an 8 kilometre radius south. When this work was carried out, Transpower had not completed its system studies and had not determined whether a separate substation site was practicable from a system point of view. Similarly, a preferred corridor for the then proposed 400kV line had not been identified, so it was not clear whether a location to the east or west of Otahuhu could be readily accessed.

Nine separate site options were identified that met the following criteria:

- Sufficiently large site to accommodate the proposed activities and provide a suitable buffer;
- Vacant available land; and
- A location where environmental effects could be appropriately mitigated.

Sites were identified in Favona, East Tamaki, Wiri, Otahuhu, Waiouru Peninsula and Brookby Road. A preliminary evaluation in terms of zoning, natural hazards, access, adjacent landuses, and potential cultural issues was undertaken. All sites, except for the Otahuhu Substation, were identified as having difficulty connecting to the Otahuhu Substation, and most were in locations which were considered unlikely to be readily accessed by an overhead 400kV line. In addition, only the Otahuhu Substation site was regarded as suitable by Manukau City Council officers because of concerns about overhead lines to the various locations, and the use of scarce industrially-zoned land for substation purposes.

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<sup>3</sup> See description of this process in Part II of the Notices of Requirement documentation.

## 5. Description of the environment

### 5.1 Existing landscape

The site is a corner of the urban landscape dominated by existing infrastructure. The existing substation is the central substation for the Auckland urban area. The main switchyard itself covers an area of approximately 300 by 120 metres with ranks of gantries, lines and transformers. The site as a whole covers a much wider area including storage yards, warehouses and heavy workshops. It is dominated by the transmission towers covering a range of designs radiating from the substation. There is also a lattice communication tower located within the site.

The Otahuhu 'B' Combined Cycle Power Station is located to the northeast of the site. This comprises two main structures with a total length of approximately 100 metres and height of approximately 35 metres high. The Otahuhu 'A' Power Station, with the remaining two tall smoke stacks is located further to the east.

The site is adjacent to the Southern Motorway and the interchange with the new expressway to Waiouru Peninsula that is currently under construction.

Beyond the site to the north is the route of the new expressway under construction, and the headwaters of the Tamaki River.

To the south and east are residential areas, mainly comprising state housing, forming part of Otara. There is also a residential area on the opposite side of the Motorway, similarly comprising mainly state housing, in the Wymondley Road area.

The main natural feature in the area is the Tamaki River, a tidal estuary fringed with mangroves, and bordered by low wave-cut banks. The estuary itself has a modest degree of natural character, although it is moderated by the extent of built development along the banks. The estuary provides a reasonably attractive outlook that provides relief from the urban landscape.

The area in the vicinity of the site, on the other hand, has a low degree of natural character and a low level of visual amenity. It is dominated by hard surfaces, large scale industrial buildings, and a complex arrangement of gantries, lattice towers and wirescapes.

### 5.2 Existing noise

Noise surveys have been undertaken in the vicinity of the Otahuhu Substation to determine the existing noise levels for the area.

Noise surveys have measured background noise levels around 50dBA at the most affected residences (8, 12 and 16 Waipapa Crescent). It is only during a few hours in the early morning, and under certain wind directions, that low background noise levels can be measured.

In measuring noise levels in the vicinity, great care was taken to ensure that extraneous noise from traffic was removed from the measured noise levels. Thus, the actual background noise levels may in some areas of the

receiving environment be higher, but these are unlikely to exceed 50dBA in the early hours of the morning for residences that are some distance from the Southern Motorway.

The area surrounding the Otahuhu Substation can, however, generally be described as noisy. It is subject to noise from Contact Energy's power stations and traffic noise from the Southern Motorway. The proposed Waiouru Interchange and the new expressway will result in an increase in traffic noise in the area.

### 5.3 Land stability

The Otahuhu Substation is located on a flat alluvial terrace adjacent to the Tamaki River and Otara Creek. The ground level is approximately ten metres above mean sea level and the existing Substation is 500 metres from the closest terrace edge. The terrace is composed of Tauranga Group Alluvium underlain by Tamaki Sandstone (basement rock).

Geotechnical investigations in the area show that the Tauranga Group alluvium consists of silty clay, fine sandy silt and loose-dense sand with minor beds of organic clay and peat. The thickness of alluvium across the terrace is relatively uniform. Investigations indicate that the boundary between alluvium and underlying sandstone is subhorizontal at an R.L. of approximately minus 8 metres. Areas of very stiff, engineered fill, infill an old creek inlet south of the Contact Energy Power Station. Given the distance of the substation site from Otara Creek, it is considered unlikely that any fill exists below the substation platform. The depth of alluvium (and any fill) beneath the Substation is likely to be approximately 18 metres. From investigations in the area, it is envisaged groundwater will be about 2.4 to 4 metres below ground level at the substation.

The closest active fault to the Otahuhu Substation is the North Wairoa Fault in the Hunua Ranges and therefore the risk of the substation being affected by surface fault rupture is negligible.

Assessment of the susceptibility of the site to liquefaction, based on empirical studies of past liquefaction events, indicates much of the alluvium is not susceptible to liquefaction. It is possible that silty sand layers up to 4 metres thick are potentially liquefiable. The presence of these silty sand layers means the substation site could be affected by liquefaction during earthquakes. As such, this will be specifically addressed as part of the substation foundation investigations and design.

The distance of the substation from the Otara Creek and the Tamaki Estuary is sufficiently great that the substation is not at risk of lateral spreading under earthquake loads or slope instability along the banks of the waterways.

### 5.4 Tangata whenua values

Historically the Otahuhu Substation is located within what has been recognised in contemporary times as the wider Waikato-Tainui rohe, and the iwi and hapu links associated with this part of Tamaki Makaurau reflect this.

Consultation has been undertaken with Te Aki Tai, Ngai Tai ki Tamaki, Ngai Te ki Umupuia and Ngati Paoa all of whom have Tainui links. The nearest marae to the Otahuhu Substation is the Te Aki Tai marae of Pukaki located in Mangere while Ngai Tai ki Tamaki are based in Mt Wellington.

After an initial round of consultation with the Ngai Tai Umupuia Te Waka Totara Trust, Te Aki Tai, Ngai Tai ki Tamaki and Ngati Paoa ki Tamaki, the iwi authorities agreed that the Te Waka Totara Trust would represent:

- Ngai Tai Umupuia, Umupuia Marae;
- Ngati Paoa, Kaiaua Marae;
- Te Aki Tai, Pukaki Marae; and
- Te Ahi Waru, Makaurau Marae.

There are no sites identified in the MDP as being of significance to tangata whenua located within the substation site. However, Ngati Tai Umupuia has advised that the site has some significance in terms of its proximity to the river and to the Tainui Waka site. It can be considered the gateway to the west coast.<sup>4</sup>

## 5.5 Heritage values

There are no archaeological or heritage items on the site identified in the MDP. The site has been developed for many years and no record of such sites has been recorded in this time. An archaeological survey of the site has not been undertaken for this project. However, past surveys (R.E. Clough and D. Prince 1996, R.E. Clough and D. Prince 2000) did not find any archaeological evidence within the Otahuhu Substation site and indicate that it is unlikely that any undetected evidence exists.<sup>5</sup>

## 5.6 Ecological values

The Otahuhu Substation site is largely covered in development or consists of grassed land. There are no notable trees or species of vegetation that have been identified in the MDP on the site.

A large area covered in grass extends from the southern boundary of the sub-station to properties on Gilbert Road. Tree cover in this area is limited to a small number of young pohutakawa plantings, a small gum tree (*Eucalyptus* sp.) and two deodar trees located adjacent to the western side of a disused road off Kaitawa Street.

A grassed area is also located on the northwestern edge of the site.

## 5.7 Roading network and access

The Otahuhu Substation is located on the northern edge of Otara, on the eastern side of the Southern Motorway (SH 1). Access is via Hellabys Road, and then via either Substation Road or Sparky Road. These are no exit roads, which serve the substation and Power Stations. Substation Road and Sparky Road are private roads located within the substation site. The part of Hellabys Road from its junction with Bairds Road until it extends in an easterly direction into the substation site is owned by MCC. Substation Road is a no exit road solely to provide access within the substation site and is accessed by a minor priority junction with Hellabys Road. Hellabys Road joins Bairds Road at a larger T style priority junction. Bairds Road is listed in the MDP as a District Arterial Road.

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<sup>4</sup> Umupuia Consultation Meeting Notes 30.09.05.

<sup>5</sup> An assessment of the archaeological effects of the project is included as section 9 of Part X of this documentation.

Hellabys Road runs down the western side of the Substation site, before turning through 90 degrees to head east to the Contact Power Station. The Southern Motorway runs north - south alongside part of Hellabys Road.

A new motorway access is under construction and nearing completion, which will see a link through to East Tamaki. The new junction will also link in with Hellabys Road. It is likely that Hellabys Road will be reclassified in importance and given the size and location of the new junction it will carry an increase in through traffic. Two new signal junctions are to be installed on Hellabys Road one set at the junction with Bairds Road and one where the new link joins at the north west corner of the Substation site.

Land uses to the south and west of the substation are predominantly residential, but also include schools and colleges (Bairds Primary School, the Manukau Institute of Technology and the Sir Edmund Hillary Collegiate). All these activities are generators of high, morning peak hour traffic flows.

## 5.8 Existing utilities

Existing utilities at the Otahuhu Substation include:

Utility	Equipment	Location
Telecom	Communications cables	1. From the area control building and along the north western fenceline of the existing switchyard 2. Across the north western area
TelstraClear	Communications cable	Along Hellabys Road
Watercare Services	Otara Branch Sewer	Crosses the site from east to west
Manukau City Council	Connection to the Otara Branch Sewer for Contact Energy	Manhole MH11 (near Sparky Road)
Contact Energy	Sewer line	Crosses the north western area site to connect into MH11
	22kV cable	From the control, relay and switchgear building and across the north western site
	Communications cables	Crosses the north western site to the Regional Control Centre
Vector	Gas pipeline	Along Hellabys Road and the north eastern site boundary
	22kV switchgear building	East of the crane room and workshop
	22kV power cables and various control and protection cables <sup>6</sup>	1. Between the control, relay and switchgear building or Vector's 22kV switchgear building; and 2. From the control, relay and switchgear building or Vector's 22kV switchgear building and: <ul style="list-style-type: none"> <li>▪ Along the north western fenceline of the existing switchyard; or</li> <li>▪ Along Substation Road; or</li> </ul>

<sup>6</sup> A number of these cables are now redundant, but have not been removed

	Relays and check metering	<ul style="list-style-type: none"> <li>▪ Across the north eastern site</li> </ul> Transpower's control, relay and switchgear building
Transfield Services	Buildings and associated services	Various
Vodafone NZ Ltd	Microwave dishes Communications compound Copper and fibre optic cables	Mounted on Transpower's communications tower Adjacent to the communications tower Between the communications tower and Vector's 22kV switchgear building
Counties Power	Telecommunications cabinet, broadband antennas, microwave linking antennas	Various

## 6. Assessment of construction effects

The construction methodology for the extensions to the Otahuhu Substation has been described in Section 2.5 of this report. The following section assesses the effects on the environment of the construction phase.

### 6.1 Noise

#### *Description*

During the construction of the extension to the Substation there will be noise generated from the construction activities, including construction traffic, ground improvement works such as dynamic penetration, pile driving, dewatering/ pumping equipment.

#### *Potential Effects*

The effect of noise from construction is likely to have a potential effect only on the residential properties adjoining the southern boundary and part of the eastern boundary of the Transpower site. Land use activities adjoining the site include the Contact Energy combined cycle power station to the north and State Highway 1 to the west. These activities contribute to the existing high noise environment. Noise during the construction phase may however, have the potential to affect residential properties to the south and east of the Substation site.

The construction activities will be of a temporary nature, with the proposed substation extensions anticipated to be completed within 18 to 24 months.

#### *Mitigation Measures*

A condition is proposed requiring that any noise generated by construction activities will not exceed the limits specified in New Zealand Standard 6803:1999 Acoustics – Construction Work, and that sound levels are measured in accordance with NZS 6803:1999, as part of an overall Construction Management Plan. This will ensure that effects of noise generated by construction activities will be minor, particularly given the existing noise environment and high ambient noise levels in the vicinity of the site.

## 6.2 Vibration

### *Description*

Some earthworks on the substation site may require compacting of earth with large machinery to ensure a stable foundation platform for new transformers or other structures.

### *Potential Effects*

The use of large machinery on the site may produce a vibration nuisance effect on nearby properties if continued for long periods of time. Vibration can cause complex sensations depending on the severity and location which may cause discomfort or annoyance.

### *Mitigation Measures*

Rule 5.18.4.1 of the MDP states that activities should not create vibration that exceed specified levels and that measurements should be at the boundaries of residentially zoned land. However, these standards apply to permanent or on-going vibration levels and are significantly lower than vibration levels that can be tolerated for relatively short construction periods.

In the absence of a specific requirement for construction vibration, it is appropriate to take the “Best Practicable Option” approach to avoid, remedy or mitigate any adverse effect of vibration. For transient construction activities, vibration criteria should be based on the avoidance of damage to any buildings adjacent to the demolition and construction sites. In the absence of an appropriate New Zealand standard, it is recommended that the German Standard DIN 4150 be used. The structural damage criteria specified by DIN 4150 are presented in the following Table. Measurement locations for compliance with these acceleration levels are identified following an initial assessment of the area. This would be done as part of the development of the Construction Management Plan, described below.

Type of building	Vibration limit (PPV)
Industrial buildings, concrete buildings	20mm/s
Dwellings	5mm/s
Other buildings, including buildings of historical value	3mm/s

Vibration effects can be adequately mitigated by the imposition of a condition requiring compliance with the German Standard DIN 4150 and through the implementation of a Construction Management Plan. The Plan will include such measures as:

- Limits on hours of operations where vibration causing machinery is used
- Identification of assessment locations where compliance with the vibration limits is required
- Review of the proposed vibration sources and avoidance of use of equipment that produces excessive or unnecessary vibration
- Consultation with residents, including advising residents of any upcoming periods of potential vibration effects
- Monitoring and reporting of vibration levels at affected buildings
- Investigation and mitigation of any specific activities or response to complaints

- Establishment of a programme to inspect houses and measure vibration to address the issue of ground vibration.

## 6.3 Dust

### *Description*

Earthworks associated with the excavation of the site, the transportation of equipment and material to and from the site and the construction of the substation extensions could generate dust.

### *Potential Effects*

The activities associated with the works have the potential to generate dust, which may affect the surrounding environment. There is the potential that dust may affect the operation of the nearby State highway, and be an irritant to occupiers of adjacent residential properties. Unmanaged dust may cause a flashover which could self extinguish or cause a circuit breaker to trip and disconnect the affected equipment that may lead to a temporary reduced system security or loss of supply.

### *Mitigation Measures*

During construction, appropriate dust control measures will be put in place through the Construction Management Plan process. Excavated material will mostly be removed from the site rather than stockpiled although topsoil may be retained for later reuse. Following completion of the works any exposed soil will be re-grassed to mitigate the effects of dust and runoff. Any potential flashover risk can be avoided by appropriate dust control measures.

Vehicles will go through a water bath before leaving the site during the construction phase, and potentially dusty loads may need to be covered.

## 6.4 Visual

### *Description*

During construction a significant amount of machinery and new structures such as transformers and pylons will be temporarily stored and then erected on the site. The site will appear different from its existing format in that some structures presently on site will be relocated permanently, and some temporarily relocated (such as incoming conductors) to allow room for site development.

### *Potential Effects*

The potential visual effects during construction are considered to be minor. The site is not undergoing any change in its 'use' and the appearance of the site during construction will be temporary. The site is an existing large industrial site that is adjoined on its eastern, northern and western boundaries by heavy industrial activities, the Southern Motorway and the construction site of the Waiouru Interchange. Given this existing environment it is anticipated that any visual effects generated by the construction activities will be minor.

### *Mitigation Measures*

During construction, careful consideration will be given to where particular structures and machinery are stored on site so as to not create adverse visual effects from the motorway or from adjacent residential properties. A Construction Management Plan will be prepared and may include (but not be limited to) measures such as

fencing the site along the motorway and residential boundaries with material such as plywood so the works on site do not provide a visual distraction.

## 6.5 Earthworks

### *Description*

The extent of the earthworks will depend on the option approved by the Electricity Commission, underlying soil conditions and the allowable gradient for building platforms. Earthworks may include break out and removal of concrete slabs, concrete footings and asphaltic concrete. The earthworks could be in the order of cut to fill 2,500m<sup>3</sup> and cut to waste (topsoil) about 3,500m<sup>3</sup>. Earthworks associated with the relocation of existing underground services, 220kV underground cables and the construction of tower foundations for 220kV transmission lines are anticipated to be of a minor nature.

### *Potential Effects*

During the excavation of material there is potential for runoff and stormwater flow to occur. This could result in sediment entering the nearby water bodies and affecting water clarity and the amount of suspended solids present in the water bodies.

### *Mitigation Measures*

Depending on the scale and location of the proposed earthworks, resource consents may be required from the ARC. This process will determine the necessary mitigation measures required.

During construction appropriate sediment control measures will be put in place through the Construction Management Plan process. This plan will be prepared to address the effects of site works. Following completion of the works any exposed soil will be re-grassed to mitigate the effects of dust and runoff.

## 6.6 Land stability and erosion

### *Description*

Ground conditions at the Otahuhu Substation site pose no particular problems for construction of the substation extensions. The site is located in an area with a very low susceptibility to slope instability as assessed from the combination of slope and rock/soil materials and where no slope instability has been recorded in the past.<sup>7</sup> It is expected that shallow foundations will be acceptable for new structures. Some undercutting of fill and of weak alluvial material may be required for heavily loaded structures.

### *Potential Effects*

No potential effects have been identified.

### *Mitigation Measures*

No mitigation measures are proposed.

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<sup>7</sup> Manukau City Council Land Information Memorandum 06.11.06

## 6.7 Stormwater

### *Description*

Stormwater from the impervious surfaces of the site arise during rainfall and will consequentially be directed into a stormwater network and discharged offsite. The addition of the new 220kV substation and/or substation extensions and the associated works on site will lead to an increase in impervious surfaces areas, consequentially increasing the stormwater run-off. Investigations into the stormwater at the Otahuhu Substation has determined that the stormwater flows into the existing stormwater system on the Transpower site, and then into a system owned and operated by Contact Energy before discharging into the coastal marine area. Investigations on the stormwater network operational aspects, capacity and the treatment levels are continuing and may result in the need for further resource consents from Auckland Regional Council.

### *Potential Effects*

Stormwater has the potential to collect contaminants as it drains over impervious surfaces. An increase in run-off can have consequential impacts on the capacity of the stormwater network and then point of discharge. An increase in flow rates or volumes of water from a stormwater pipe can cause erosion or scouring around the end of the pipe, and create discoloration and deterioration of receiving water quality. A deterioration in the water quality impact on the aquatic life in the receiving waters by degrading clarity (affecting the amount of light that can penetrate the water column), decrease the availability of oxygen, and contaminant particles can smother benthic dwelling organisms.

Insulating oil is present on the existing substation site, and the volume of oil on site will inevitably increase with the installation of the new substation equipment. Currently, existing onsite facilities provide for the management and discharge of stormwater and the containment of oil in the event of a spill. New oil containment facilities (e.g: bunding associated with the transformers and new oil interceptor system) are proposed to serve the new substation equipment.

### *Mitigation Measures*

The effects of any increased stormwater run-off can be mitigated through the implementation of suitable treatment devices and the replacement of parts of the stormwater network which need to be increased in capacity. In addition, any resource consents required will have conditions imposed to mitigate and minimise the effects of any discharge of stormwater from the site.

## 6.8 Existing utilities

### *Description*

A number of existing network utility services, owned by other network utility operators, cross and / or are located on the Otahuhu Substation site. These are set out in Section 5.8.

Construction of a new 220kV substation in the north eastern area of the site may necessitate realignment of 22kV power cables belonging to Vector. It has yet to be determined if the power cables still exist and, if they do exist, whether they are still required by Vector. Any realignment will only be carried out following discussions with Vector.

The installation of 110 and 220kV underground power cables along Hellabys Road and across the northwestern area of the site will cross:

- Watercare's Otara Branch Sewer;
- Vector's gas pipeline; and
  - Various cables owned by Vector, Telecom and TelstraClear.

Similarly, the installation of 220kV underground power cables along Substation Road will cross 22kV power cables owned by Vector.

The impact of cable crossings on some of the existing utility cables will be minimised. Some existing cables may need to be buried deeper or raised slightly to accommodate the cable crossings. Minor realignment of smaller cables may be required. Existing utility operators will be consulted during the design of the cable crossings and/or realignment.

#### *Potential Effects*

Works associated with the proposed substation extensions have the potential to effect existing utilities under the Substation site. The construction of a 220kV substation in the north western area of the site will impact on Watercare's manhole 11 (MH11) and the Otara Branch Sewer, MCC's sewer connection at MH11 and Contact Energy's sewer line. Following discussions with Watercare it is proposed to replace MH11 with two new manholes. The location and design of the manholes, sewer connections and sewer pipeline will require approval from MCC, Watercare and Contact Energy.

Transpower will require confirmation in writing and certification from Watercare that the proposed earthworks and 220kV substation, comprising high voltage equipment and underground power cables, does not impose undue load on the Otara Branch Sewer. Given that the sewer is at a depth of about 12 metres, any additional load placed on the sewer by the 220kV installation is expected to be minimal.

Effects on cables and pipelines can be appropriately avoided, remedied or mitigated through consultation with the various network utility operators to ensure that appropriate protocols and design requirements are incorporated into the final designs and where relevant included in the Construction Management Plan.

#### *Mitigation Measures*

Transpower will work closely with the various network utility operators to identify the precise location of existing utilities and/or to determine appropriate mitigation measures. Such measures may include the relocation of existing utilities, or designing new proposed activities to avoid or minimise impact on existing utilities. Provisions for alterations to utilities are set out in the appropriate licence agreements between Transpower and the utility owners.

## **6.9 Construction traffic and access**

### *Description*

The construction phase will involve transport of large and heavy equipment onto the site. It is likely the largest single item will be drums of 220kV cable, each drum weighing approximately 20 to 25 tonnes.

Following the construction phase, traffic volumes will be similar to existing levels.

### *Potential Effects*

During construction there will be increased vehicle movements to and from the site by light and heavy vehicles. It is anticipated that the movement of large loads will not cause any significant congestion as these loads will be transported at night time and will not coincide with high or peak traffic flows.

The substation is accessed by a private road where there will be ample space to accommodate heavy equipment transporters while they await access to allow for unloading.

### *Mitigation Measures*

Transporting large and heavy equipment over night to the site will mitigate the potential disruption to traffic. These loads will travel at a predetermined time and on a predetermined route. There is an existing procedure to be followed when carrying out this type of transportation. This procedure consists of consultation and the preparation of a Traffic Management Plan. The Plan will be submitted to Transit and the relevant local authorities for approval prior to the transportation occurring.

## **6.10 Tangata whenua and heritage**

### *Description*

The subject site contains no sites of significance to Maori that have been identified in the operative Manukau District Plan. An Archaeologist on the project did not assess the site, but past surveys (Clough R.E. and D. Prince 1996, Clough R. E. and D. Prince 2000) did not find any archaeological evidence within the Otahuhu Substation grounds and indicate that it is unlikely that any exists undetected.<sup>8</sup>

### *Potential Effects*

The Historic Places Trust Act 1993 protects identified and unidentified archaeological sites and Transpower and its agents must comply with the provisions of this Act.

### *Mitigation Measures*

Should any archaeological remains such as shell, middens, ovens, burials, or occupation evidence be uncovered during construction, an authority is required under the Historic Places Trust Act 1993 to damage, modify or destroy any archaeological site. In cultural terms any excavation work in the area shall be undertaken in conjunction with the terms of the agreed project protocols, this is particularly so in respect of the possibility of uncovering koiwi or skeletal remains. The protocol will require the cessation of work in the vicinity of any such find until such time as the appropriate authorities and nominated iwi representatives have had the opportunity to examine the "find site" and make appropriate recommendations as to how the matter should be dealt with. The protocol will be developed as part of the Construction Management Plan.

Archaeological finds of any type also fall within the responsibility of the project archaeologist and iwi representative for recording and recovery purposes where appropriate.

## **6.11 Ecology**

### *Description*

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<sup>8</sup> See footnote 4.

The ecology of the Substation site has been highly modified through historical vegetation clearance and site development. The site is mainly vegetated in common grass species, which are managed through mowing. Considering the site's highly modified condition, it is considered to possess and contribute only very limited ecological benefits.

#### *Potential Effects*

Due to the degraded nature of the site's ecology, and the separation of construction works on site from the tributary to the Otara Creek, it is considered that the potential for adverse effects to ecology arising from the construction of the proposed substation is no more than minor.

It is considered that there is limited potential for adverse effects to the aquatic ecology of the tributary to the Otara Creek during the construction of the proposed substation. Adverse effects on the tributary could potentially arise through migration of sediment laden runoff from loose soil on the construction site to the aquatic environment.

Insulating oil is present on the existing substation site, and the volume of oil on site will inevitably increase with the installation of the new substation. Currently, existing onsite facilities provide for the management and discharge of stormwater and the containment of oil in the event of a spill. New oil containment facilities (e.g: bunding associated with the transformers and new oil interceptor system) are proposed to serve the new substation equipment.

#### *Mitigation Measures*

The potential for adverse effects to the tributary to the Otara Creek by sediment laden runoff from the active construction areas will be mitigated by the implementation of a Construction Management Plan focusing on the storage and reuse of top soil, on and off site disposal of spoil, and silt and dust control during site leveling and earthworks stages.

The potential for sediment to migrate to the tributary to the Otara Creek is further mitigated by the location of the proposed works being well separated from the tributary. This separation will allow sufficient area for the effective control of sediments originating from the area of works and therefore mitigating the potential for adverse aquatic ecological effects.

The potential for degradation of terrestrial and aquatic ecology by spillage of insulating oil on site is mitigated by the existing and proposed oil containment facilities, thereby avoiding the potential for contamination on site and the potential for migration of oil contamination to the surrounding environment.

Should consents for earthworks be required from the ARC, these will also include conditions to mitigate any effects of these activities on the tributary to the Otara Creek.

## **6.12 Contaminated land**

#### *Description*

It is possible that some earthworks excavations may encounter contaminated soils (e.g. asbestos, hydrocarbons) on the substation site. The site is not recorded as a contaminated site in the MDP or MCC asbestos database.

The Auckland Regional Council did not find any record of the Otahuhu Substation on its contaminated sites database. The database files contain information on historical pollution incidents and some site specific information from archived files. However, just because the site did not appear on the database does not mean the site is totally uncontaminated. Therefore a Contaminated Site Management Plan that sets out the procedures and protocols to be followed should any contaminated soil be discovered will be required.

#### *Potential Effects*

The site has a long history of being used for industrial purposes and given this history it is possible that some earthworks or excavations may disturb contaminated soils.

The type and degree of contamination could conceivably create effects on the operation or functionality of some equipment, the health and safety of on-site construction staff, and on nearby residents if the contamination is particulate (dust) and able to disperse in the air.

#### *Mitigation*

The approach to contamination assessment and, if contamination is suspected or found, to quantification, mitigation and possibly clean-up will be based around the hierarchy of approaches and procedures to be found in the Ministry for the Environment's Contaminated Sites Guidelines series. These MfE documents set out the detailed protocols for qualitative site assessment (already conducted at the Otahuhu Substation site) through to soil sampling methodologies, concentrations of contaminants which trigger specific further actions, and the nature and necessary extent of these action.

Significant hydrocarbon contamination is typically indicated by a distinctive odour in the exposed soil. Should odorous material be uncovered during excavations work should cease and representative samples should be obtained for analysis. Similarly, if foreign material suspected to contain asbestos (such as asbestos-cement board fragments) is uncovered samples will be collected and tested in accordance with a method specified by a New Zealand accredited laboratory for the identification of asbestos. A Contaminated Site Management Plan that sets out the procedures and protocols to be followed should any contaminated soil be discovered at the Substation site will be included as part of the Construction Management Plan and will include the following steps:

- Qualitatively assess excavated soils for contamination; indications can include visual observations such as staining or obvious foreign material (e.g. asbestos-cement), or odour.
- Cease excavation work, take samples as noted above and have these analysed by an accredited laboratory for the suspected contaminants.
- Retain and isolate exposed/excavated soil suspected of being contaminated until laboratory results are received.
- If the material is contaminated above Guideline levels, dispose of as hazardous waste.
- Replace the excavated contaminated material with clean fill, as necessary.
- Groundwater or stormwater which may be contaminated by contact with impacted soils will be retained in a secured area, such as a lined pond. The retained water will be analysed for suspected contaminants; if concentrations are below relevant Guidelines (ANZECC) the water can be disposed to the stormwater system. If contaminants are at or above levels of concern the retained water shall be removed for off-site disposal by a liquid waste disposal contractor.
- At all times isolate site workers from the contaminated material by:

- removing the material to a dedicated position on site
- dampening down and/or covering the material until analytical results are received and off-site disposal can be arranged if required
- ensuring that workers know about the potential risks posed by contact with the material
- prohibiting eating, drinking or smoking except at designated site locations and following thorough washing of exposed skin.

In addition, should evidence of contamination be found, resource consents from the ARC will be required.

## 6.13 Removal of clean fill

### *Description*

Spoil from cut will be mostly or entirely removed from the site. Topsoil, consistent with the MDP requirements, will be retained on or in the vicinity and used for remediation.

### *Potential Effects*

Spoil removal can involve the nuisance effects of dirt and noise, contamination of surface water and traffic impacts.

Clean fill is a resource, which may be able to be reused in an appropriate approved off-site location, or disposed of in a cleanfill or landfill.

### *Mitigation Measures*

Effects associated with the removal of spoil from the site will be avoided remedied or mitigated through the implementation of the requirements of the Construction Management Plan.

## 6.14 Summary of mitigation measures

Mitigation measures during construction will be largely within the scope of the Construction Management Plan which will include provisions to minimise temporary adverse effects on surrounding activities and the environment, including dust, noise, traffic, lighting and safety.

Section 2.6 lists the various aspects which will be included in the Construction Management Plan. A draft Plan will be provided to MCC for review as part of the outline plan process. The Construction Management Plan will also address aspects relating to resource consents required from the ARC.

## 7. Operational effects

### 7.1 Electric and Magnetic Fields

#### *Description*

As described in section 13 of Part II of the Notices of Requirement documentation, electric and magnetic fields (EMF) are a component of the Grid Upgrade Project, as they are an unavoidable part of all systems involving the transmission, transformation and use of electricity.

#### *Potential Effects*

It is Transpower's intention that any EMF from the Substation will meet the guidelines set by the International Commission on Non-ionizing Radiation Protection (ICNIRP). These guidelines have been endorsed in New Zealand by the National Radiation Laboratory (part of the Ministry of Health). In particular, the guidelines recommend a limit of 100 $\mu$ T (microtesla) for magnetic flux density and 5kV/m for maximum electric field strength for public areas.

#### *Mitigation Measures*

Transpower is in the process of confirming that any EMF associated with any existing activities at the Otahuhu Substation and the proposed extensions will meet all the guidelines set by the ICNIRP, even bearing in mind the nature of the immediately adjacent environment. As explained in section 13 of Part II, and in section 12 of Part X, achieving these guidelines safeguards against potential health effects associated with EMF.

## 7.2 Radio frequency interference

#### *Description*

Radio Frequency Interference (RFI) is the generation of unwanted radio signals that can interfere with the correct operation of electrical, electronic, mobile and wireless devices. The four potential sources of RFI from within 220kV substations are corona, disconnector operation, gap discharge and tracking.

#### *Potential Effects*

Gap discharge and tracking are identified by their disturbance characteristic and are commonly attributed to incipient faults. Transpower's policy is to quickly correct these events before they can cause equipment failure. Disconnector operation emissions cannot be corrected or prevented by design but they are irregular (few times per year) and short duration events (seconds).

Corona discharge is the only source of continuous RFI emission and is the principal source of RFI in substations. Corona becomes an issue on networks where the operating voltage exceeds 300kV, but can be controlled by design.

NZS 6869:2004 sets out compliance criteria for RFI emissions from High Voltage Electrical Installations within New Zealand. NZS 6869 requires the RFI strength to be less than 62dB/1  $\mu$ V/m, 20 metres outside the security fence. NZS 6869 also allows an additional 10dB margin for urban environments where the radio signal strengths are stronger than in a rural setting.

Calculations for a proposed 220kV AIS installation indicate RFI will be below the NZS 6869 limits at 20 metres outside the security fence.

#### *Mitigation Measures*

A 12kV/cm voltage gradient design limit will limit the inception of corona even during humid or wet weather.

Live parts in a GIS substation at Otahuhu would be fully encapsulated in earthed steel enclosures. These enclosures provide close to 100% screening of any source of RFI (and EF) emissions. There will be no RFI effects on surrounding land uses at Otahuhu.

Calculations for the proposed AIS installation indicate RFI will be below the NZS 6869 limits at 20 metres outside the security fence. Given the nature of the surrounding environment, effects associated with RFI will be no more than minor.

### 7.3 Noise

#### *Description*

The area surrounding the Otahuhu Substation can generally be described as noisy. The area is subject to high ambient noise levels from Contact Energy's power stations and traffic noise from the Southern Motorway. Records show that the background noise level at Waipapa Crescent increases significantly after 4am in the morning, to a point where it is no longer possible to measure substation noise. Estimates of the background noise indicate levels in excess of L95 50dBA after 4am. The proposed Waiouru Interchange and expressway will result in an increase in traffic noise in the area.

The Otahuhu Substation has existing use rights for existing levels of noise emissions. These levels do not meet the current rules for the Business 5 Zone in the MDP. The noise levels set out in the MDP (Rule 14.11.7) are as follows:

*"The noise level measured at or within the boundary of a site zoned Residential shall not exceed the following:*

ACTIVITY	AVERAGE MAXIMUM LEVEL			MAXIMUM
	L <sub>10</sub> dBA			L <sub>MAX</sub> dBA
	MONDAY TO SATURDAY 7.00AM - 6.00PM (0700-1800)	MONDAY TO SATURDAY 6.00PM - 10.00PM (1800-2200)  SUNDAY AND PUBLIC HOLIDAYS 7.00AM - 10.00PM (0700-2200)	AT ALL OTHER TIMES	10.00PM - 7.00AM (2200-0700)
Residential Papakainga or Maori Purpose zoned sites adjacent to land zoned Business 4, 5 or 6, and where the background noise level is 50 dBA or greater.	55	50	45	75 [Am5]
All other sites	50	45	40	70 [Am5]

*The noise shall be measured with a sound level meter complying at least with the International Standard IEC 651 (1979) Sound Level Meters, Type 1."*

Transformer noise is tonal in character, and thus it incurs a 5dBA penalty for special audible characteristics as prescribed in NZS 6802:1991 *Assessment of Environmental Sound* and NZS6802:1999 *Acoustics-Assessment*

of *Environmental Noise*. Thus any noise levels specified in district plans need to be reduced by 5dBA when noise is measured for compliance purposes.

Transformer noise is relatively constant, and therefore contributes to the “ambient” or background noise of the area. It is most likely to be noticed at night when other noise is at lowest levels.

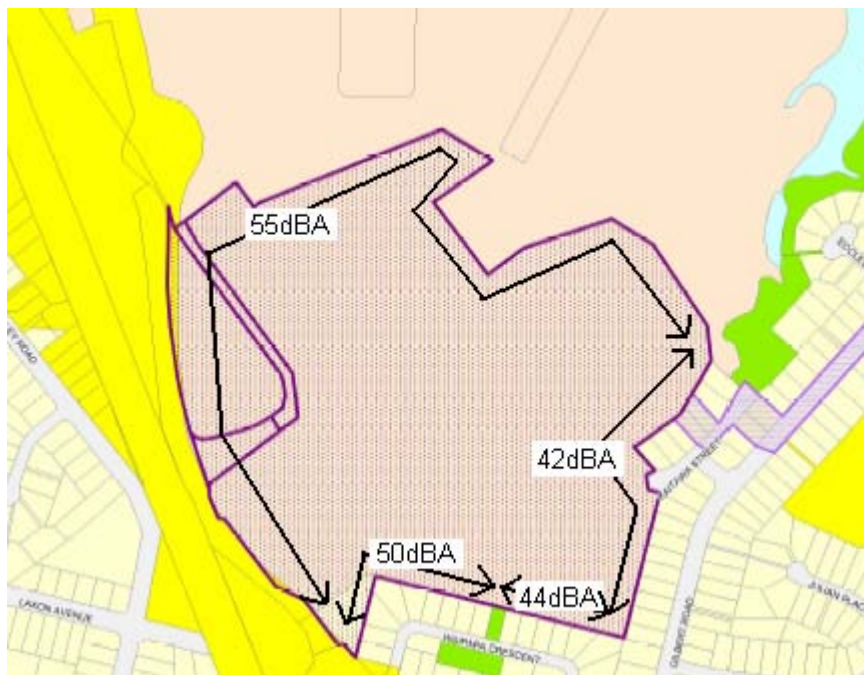
#### *Potential Effects*

Noise effects can become a nuisance for people in nearby inhabited dwellings or workplaces that cause discomfort or annoyance in people who hear, or who consider they are particularly sensitive to noise. As far as is known, there have been no noise complaints relating to the existing substation, which makes a relatively small contribution to overall noise levels in the area.

#### *Mitigation Measures*

To provide a framework which is both reasonable for Transpower and for the surrounding community it is recommended that a specific noise limit for the Otahuhu Substation Designation be based upon the existing noise emissions from the substation.

Figure 5 presents the recommended noise limits at various locations along the designation boundary, and is the basis for a proposed condition. These noise limits should apply regardless of which substation extension option is selected.



**Figure 5: Recommended designation boundary noise limits (L<sub>10</sub>)**

Compliance with the above provisions is proposed to be assessed by measurement of sound power levels at transformers and other equipment and calculated at the designation boundary where it adjoins land zoned Residential. This method of measurement and assessment of compliance will overcome the difficulty of actual measurement and demonstration of compliance within the high ambient noise environment.

The designation boundary adjacent to the Residential Zone as a compliance location, rather than the more typical measurement location at or within a zone boundary, is also proposed for simplicity, because of the varying noise levels received in different parts of the residential area, and the changes that will take place over time at or within the residential zone.

## 7.4 Light spill

### *Description*

For reasons of security or for urgent maintenance, outdoor lighting is required at substations. As set out in section 3.2 the MDP contains rules relating to light spill. Transpower intends to meet the requirements of the MDP by applying the following policies and standards:

- Transpower Policy TP.GS.41.01 Issue 2, 2003 – Requirements for Outdoor Switchyard Lighting.
- AS 4282 1997 – Control of the Obtrusive Effects of Outdoor Lighting.
- AS/NZS 1158 Lighting for Roads and Public Spaces part 3.1 2005 : pedestrian area lighting.

### *Potential Effects – Residential Land*

Site investigations carried out in May 2006 established that all the residential boundary requirements of the MDP are currently being met.

The distance from the nearest residential boundary to the 220kV substation extensions will depend on the option approved by the Electricity Commission. The new substation extensions could vary from 30 metres to over 300 metres from the nearest residential boundary in Kaitawa Street. The new substation extensions could vary from 50 metres to over 250 metres from the nearest residential boundary in Waipapa Crescent. The new 220kV compounds will be at least 200 metres from residential areas on the west of State Highway 1. At distances over 50 metres, an obtrusive light level of 10 lux (horizontal or vertical) resulting from the additional switchyard lighting is extremely unlikely. Careful lighting design will be sufficient to meet the MDP requirements of rule 5.18.2.1 (i) at the closer boundaries.

The 220kV extensions on the north of the site are unlikely to affect the residential areas to the south. Depending on the option approved, these extensions could be within 200 metres of residential properties to the west. Site investigation in May 2006 indicated that while there was some unnecessary spill light coming from security fittings mounted on the existing ancillary buildings in this area, the light spill clauses of the MDP were being met at residential boundaries. The proposed designs will remove or revise existing buildings in this area so the MDP will be met by designing new lighting in accordance with Transpower's policy.

To limit any effects related to indirect illuminance (Rule 5.18.2.1 (ii)), it is proposed to provide planting along the Gilbert Street boundary and at the boundary with Kaitawa Street in order to screen the switchyard ground surface.

Transpower's policy is to limit glare in accordance with AS4282 1997. Therefore, the effects of obtrusive light spill, glare or other visual disturbance on or at the residential boundaries should be no more than minor and Rule 5.18.2.1 (iii) will be met. For the enclosed switchyard option, particular care would be taken to limit contrast glare arising from lighting seen through switchyard building windows at night.

The existing south boundary abuts residential properties in Kaitawa Street. It is proposed that the general amenity/car park lighting in this area will be reduced to P11b or P11c class (AS / NZS 1159 part 3.1 2005 refers) to meet the MDP requirements.

#### *Potential Effects – Roadway Network*

Rule 5.18.2.1 (iii) of the MDP also refers to glare issues related to the roadway network. Provided the proposed Substation extensions are lit in accordance with Transpower's policy, it is unlikely to affect the Southern Motorway (SH 1). However, the placement of lighting in the new 220kV substation extensions in the north-western area will need to be designed to limit glare to the new interchange roundabout and associated roads and additional mitigation methods may be required to achieve this.

Prior to the Waiouru Interchange project, the shortest distance between the Transpower site boundary fence and the Southern Motorway was approximately 25 metres, with a distance of over 40 metres between active switchgear and the Motorway. At that time there was mature vegetation planted along the Motorway boundary. While there are some mature trees adjacent to the Motorway boundary in the area closest to the existing 110kV switchyard (Hellabys Road area), southbound traffic currently has a view of the existing buildings to the north, where new substation extensions are proposed.

The Waiouru Interchange design does not change the overall alignment of the Southern Motorway, but it does introduce a roundabout and various slip lanes on the east of the highway as well as a merge lane near the existing 110kV and 220kV switchyards. The merge lane reduces the distance between existing equipment and the Southern Motorway. The new overbridge and roundabout screens some of the new 220kV site from the southbound traffic, but traffic coming from Waiouru Peninsula and on the roundabout will have an elevated view of the 220kV substation extensions in the north-western area and this will need to be considered in the lighting design.

The roundabout comes within 45 metres of the boundary fence, the slip road comes within 25 metres of the boundary fence, and new equipment in the northwest area could be as close as 65 metres from the slip road and 85 metres from the roundabout respectively. These distances are similar to those between the Motorway and the existing 110kV and 220kV equipment. Appropriate planting could be used for mitigation of direct and indirect glare.

One slip lane comes off the roundabout and connects to the existing site access road (Hellabys Road). The status of this road changes, as it appears to offer a bypass route through to Otara from the Waiouru Peninsula. This road is now extremely close to the boundary and appears to be within 15 metres of active equipment. A tall concrete wall has been installed in this area which limits indirect glare from the switchyards. Direct effects from the existing switchyards are not significant for slip lane traffic, but the glare source presented by security lighting to the northwest will need to be addressed during extension design. Particular attention will also need to be paid to limiting any glare to slip lane traffic from the substation extensions in the northwest area.

Transpower policy is to meet MDP requirements and avoid adverse environmental effects from switchyard lighting. However, additional mitigation measures will be investigated in the area to the northwest, as lighting within the new 220kV compound may still affect the traffic on and approaching the new roundabout, even with careful design. Existing mitigation measures in the Hellabys Road area will also need to be retained and/or modified.

### *Mitigation*

All exterior lighting will be designed and located to ensure compliance with the following policies, standards and requirements:

- Rule 5.18.2 of the MDP (and thereby Rule 14.11.11 of the plan).
- Transpower's Requirements for Outdoor Switchyard Lighting Policy (2003)
- AS/NZS 1158 Lighting for Roads and Public Spaces, Part 3.1 (2005)
- Australian Standard – Control of obtrusive effects of outdoor lighting (AS 4282 – 1997)

In addition to meeting the policies and standards listed above the following mitigation measures are also proposed.

- A Lighting Design Assessment Plan will be prepared as part of the Construction Management Plan.
- Additional planting to the northwest and southeast of the site

## **7.5 Earth potential rise**

### *Description*

For a description of earth potential rise (EPR) and its potential effects refer to Part II, section 14 of the Notices of Requirement.

Transpower will design all substation equipment to comply with the requirements of regulations 58 and 60 of the NZ Electricity Regulations 2002, using the formulae and methods detailed in IEEE 80 (2000) "*IEEE Guide for safety in AC substation grounding*". The design procedure will follow established industry best practice and will ensure that step, touch, and transferred voltages are controlled to prevent any danger to the public.

### *Potential Effects on other Utilities and Mitigation*

Design work will be carried out to ensure compliance with the above regulations and industry recognised guidelines in relation to infrastructure services located in close proximity to overhead lines and underground cables within the Otahuhu Substation. This can include use of standard mitigation measures such as use of earth mats and other targeted protection.

Where specific instances require, Transpower will work with utility owners to modify or improve conductive telecommunications, pipelines, or power and utility services, in order to reduce risks associated with EPR issues to the lowest practicable level. These works would be designed and agreed upon between Transpower and the service owner to minimise any service issues for customers.

## **7.6 Landscape effects**

### *Description*

Due to its location, surrounding land uses and existing activities, the site has a high capability to accommodate any of the three extension options proposed for the Otahuhu Substation. All the options will be in keeping with the existing character and will constrain effects to a site already affected by existing infrastructure.

The AIS substation options are similar in general appearance to the existing equipment on site, comprising a hard surfaced compound containing a series of gantries and 'buswork', a complex wire-scape of circuits, and ground mounted equipment including transformers. The GIS substation option would be more compact and would contain the relevant equipment within a large building. Re-alignment of existing transmission lines and termination towers would also be required.

#### *Potential Effects*

The site has a high capability to accommodate the proposed substation extensions which will be in keeping with the existing character. The effects will be constrained to an area already affected by existing infrastructure.

The substation extensions will be buffered from surrounding areas by other infrastructure elements including the existing switchyard, heavy workshops and storage compounds to the south; warehouses to the west; the Otahuhu Power Station to the east; and the new expressway to the north. A planted bund has recently been installed on the southern side of the expressway (i.e. between the expressway and the site).

While the site is a logical location for such a facility, consideration needs to be given to cumulative effects. The proposal will add to the visual clutter, and require additional towers and 'wire-scapes' within the site. However, the change will be incremental in nature. It will not lead to a qualitative change in how the site is perceived. The appropriate strategy is to constrain effects to the existing site, and undertake mitigation works to improve screening of the entire site.

Options 1 and 2 will be somewhat similar in appearance, and the nature and degree of effects will be similar. Option 3 will result in a large building in the north-west part of the site, closer to the southern motorway and new expressway. It will be more prominent from these directions than Options 1 and 2. However the site is still able to readily accommodate option 3 and the overall degree of effects will be similar.

Effects on natural biophysical features and the landscape's natural appearance will be insignificant given the site's completely modified character. In particular any effects on the Tamaki River will be minor. The substation is separated from the Tamaki River by the new expressway which incorporates a planted bund on its inland side.

#### *Mitigation Measures*

The degree of effects likely to be generated by the proposed substation extensions do not warrant mitigation specific to the substation. Rather it is recommended that mitigation measures be applied to address cumulative effects of the site as a whole.

It is recommended a Comprehensive Landscape Plan be prepared as part of the Construction Management Plan to provide:

- screening of the entire Substation site from the Southern Motorway, the Waiouru Link Road, and Tamaki River – where practicable such planting to complement mitigation work being carried out in association with current road construction;
- screening of particular views from residential areas, such as in the direction of Kaitawa Street, and part of Wymondley Road.

## 7.7 Visual effects

### *Description*

The site can be viewed from the Southern Motorway and the Bairds Road Overbridge. Once the Waiouru Interchange and Expressway are completed the site will be visible from these roads. The site is also visible to a limited extent from some nearby residential areas.

### *Potential Effects - from roads*

The site potentially has high visibility because of its location at the interchange of the new Waiouru link road. However the actual visibility will be restricted by other features around the site, and the effect on visual amenity will be relatively minor because of the context.

Views from the motorway will be constrained south of the site by the Bairds Road over-bridge and existing development adjacent to the motorway, and views will be constrained from the west immediately adjacent to the site by the new interchange which includes ramps either side of a new over-bridge. There will be longer distance views across the Tamaki River from the motorway to the north, although planting associated with the new expressway is likely to restrict this, and it could be reinforced by additional planting on the substation site. From this viewpoint Option 3 is likely to be the most prominent of the three options although the effects can still be readily absorbed within the context of the existing substation.

The clearest view is likely to be from the new over-bridge associated with the interchange, which will provide elevated views over the site. However in this instance, and other places where there are glimpses to the site, the substation will be a reasonable distance back within the site and will tend to merge with the existing infrastructure.

The substation extensions will be visible from the Bairds Road over-bridge, although views will be through the gantries and buswork of the existing switchyard.

### *Potential Effects – from residential areas*

The site will be visible from the rear yards of properties on Kaitawa Street to the east. Options 1 and 2 would have similar effects from this area. In the medium term Option 3 would have less effects, although in the longer term, extension of the existing substation is likely to be similar in effects to Options 1 and 2.

The substation extensions will be approximately 120m from houses, and there are clear views in places from the rear of the properties. However the visual amenity effects would still be low given the separation and context with the surrounding substation site. The intervening landscape includes a storage compound and several smaller buildings.

Large trees growing along a tributary of the Otara Creek screen the site from residential areas further to the east, for instance from Eccles Place, Gaye Crescent, Bentley Road, and most of Gilbert Road.

The substation site is technically visible from the rear yards of houses to the south on Waipapa Crescent and a small part of Gilbert Road. However it will be approximately 350m away, and beyond intervening buildings and the existing switchyard.

Ramps associated with the new interchange will screen the site from most residential properties on the opposite side of the motorway to the west. There are currently glimpses toward the site from the rear of about six properties on one part of Wymondley Road, although these are likely to be screened by planting associated with the new interchange. In any event any visual amenity effects would be negligible. The substation extensions

would be quite distant, and seen in the context of the existing facility. The existing switchyard is closer and likely to remain far more prominent.

As set out in section 3.4.2 of this report, the MDP sets no height limit for activities located in the Business 5 Zone (the substation land is zoned Business 5). However, the zone provisions include rules relating to height in relation to boundaries and require that buildings must be contained within a specified building envelope where a site adjoins a residential zone or a road. Whichever substation extension option is chosen will be designed and located to ensure compliance with the yard (Rule 14.11.2) and height in relation (Rule 14.11.1) requirements of the Business 5 Zone.

#### *Mitigation Measures*

As for landscape effects, the extent of effects likely to be generated by the proposed substation extensions do not warrant mitigation specific to the substation (apart from compliance with the yard (Rule 14.11.2) and height in relation (Rule 14.11.1) requirements of the Business 5 Zone). Rather it is recommended that mitigation measures be applied to address cumulative effects of the site as a whole.

It is recommended a Comprehensive Landscape Plan be prepared as part of the Construction Management Plan to provide:

- screening of the entire substation site from the Southern Motorway, the Waiouru Link Road, and Tamaki River – where practicable, such planting to complement mitigation work being carried out in association with current road construction;
- screening of particular views from residential areas, such as in the direction of Kaitawa Street, and part of Wymondley Road.

## **7.8 Hazardous substances**

#### *Description*

The Otahuhu Substation utilises insulating oil in power transformers, circuit breakers and other transmission equipment. Transpower's policy document 'Oil Spill Management, TP:GS.54.01' will be observed in order to avoid, remedy or mitigate any adverse effects which may occur in the unlikely event of an accident occurring. This document provides design guidelines, including requirements for bunding and requires the preparation of an Oil Spill Management and Contingency Plan. In total, there are about 550,000 litres of transformer oil in use at the site.

There are also other hazardous substances used and/or stored at the site. These include paints and solvents of various sorts (approximately 30 litres in total) which are stored, when not in use, in a metal dangerous goods cabinet, and polychlorinated biphenyls (PCBs; about 50 kilograms in total). These latter materials are stored in securely sealed containers within a locked cage in the site workshop. The PCBs are no longer used and are in storage awaiting collection and disposal.

#### *Potential Effects*

The likelihood of leakage or spillage of transformer oil is considered to be low as the equipment is sealed or self contained; nonetheless the transformers will be bunded to provide additional secondary containment.

Adverse environmental effects from leakage of stored PCBs awaiting disposal is considered to be highly unlikely, given the stringent and secure storage conditions imposed.

The use of a lockable dangerous goods cabinet to store paints and solvents is an effective measure aimed at preventing spillage of these materials and thus precluding any associated adverse effects.

#### *Mitigation Measures*

Several of the measures applied have been commented on in the preceding paragraphs. Any oil and/or stormwater within the bunded areas around the transformers will be contained and will pass through an oil interceptor before being discharged to ground soakage. The bunded areas and drainage will be regularly inspected, and any oil found will be removed and disposed of in compliance with the Oil Spill Management and Contingency Plan for the site as required by TP:GS 54.01.

The Hazardous Facility Screening Procedure has been applied to the types and quantities of hazardous substances stored at the site, in order to establish the relative degree of risk posed by the different materials stored or used and whether or not a consent is required. In fact the HFSP calculations show that the derived Quantity Ratio for the “Environment” Effect Type exceeds the trigger level for which the storage or use of hazardous substances would be a discretionary activity under the MDP. It is the transformer oil and, more particularly, the quantity and potential environmental effects of this material if released, which dominate the HFSP calculations. Thus this suggests that any designation conditions with respect to hazardous substances used at the Otahuhu Substation site should focus on containment of transformer oil and other contingencies to prevent or mitigate spillage. As noted above, such extensive mitigation measures are already in place.

## 7.9 Greenhouse gas effects

#### *Description*

Sulphur hexafluoride (SF<sub>6</sub>) is an inert, non-flammable, non-toxic, odourless and colourless gas that is five times heavier than air. The global warming potential of SF<sub>6</sub> is extremely high. It is a synthetic gas and is exceptionally stable once released into the atmosphere. SF<sub>6</sub> has excellent insulating properties, which makes it the preferred insulator for high voltage equipment within the electrical supply industry.

At the Otahuhu Substation SF<sub>6</sub> will be used in circuit-breakers (20 kg per current breaker for the AIS 220kV substation equipment, and less than 150 kilograms per circuit breaker for the 220kV GIS substation (Option 3), or less than 2000 kilograms in total initially and 3500 kilograms in total ultimately). SF<sub>6</sub> is subject to some leakage even from the best-maintained equipment. Manufacturers guarantee leakage to be less than 0.5% per annum but industry experience indicates the leakage is more likely to be between 0.1 to 0.2%.

#### *Potential Effects*

To recognise the high global warming potential of SF<sub>6</sub>, a Memorandum of Understanding (MOU) has been signed between Transpower, other SF<sub>6</sub> users and the Government. This provides an appropriate mechanism for monitoring SF<sub>6</sub> use nationally and ensuring that emissions are minimised, without placing undue costs or restrictions on the electricity supply industry.

The proposed use of SF<sub>6</sub> will comply with all requirements of the MOU.

#### *Mitigation*

A slight loss of SF<sub>6</sub> is an unavoidable effect from insulated transmission equipment. It is dealt with at national policy level through the MOU, and implemented through a rigorous monitoring and maintenance programme.

## 7.10 Summary of mitigation measures

Mitigation of the operational effects of the Otahuhu Substation and proposed extensions is achieved through the choice of site, design requirements and the imposition of conditions on the designation. The site is sufficiently large that most effects (other than visual and construction traffic) are or will be readily contained within the site boundaries. Visual impacts are moderated by the existing character of the area, which is dominated by heavy industrial activities and other major infrastructure.

Mitigation through the construction phase is provided for through contract specifications, which include a range of requirements including the preparation and implementation of a Construction Management Plan. This will address and seek to avoid or minimise construction noise, dust, sediment, traffic and any community effects. These are temporary, but potentially significant effects if not well managed.

Long-term potential effects relating to hazards such as oil storage and SF<sub>6</sub> release involve appropriate maintenance and best practice in compliance with Transpower's standards and policies. The minor potential risk of EPR affecting network utilities will be addressed through ongoing investigations and negotiations as design proceeds.

Any long-term adverse effects of the use and maintenance of the Otahuhu Substation are minor and no specific ongoing mitigation is required beyond that which is an integral part of the project design and operation.

## 8. Other effects

The proposed extensions to the Otahuhu Substation will have the following additional effects.

### 8.1 Cumulative effects

Increasing the size of the substation will lead to a consequential increase in a number of effects such as visual and stormwater discharge volumes. The cumulative visual effect will arise from the additional built development on the site. However, the use of the site will not change, nor will the visual effects be markedly different given the equipment that is already located on site. Therefore, the visual effects are likely to become reduced over time as people who live nearby or travel past regularly become more accustomed to what they are viewing.

It is considered that the effects of the additional stormwater discharges can be appropriately managed throughout the implementation of effective and efficient on-site stormwater treatment.

Noise levels will be managed so that they remain at existing levels.

### 8.2 Positive effects

The positive effects of the designation are part of those that relate to the whole of the North Island Grid Upgrade Project in terms of ensuring adequate delivery of electricity to the upper part of the North Island. The upgrade of the Otahuhu Substation as part of the North Island Grid Upgrade Project from Whakamaru to Auckland will

enable Transpower to ensure the bulk supply of electricity to Auckland and the upper North Island to meet growing demand by 2010, and for the following decades.

The Grid Upgrade Project is nationally significant and will have a range of benefits and positive effects for both the regional and national economy and, as a consequence, for the social and economic well-being of the country.

The upgrade of the Otahuhu Substation is an integral part of this Project and has a specific role in the transformation of electricity into an appropriate voltage, and its subsequent transmission and distribution.

In addition, the project will provide local jobs on a temporary basis and provide stimulus to the local economy through the purchase of goods and services during the construction stage.

### 8.3 Social effects

No potential social effects on the households living in the vicinity of the Otahuhu Substation have been recorded in the consultation documentation. It can be anticipated that the project will create some uncertainty about the nature and scale of impacts for these households. However, as demonstrated in sections 6 and 7 of this report, any social effects, including during the construction phase, are expected to be minor. Potential effects can be mitigated by good community information and liaison programmes.

In the operational phase the substation extensions will be integrated into the wider site and operated within a range of performance conditions, which should limit any on-going effects.

## 9. Consultation

A consultation programme for the changes at Otahuhu Substation was undertaken as part of the wider consultation for the underground cable section and the transition station. This is described in section 7 of Part II and in section 2 of Part X. A brief outline is provided here.

On the advice of Mikaere and Associates Ltd, Transpower consulted with the following iwi, hapu and organisations.

- Ngai Tai Umupuia, Umupuia Marae;
- Ngati Paoa, Kaiaua Marae;
- Te Aki Tai, Pukaki Marae; and
- Te Ahi Waru, Makaurau Marae.

Stakeholder and statutory organisations consulted included:

*Utility Operators*

Watercare

Vector

Telecom

TelstraClear  
Natural Gas Corporation

*Statutory Bodies*  
Auckland Regional Council  
Manukau City Council  
Department of Conservation

*Others*  
Contact Energy  
Transit

Public consultation activities in relation to the Otahuhu Substation were also undertaken, including the distribution of newsletters and information sheets, and drop-in sessions at local libraries, attended by a number of local people. At the stage of public consultation, a larger (400kV) upgrade was proposed at Otahuhu Substation.

No submissions were received in relation to the extensions to the Otahuhu Substation during the submission period on the substations, underground cable and former proposed transition station, and consequently no people spoke to the topic at the hearings that were later held. No specific issues relating to the substation have been identified through the consultation process.

Transpower is continuing consultation through meetings, particularly with stakeholders such as Watercare, Contact, Vector, Telecom and TelstraClear.

In terms of public consultation it was considered that the reduced level of development at the Otahuhu Substation associated with the North Island Grid Upgrade Project (compared to the earlier proposal) did not require further consultation, as generally, any associated effects are less.

## 10. Conclusion

The upgrade of the Otahuhu Substation is an integral part of the North Island Grid Upgrade Project from Whakamaru to Otahuhu. The upgrade will help to meet the growing demand for electricity in the upper North Island and to ensure that homes and workplaces have a secure electricity supply by the time preliminary works are completed in 2010. The positive effects associated with the Project require consideration in any assessment under the RMA.

The expansion of the existing Substation is the most suitable option and it is considered that the mechanism of a designation is the best way to holistically consider all aspects of the operation and obtain longer-term RMA security commensurate with the large investment being made in the infrastructure upgrade.

The Otahuhu Substation site has a long history of being used for electricity system purposes. The extensions to the substation will be relatively modest additions to the existing Otahuhu Substation and in keeping with the existing character and amenity of the wider area, which is dominated by hard surfaces and large scale industrial buildings and infrastructure.

The range of mitigation measures proposed will ensure that adverse effects are appropriately avoided, remedied or mitigated.

## 11. Section 171(1) of the RMA

Section 171(1) of the RMA requires that particular regard must be had to a number of matters when considering a notice of requirement, submissions received on the notice, and the effects on the environment of allowing a requirement. These considerations are subject to Part 2 of the RMA, which sets out the RMA's purpose and principles. With regard to the section 171(1) matters, the following commentary is provided.

### 11.1 Relevant provisions of plans and policy statements

The Otahuhu Substation site, while it is within the coastal environment, does not raise any material issues with regard to the New Zealand Coastal Policy Statement (NZCPS) given the current use of the site, the lack of any special or notable features, and the nature of the existing environment. Therefore, the NZCPS has no particular relevance to this Notice of Requirement. There are no other relevant national policy statements. The provisions of the Hauraki Gulf Marine Park Act 2000 are also not considered to be of particular relevance to this Notice of Requirement.

The relevant provisions of the Auckland Regional Policy Statement are set out in section 4 of Part X of the documentation, and it is considered that the proposal is generally in accordance with the objectives and policies that relate to the provision of national and regional infrastructure, in the interests of the economic and social wellbeing of people and communities in the region. In terms of these provisions, and also in terms of relevant objectives and policies of the MDP set out in section 5 of Part X of the documentation, there is recognition of the need for and benefits of a reliable electricity system. Generally, the choice of the existing Otahuhu Substation site has avoided any conflict with other policy provisions. In summary, the Notice of Requirement is generally consistent with the relevant rules and standards, and is not inconsistent with the objectives and policies of the relevant parts of the MDP.

### 11.2 Consideration of alternatives

Transpower is the owner of most of the land proposed for designation, and the site has been used for electricity system purposes for many decades. Regardless of whether Transpower is obliged to give adequate consideration to alternative sites, routes and methods by virtue of section 171(1)(b) of the RMA, for the reasons set out in section 4 of this report, it is considered that Transpower's consideration of alternative sites and methods has been adequate. Transpower has considered both location and substation alternatives in considerable detail and taken into account a range of relevant factors, including environmental effects.

### 11.3 Work and designation reasonably necessary to achieve objectives

This aspect is addressed in section 1 of this report (and in Part II as part of the overall project), and it is concluded that both the work and the designation are reasonable for achieving Transpower's objectives.

## 11.4 Other relevant matters

There are no other matters which are considered reasonably necessary to consider in relation to the Notice of Requirement, other than to emphasise that while components of the entire project are addressed in separate documents because of the legal requirements of the RMA, the entire project is an integrated project. This means that there is a need to consider the Notices of Requirement for all parts of the project together in an integrated manner and where appropriate, the associated applications for resource consents.

Details of the development will be subject to further scrutiny by the MCC through the outline plan process.

## 11.5 Part 2 of the RMA

The purpose and principles of the RMA are set out in Part 2 (sections 5, 6, 7 and 8) of the RMA. The Notice of Requirement needs generally to be consistent with Part 2 of the RMA.

Section 6 of the RMA identifies matters of national importance, which must be recognised and provided for in achieving the purpose of the RMA. Section 6(a) - the preservation of the natural character of the coastal environment, wetlands, lakes and rivers is relevant to this Notice of Requirement. It is considered however that the site, while it is within the coastal environment, has very low natural character and any effects on the natural character of the coastal environment will be negligible in this location.

It is considered that no issues are raised with regard to section 6(b) – the protection of outstanding natural features and landscapes from inappropriate subdivision, use and development, in that the site and its surrounds is part of a developed urban area.

The proposal does not affect section 6(c) – the protection of areas of significant indigenous vegetation - as no removal of vegetation is proposed and there is in fact no significant vegetation or habitats affected.

In terms of section 6(d), the proposal does not further impact on public access to the coastal environment in comparison with the existing situation, and there are no known archaeological or cultural heritage features associated with the site, ensuring that section 6(e) is met.

Sections 6(f) and (g) are not considered relevant.

The proposal is not inconsistent with other relevant matters in section 7 of the RMA to which particular regard must be had. The proposed archaeological protocol ensures consistency with sections 7(a) and (aa) kaitiakitanga and the ethic of stewardship.

Section 7(b) refers to the efficient use and development of natural and physical resources. The Otahuhu Substation forms an integral part of the transmission link between Whakamaru and Otahuhu and it is Transpower's objective that the link is safe, efficient and consistent with grid reliability standards. In addition, the location of the new substations generally on the same site as the existing substation is considered to be an efficient use of the land and existing physical resources in the vicinity, by avoiding the need for the development of a substation on a Greenfield site.

Due to the nature of the existing environment, and the proposed mitigation measures, it is considered that amenity values and the quality of the environment in the area will be maintained and potentially enhanced with regard to noise emissions, consistent with sections 7(c) and (f).

## 12. Suggested conditions

Proposed restrictions and indicative outline conditions are proposed for the Otahuhu Station in this Notice of Requirement. Transpower would wish to discuss further the precise wording of any specific conditions with the MCC during the processing of this NOR.

### 12.1 Proposed restrictions

#### Noise levels:

- Compliance with New Zealand Standard 6803:1999 Acoustics – Construction Work, and that sound levels are measured in accordance with NZS 6803:1999
- Compliance with the existing noise emission levels from the Otahuhu Substation

#### Earth Potential Rise

- Compliance with regulations 58 and 60 of the NZ Electricity Regulations 2002

#### Electromagnetic fields:

- Compliance with ICNIRP Guidelines

#### Radio frequency emissions

- Compliance with Radio Frequency Standards – NZS 6869:2004 Limits and Measurement Methods of Electromagnetic Noise from AC Power Systems

#### Vibration

- Compliance with German Standard DIN 4150

#### Light Spill

- Compliance with AS/NZS 1158 Lighting for Roads and Public Spaces 2005 Part 3.1
- Compliance with AS4282 1997, Control of Obtrusive Effects of Outdoor Lighting
- Compliance with Transpower's Requirements for Outdoor Switchyard Lighting Policy (2003)

#### Hazardous Substances

- Compliance with Transpower's Oil Spill Management Policy (TPG:GS.54.01)

#### Location and Height and Bulk

- Compliance with the yard (Rule 14.11.2) and height in relation (Rule 14.11.1) requirements of the Business 5 Zone of the Manukau District Plan (as at time of lodging the NoR).

## 12.2 Other proposed conditions

- A Construction Management Plan to be provided as part of the outline plan process as set out in Section 2.6 of this report.
- An accidental discovery protocol for archaeological and cultural sites to be implemented should any such sites be uncovered