BEFORE INDEPENDENT COMMISSIONERS
AT PALMERSTON NORTH

UNDER	the Resource Management Act 1991 ("**RMA**")
IN THE MATTER	of a notice of requirement ("**NoR**") for a designation by KiwiRail Holdings Limited ("**KiwiRail**") for the Palmerston North Regional Freight Hub under section 168 of the RMA

EVIDENCE ON BEHALF OF KIWIRAIL

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UNDER the Resource Management Act 1991 ("**RMA**")

AND

IN THE MATTER of a notice of requirement ("**NoR**") for a designation by KiwiRail Holdings Limited ("**KiwiRail**") for the Palmerston North Regional Freight Hub ("**Freight Hub**") under section 168 of the RMA

STATEMENT OF EVIDENCE OF TODD MOYLE
ON BEHALF OF KIWIRAIL HOLDINGS LIMITED

CORPORATE

1. SUMMARY

1.1 KiwiRail manages and operates the national railway network and the Interislander Ferries. This infrastructure carries approximately 25% of New Zealand's exports, 1 million tourists, and provides for 28 million commuter journeys in Auckland and Wellington every year. Over the coming decades, freight growth is projected to increase substantially. The rail network is a critical part of ensuring the transport network can efficiently support this growth.

1.2 One of the greatest challenges of our time is climate change. The Government has recognised that rail will be instrumental in reducing New Zealand's greenhouse gas emissions, and is supporting KiwiRail to make significant investments to improve the capacity, efficiency, and resilience of its network. This will help to encourage a modal shift to increase the share of freight being moved by rail over road, which also has a range of safety benefits.

1.3 Palmerston North is a key freight distribution centre and plays a critical role in New Zealand's supply chain. Palmerston North is a transport crossroads where critical roads and rail corridors intersect. The North Island Main Trunk Line ("**NIMT**") runs through the region from Auckland to Wellington. KiwiRail has an existing intermodal freight hub in Palmerston North located on the NIMT ("**Existing Freight Yard**"). However, the facilities are old and fragmented, and need to be redeveloped to accommodate longer trains, and better freight distribution facilities, and to adapt to changes in the way freight is handled. As

the Existing Freight Yard is surrounded by residential development, it is constrained in its ability to expand to accommodate future demand in an efficient manner.

1.4 Following on from an analysis of its options, KiwiRail considered that it needed to develop a new intermodal freight hub to accommodate freight growth over time. The Government supported this by granting KiwiRail funding to plan for a new intermodal freight hub near Palmerston North through the Provincial Growth Fund ("**PGF**") in 2019.

1.5 The proposed Freight Hub is a centralised intermodal hub incorporating arrival and departure tracks, freight handling facilities, a container terminal and maintenance facilities. The Freight Hub has been designed with a long-term horizon in mind so that it can efficiently service the regional and national rail network both now and well into the future. This is a complex project which will be designed and built over many years in stages. It is anticipated to be fully operational by approximately 2051.

1.6 The Freight Hub will be a major change for the movement of freight by rail in the central North Island and will unlock a range of benefits for the region and New Zealand. Not only will the Freight Hub assist in accommodating freight demand more efficiently over time, it will result in employment and new business opportunities that will have wider benefits for the region and New Zealand. KiwiRail is proud to propose the delivery of this critical piece of infrastructure and is committed to working with the community and wider stakeholders on the delivery of this to the region.

2. INTRODUCTION

2.1 My full name is Todd Louis Moyle. I am the Chief Operations Officer and Deputy Chief Executive at KiwiRail. I am authorised to give this evidence on behalf of KiwiRail.

2.2 I hold the qualifications of a Bachelor of Engineering (Mechanical) (1st Class) from the University of Canterbury and a New Zealand Certificate in Engineering from AUT.

Experience

2.3 As the Chief Operations Officer, I oversee all operational parts of the business, including rolling stock, network maintenance, operations and the Interislander Ferries. I have been involved in the Freight Hub project for several years.

2.4 Prior to my current role, I was the Group General Manager of Network Services, leading KiwiRail's 'below rail' network of track, bridges and tunnels along with the engineering functions. I have worked for KiwiRail since 2007. Prior to this, I worked with London Underground, and prior to this I worked in roles across the pulp and paper sector.

2.5 I am familiar with the operations of KiwiRail's network and the operational requirements for a regional freight hub.

3. SCOPE OF EVIDENCE

3.1 This statement of evidence will:

(a) outline KiwiRail's operations, both nationally and regionally in the Manawatū;

(b) explain the key drivers for the development of the Freight Hub;

(c) outline the planning and funding to support the Freight Hub; and

(d) provide an overview of the key components of the Freight Hub and the benefits it will deliver.

4. KIWIRAIL'S OPERATIONS

4.1 KiwiRail is a State-Owned Enterprise responsible for the management and operation of the national railway network. This includes more than just "track"; it includes managing railway infrastructure and land, as well as rail freight and passenger services within New Zealand. In particular, KiwiRail:

(a) provides for the transport of bulk and consolidated freight;

(b) provides ferry services (forming the 'bridge' between the North and South Islands) for rail and road freight as well as for passengers and their vehicles;

(c) provides and supports rail passenger services in metropolitan areas, and long-distance services for both domestic and tourist markets; and

(d) manages and develops property holdings for rail operations.

The national rail network

4.2 KiwiRail's national rail network includes more than 3,700 km of track and 1,300 bridges, with over 200 locomotives available to transport both freight and passengers.[1] The importance of KiwiRail's rail network to the New Zealand economy is demonstrated by the significant volume of freight and passengers it carries every year. On an annual basis, KiwiRail transports approximately 25% of New Zealand's exports, carries over 1 million tourists and provides the infrastructure for 28 million commuter journeys in Auckland and Wellington.[2]

4.3 The use of rail for freight and passenger services delivers a variety of benefits to New Zealand, including environmental and safety benefits. From an environmental perspective, the use of rail supports New Zealand's goals in reducing greenhouse gas emissions. Transporting a tonne of freight by rail generates 70% less emissions than road transport.[3]

4.4 As a company that currently depends on fossil fuels to power many of our locomotives and all three of our Interislander ferries, we are looking for improved environmental performance as we replace ageing assets, and also adopt new initiatives to assist New Zealand in reducing its greenhouse gas emissions.

4.5 Rail freight services also support community health and wellbeing goals set by the New Zealand Government, particularly the target to reduce the national road toll. By reducing heavy vehicles on New Zealand roads and state highways, KiwiRail's network helps provide a safer environment for smaller private vehicles, cyclists and pedestrians.

4.6 Heavy rail is critical infrastructure that is recognised for its ability to efficiently and safely transport significant volumes of freight. This is important for the growth of the national economy and regional productivity as rail provides a vital connection between primary producers and the nation's ports. Rail is an integral part of New Zealand's freight supply chain and helps ensure resilience by providing an alternative transport option for distributors and exporters.

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1 The New Zealand Rail Plan, Minister for Transport, dated April 2021 ("**Rail Plan**"), at page 10.

2 KiwiRail Integrated Annual Report 2020, at page 9, with data from Auckland Transport and Greater Wellington Regional Council.

3 Ministry of Transport (2019) *Real World fuel economic of heavy trucks*, Transport Knowledge Conference 2019 (available on the Ministry of Transport's website).

4.7 An estimate of the benefits of the existing rail system in New Zealand is set out in the 2021 Value of Rail in New Zealand Report.[4] The 2016 Value of Rail in New Zealand Report also identifies a number of benefits from the existing rail network including connectivity between ports and regional suppliers and businesses, resulting in better connection for imports and export routes. Other benefits include land use and value uplifts and resilience benefits for the transport network.[5]

KiwiRail's role in the Manawatū

4.8 KiwiRail owns and operates the NIMT which is a nationally significant transport corridor that connects Auckland to Wellington.

Figure 1: North Island Network

4.9 Figure 1 shows the location of Palmerston North in relation to KiwiRail's North Island network as well as the links to key ports including at Tauranga and Auckland. It shows the significance of Palmerston North as a key point in the

4 EY (2021) *The Value of Rail in New Zealand* Report for the Ministry of Transport February 2021.

5 EY (2016) *The Value of Rail in New Zealand* Report for the NZ Transport Agency, pages 27 and 28.

rail network, located at the intersection of the NIMT, the Palmerston North – Gisborne line and the Marton – New Plymouth line. Palmerston North is also at the southern end of the electrified section of the NIMT that runs from Hamilton, which makes it a logical place to stop trains travelling south east and west to change locomotives. KiwiRail has been operating in Palmerston North since the late 1960's. The Existing Freight Yard is a key part of the logistics chain for freight travelling from Auckland, Wellington or other local areas in the central North Island.

4.10 Palmerston North essentially services the entire lower North Island in terms of freight distribution, with connectivity to Auckland and the upper North Island. Goods moving to and from the South Island travel through Palmerston North. Similarly, exports heading by rail to and from the Manawatū, Wanganui, Taranaki and Wairarapa travel to and from Auckland and Tauranga through Palmerston North. Palmerston North is a strategic location for the Freight Hub and the movement of freight as it is a transport crossroads where critical roads and rail corridors intersect.

4.11 State Highway 1 and State Highway 3 currently intersect in the region and the completion of the State Highway 3 project highway Te Ahu a Turanga will also better connect the region to State Highway 2 and the Manawatū, Tararua District, Hawke's Bay and northern Wairarapa.

5. THE DRIVERS FOR A NEW INTERMODAL FREIGHT HUB

5.1 KiwiRail's objectives in delivering a new intermodal freight hub near Palmerston North are to:

(a) increase its operational capacity and adjacent freight handling and storage facility, to efficiently accommodate projected regional and national freight growth and support wider regional development;

(b) enable rail to be integrated with, and connected to, other transport modes and networks; and

(c) improve the resilience of the regional and national freight transport system over time.

5.2 Over the coming decades, the demand for freight movements is expected to increase substantially.

5.3 The rail network plays an important part in ensuring that the transport network can efficiently support this growth. In order to ensure that it can meet

increasing levels of demand in the future, KiwiRail needs to have the necessary infrastructure to accommodate this demand efficiently in the long term. The capacity of our existing infrastructure and ageing assets are critical factors that impact KiwiRail's ability to meet this growing demand.

5.4 Not only is demand growing but the way freight is handled is also changing. There is an increased need for "inland ports", which are used to manage and stage freight containers in order to efficiently deal with the demands of importers and exporters. Direct access to rail is utilised to ensure this efficiency.

5.5 KiwiRail is investing in extensive upgrades to the national rail network to increase its capacity, resilience and efficiency. Examples of improvements already occurring across the rail network include triple tracking in the Auckland metro network to provide for both freight and passenger movements, double tracking in the Wellington metro, and bridge replacements nationally. The Freight Hub is also a key component of KiwiRail's network improvements.

5.6 To efficiently accommodate longer term growth, KiwiRail has also identified a need to increase the length of trains (of up to 1500m in length) that can operate on its network. Longer trains will result in a number of operating efficiencies and cost savings. With the price of carbon only expected to rise in the future, these types of investments will continue to make freight movement by rail more attractive, both in terms of economic efficiency and environmental sustainability. While KiwiRail currently operates trains up to 900 m in length, parts of the network can already provide for longer trains (up to 1200 m) and the intent is to, over time, grow the rest of the network to meet that length and benefit from the efficiencies.

5.7 In the context of Palmerston North, there are many constraints on the ability of the Existing Freight Yard to efficiently accommodate forecast demand and to adapt to the changes in the way that freight is handled:

(a) The Existing Freight Yard is small, long and thin, which makes it challenging for the adjacent services and opportunities to reconfigure operations are limited.

(b) The proximity of the residential development to the Existing Freight Yard constrains the redevelopment potential of the site. At the time it was constructed it was on the outskirts of the city. However, as Palmerston North has grown over time, greater urban intensification

has occurred around the Existing Freight Yard which affects its redevelopment potentially, physically and operationally.

(c) The layout of the Existing Freight Yard is fragmented, and some of the existing buildings are nearing the end of their useful life. Significant investment would be required to improve their efficiency, and to create modern fit for purpose facilities.

(d) It is anticipated that road congestion along Tremaine Avenue and the other key arterial roads will increasingly impact on the efficiency of freight movements to and from the Existing Freight Yard and the efficiency and function of Tremaine Avenue.

5.8 Following an analysis of its options, KiwiRail considered that it was not practicable to expand operations at the Existing Freight Yard and instead, focused on developing a modern freight hub that would have capacity to meet increasing freight demands, and ensure that rail remains an integral part of central North Island freight flows. Critical to this was planning, and securing funding, for the development of this facility.

5.9 A key part of this planning involved engaging with Palmerston North City Council ("**PNCC**"), Waka Kotahi NZ Transport Agency and other key stakeholders in the region to ensure that the development of the Freight Hub aligned with both central and local government planning and investment priorities, as well as Waka Kotahi's future development plans for the region.

6. PLANNING AND FUNDING FOR RAIL

6.1 The Government has identified the national rail network as a critical component of the nation's wider transport sector. In an effort to strengthen the provision of rail in our transport system, the Government released the first New Zealand Rail Plan ("**Rail Plan**") and Rail Network Investment Programme in May this year.

6.2 The Rail Plan outlines investment priorities to inform investment decisions over a longer horizon (being the next 10 years) as part of the new planning and funding framework for rail. These investment priorities inform the development of KiwiRail's network investment programme and regional transport planning processes.

6.3 The Rail Plan does not provide a definitive list of investments for rail over the next decade, nor does it provide a funding commitment for all of the projects

outlined. However, it does send a strong signal of the Government's commitment to rail over the next decade, and the investments needed to achieve a resilient and reliable rail network. Relevant to the Freight Hub project, the Rail Plan includes a strategic priority to invest in the national rail network to restore rail freight and provide a platform for future investments for growth. The Rail Plan identifies a future priority for the rail system as including more regional routes and improved logistic hubs.[6]

6.4 In recognition of the critical function that rail plays in our transport system, there have been some significant changes in recent years as to how rail is funded. The Government has recently provided a significant boost in funding for upgrading and improving rail in New Zealand, including $1.2 billion in the Budget for 2020 and $1.3 billion in the Budget for 2021. The Government has also allocated funding through the PGF for regional rail initiatives.

6.5 In 2019, KiwiRail obtained funding through the PGF for eight projects, one of which was to secure the land and designation necessary for the development of a new intermodal freight hub near Palmerston North. This was the catalyst for the development of the master plan for intermodal freight hubs in New Zealand ("**Master Plan**") that could be used to develop more efficient and technologically advanced freight hubs around the country.

6.6 The development of the Master Plan and the extensive site selection process that KiwiRail undertook to determine the preferred site for the Freight Hub is discussed in more detail in Ms Poulsen's evidence. In the following section of my evidence, I outline the key operational features of the Freight Hub.

7. FREIGHT HUB PROPOSAL

7.1 Through this NoR, KiwiRail seeks to develop a new future-proofed intermodal freight facility. In time, KiwiRail intends to decommission the facilities at the Existing Freight Yard (except for the passenger terminal and network communications centre). The future use of the Existing Freight Yard is yet to be determined.

Key components of the Freight Hub

7.2 The Freight Hub is underpinned by the concept of "hubbing" which involves locating tracks and arrival and departure yards with critical and connected freight handling and storage facilities to improve the efficiencies in the

6 The New Zealand Rail Plan, April 2021, at page 28.

distribution and movement of freight by rail. The Freight Hub will incorporate what are otherwise fragmented facilities in the Existing Freight Yard into one place and will result in improved handling facilities for goods transferring between road and rail for unitised cargo (such as export containers) and other products, such as logs.

7.3 The Freight Hub must sit immediately adjacent to the NIMT to allow track access to and from the yard to mainline trains, shunts and other train movements as is required as part of a functioning freight hub.

7.4 It is critical that the rail terminal and yard is efficient. Operations must be focused on keeping freight moving. The Freight Hub will be one part of the overall supply chain for many goods transiting the region. It has therefore been designed to operate 7 days a week and 24 hours a day to keep assets moving and cater for the needs of different traffic flows through the Freight Hub. From an operational perspective, this is necessary:

(a) to align with port calls for export of goods, which often requires shipments to be able to be distributed at all hours of the day and work within other constraints such as metro-area peak-time curfews;

(b) as lead in times for distribution of goods must allow time to marshal wagons in putting a train together (or for inbound goods, most distribution centres require their freight to be available very early in the morning);

(c) for scheduling, driver hours and safety – these need to be efficient on staff and fuel, and ensure safe operations, so that breaks and driving restrictions are observed;

(d) to cater for the multitude of time gates served by the different routes that pass through the Freight Hub, each of which may require freight connections with other routes (and most of these connections take place overnight);

(e) to optimise fleet utilisation and maximise available capacity (all leading to lower unit costs); and

(f) to manage outages on the line (networks and signalling depot and mechanic workshop activity) caused by faults, weather, and emergencies such as slips, earthquakes and Covid-19.

7.5 The proposed operations are also essential for rail to be competitive with road and to grow the share of freight movement by rail over time. Any restrictions on hours of operation would mean that the Freight Hub will disrupt the supply chain of goods transiting the region to their ultimate destination which would significantly reduce the attractiveness of freight transport by rail over road. This would have negative flow on effects for the environmental and safety benefits that transport by rail enables. In order to meet safety requirements, the Freight Hub also needs to be well lit to provide for staff working safely.

7.6 To ensure that it meets the needs of future generations, the Freight Hub has been designed with a longer-term horizon in mind and will be constructed to the latest industry standards. This includes provision for four electrified tracks, with capacity for further electrification over the life of the Freight Hub.[7]

7.7 Construction of the Freight Hub will seek to incorporate environmentally sustainable design where possible through the building materials used and modern facilities that will make operation of the Freight Hub sustainable, cost effective, and safe for workers. The complexity and scale of the project means that it will be constructed and developed over several years. KiwiRail is committed to working with the community and stakeholders on its delivery over that time.

Benefits of the Freight Hub

7.8 Palmerston North already plays a critical role in New Zealand's supply chain and this is only set to increase. The development of the Freight Hub will ensure that Palmerston North remains an integral part of central New Zealand rail network and freight flows. The Manawatū–Whanganui region's economic success relies heavily on supply chain and logistics due to its significant agriculture and manufacturing industries. The Freight Hub will assist in ensuring that the demands of importers and exporters can be efficiently met and will support the flow of goods through the lower North Island. The Freight Hub will also generate future long-term employment opportunities in the logistics sector.

7.9 The proposed location of the Freight Hub, in proximity to Palmerston North Airport and the North East Industrial Zone ("**NEIZ**"), also provides significant opportunities to efficiently integrate transport modes and support other businesses in the vicinity of the Site. KiwiRail is also working closely with Waka Kotahi NZ Transport Agency and other stakeholders to integrate the Freight

[7] Evidence of Michael Skelton, dated 9 July 2021, at Section 4.

Hub with planned future roading network upgrades which will assist in building the resilience of the transport network.

7.10 Overall, the Freight Hub will assist in accommodating freight demand more efficiently over time and enabling more freight to be moved by road, aligning with the Government's goals of reducing carbon emissions and resulting in wider benefits to the region and New Zealand.

Todd Moyle
9 July 2021

UNDER the Resource Management Act 1991 ("**RMA**")

AND

IN THE MATTER of a notice of requirement ("**NoR**") for a designation by KiwiRail Holdings Limited ("**KiwiRail**") for the Palmerston North Regional Freight Hub ("**Freight Hub**") under section 168 of the RMA

STATEMENT OF EVIDENCE OF OLIVIA POULSEN
ON BEHALF OF KIWIRAIL HOLDINGS LIMITED

CORPORATE

1. SUMMARY

1.1 KiwiRail is seeking to improve the quality, location and layout of its freight terminals and yards, creating a more efficient and dependable network for the future.

1.2 In 2019, KiwiRail developed a master plan for intermodal freight hubs in New Zealand, which then represented a new approach to integrated logistics ("**Master Plan**"). This Master Plan was used by KiwiRail to identify the indicative size for a new freight hub and plan the location of different site components such that it could be adapted to fit various locations along the national freight network.

1.3 Following the development of the master plan, KiwiRail carried out a comprehensive site selection process to assist in determining a preferred site for the Freight Hub. This involved a series of workshops, decision conferencing and a comparative multi criteria analysis ("**MCA**") of a range of potential sites. As a result of that process, the proposed site near Bunnythorpe on the western side of Railway Road was selected as the preferred site for the Freight Hub from a technical perspective.

1.4 Once the preferred site was selected, the Freight Hub was developed to a preliminary concept design stage, which is future focused and has been sized to provide for forecasted freight and network operational growth. This concept design has been used to inform the boundaries of the designation

("**Designation Extent**") for the Freight Hub for which KiwiRail now seeks approval.

1.5 Since 2019, KiwiRail has carried out extensive engagement in relation to this project, to ensure that stakeholders and the public were informed of the progress of the project and had an opportunity to provide input. This has involved a multifaceted approach from in-person meetings and drop-in sessions, to (often in response to Covid-19 restrictions) online zoom sessions and an online interactive map. As well as working with a range of key stakeholders, KiwiRail has been engaging with iwi as part of an ongoing commitment to developing effective and enduring iwi partnerships.

1.6 KiwiRail is committed to working with its key stakeholders, iwi and the wider community as the project progresses.

2. INTRODUCTION

2.1 My full name is Olivia Jane Poulsen. I am the Executive General Manager of Property at KiwiRail. I hold the qualifications of a Bachelor of Laws and a Bachelor of Arts from the University of Auckland.

Experience

2.2 I have been at KiwiRail since 2017, initially as a Senior Legal Counsel. In 2019, I was appointed as the General Manager for Investment and Capital Transactions. I began my current role as the Executive General Manager of Property in January this year. Prior to working at KiwiRail, I have been employed in a variety of legal roles since 2004, including at Auckland Airport and have been involved in a range of development and consenting projects.

Involvement in the Freight Hub

2.3 In my prior role at KiwiRail as the General Manager for Investment and Capital Transactions, I led the team responsible for the development of the Master Plan for the Freight Hub, the site selection process, as well as engagement with community and stakeholders. In my current role, I have remained heavily involved in the Freight Hub particularly in relation to KiwiRail's engagement with iwi, customers, the local community and businesses.

2.4 In my role as Executive General Manager of Property, I am responsible for resource management planning, leasing, facilities management, land acquisitions and disposals, and iwi engagement and as such, I am very familiar with these matters as they relate to the Freight Hub.

3. SCOPE OF EVIDENCE

3.1 This statement of evidence will:

(a) explain the development of the Master Plan;

(b) outline the process for selecting the location and developing a concept design for the Freight Hub;

(c) explain KiwiRail's approach to community engagement in relation to the Freight Hub; and

(d) respond to relevant submissions received and matters raised in the Section 42A Report.

4. MASTER PLAN

4.1 Rail terminals and yards are a crucial part of KiwiRail's railway network. KiwiRail is seeking to improve the quality, location and layout of its freight terminals and yards, to create a more efficient and dependable network which is suitable for future growth. As part of this, KiwiRail is planning to develop intermodal freight "hubs" to improve the efficiency of the movement of freight by rail. KiwiRail's strategy for intermodal freight "hubs" is focused on improving direct access to the rail corridor to enable efficient movement of freight.

4.2 In 2019, KiwiRail developed a Master Plan for intermodal freight hubs in New Zealand, which then represented a new approach to integrated logistics. Masterplanning is a tool that major infrastructure providers use to guide the effective and efficient development (or redevelopment) of land. A master plan approach has been used to integrate KiwiRail's technical and operational rail requirements with spatial requirements, to assist KiwiRail in developing or redeveloping its yards across New Zealand.

4.3 The Master Plan was developed based on future operational requirements, using specialist rail input from Stantec's North American branch. To develop the Master Plan and identify future hub requirements, existing and future freight demand in the central North Island was used.[1] The predicted changes in freight flows and greater demand has a spatial impact in terms of the extent of land required to develop facilities that will meet the projected increase in demand. The analysis showed a need to provide longer track lengths to accommodate 1500 metre trains, plan for higher speeds for marshalling traffic,

[1] Intermodal Freight Hub Master Plan – Palmerston North Report, April 2020, at section 2.2.

and to work the marshalling yards from both ends of the terminal in order to reduce dwell times.[2] Consideration was also given to the required operational components of a regional freight hub as well as applicable rail standards, and safety requirements.

4.4 Three key functions of intermodal freight hubs were identified when developing the Master Plan, being:[3]

(a) the marshalling of trains;

(b) network services such as wagon storage, equipment maintenance and yard operations; and

(c) container and commodity storage, enabling commercial opportunities to work with partners in freight forwarding thereby improving direct access to rail for customers.

4.5 Having regard to KiwiRail's operational requirements and these key functions, a concept layout for an intermodal hub was developed. The Master Plan was used by KiwiRail to identify an appropriate location for a freight hub along the North Island Main Trunk ("**NIMT**") line (the process for which I discuss in the following sections). The Master Plan will also be used in the future development of intermodal freight hubs around the country, to guide the extent of land needed and identify the key operational requirements.

5. SITE SELECTION AND DESIGN PROCESS

5.1 KiwiRail carried out a comprehensive process to determine the location for the Freight Hub. This process is discussed in detail in Ms Bell's evidence.[4] Broadly, this was conducted by way of:

(a) a series of three workshops and decision conferencing which I attended along with various technical experts, key stakeholders, iwi representatives and other KiwiRail representatives; and

(b) an MCA of a long list and short list of potential site options against a broad range of criteria from rail and property degree of difficulty to noise and vibration, ecology and strategic fit.

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2 Intermodal Freight Hub Master Plan – Palmerston North Report. April 2020, at section 3.2.

3 Intermodal Freight Hub Master Plan – Palmerston North Report. April 2020, at section 3.2.

4 Evidence of Karen Bell, dated 9 July 2021.

5.2 Initially, nine potential area options were identified along the NIMT (and outside "developed" urban areas) and assessed. This included four sites in the vicinity of Bunnythorpe, four in the vicinity of Longburn and the existing rail yard at Tremaine Avenue ("**Existing Freight Yard**"), as shown in the table below.

Area	Description
Option 1	Bunnythorpe 1: West Side
Option 2	Bunnythorpe 2: East Side
Option 3	Bunnythorpe 3: West Side (Airport)
Option 4	Bunnythorpe 4: East Side
Option 5	Longburn 5: North Side
Option 6	Longburn 6: North West Side
Option 7	Longburn 7: West Side (River)
Option 8	Longburn 8: South East Side
Option 9	Existing KiwiRail Freight Yard in Tremaine Avenue

Table 1: *Long list of areas assessed as part of the MCA*

5.3 This was subsequently reduced to five options as a result of comparative assessments undertaken by KiwiRail's technical experts and workshops. Further assessment of those options reduced the site selection process to three potential sites all of which were in the north-east of Palmerston North.

5.4 Following further assessments by technical experts and a workshop, Site 3 was identified as the preferred site from a technical perspective for a range of reasons including its strategic fit with relevant planning and policy documents, its operational rail benefits, and the opportunities for connectivity to the wider strategic transport network.

5.5 Following the identification of the preferred site, KiwiRail considered the potential indicative layout of the site for the purposes of a preliminary concept design. Stantec developed four site layout options initially for KiwiRail to consider. While all of these layouts would meet its operational requirements, KiwiRail selected the layout where the operational areas, such as the container terminal and marshalling yard, were located further away from Bunnythorpe as the adverse effects including noise and vibration were less significant.

5.6 An indicative site layout is shown in Mr Skelton's evidence and the technical inputs that were considered in developing this site layout are discussed in more detail in his evidence.[5] The concept plan was used as the basis to then develop the spatial extent of the designation for the Freight Hub as discussed in Ms Bell's evidence.[6]

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5 Evidence of Michael Skelton, dated 9 July 2021, at section 5.

6 Evidence of Karen Bell, dated 9 July 2021.

5.7 KiwiRail recognises that a development of this scale will have potential adverse effects on the surrounding environment and will be a change for the community. KiwiRail has worked hard with its team of consultants to configure the elements of the Freight Hub in a way that minimises potential effects while also developing specific mitigation works including noise walls / bunds and landscaping. These measures are discussed in further detail in the evidence of the relevant technical experts.

6. KIWIRAIL'S APPROACH TO ENGAGEMENT

Engagement objectives

6.1 KiwiRail's representatives and consultant team have engaged with a wide range of parties over many months to ensure the community were kept informed and given an opportunity to provide feedback. This input, along with technical assessments, helped to shape the resulting layout for the Freight Hub.

6.2 The engagement objectives were:[7]

(a) Transparency in the process by keeping stakeholders and the community informed of progress, raising awareness of how the public can be involved, and clearly explaining how and why decisions have been made.

(b) Actively seeking and welcoming input from the public, iwi and stakeholders at various stages of the project. The project team wanted to develop a strong understanding of all interested parties' views on the Freight Hub.

(c) Supporting stakeholders and the community to understand how the Freight Hub fits into the development of transport infrastructure for Palmerston North and the lower North Island. As part of this, KiwiRail has actively engaged with key stakeholders to understand the broader plans and investment objectives for the region.

6.3 KiwiRail has undertaken a multifaceted approach to community engagement, the methods of which are discussed in further detail in relation to relevant parties below. The project team also adapted the engagement approach in response to the COVID-19 pandemic and nationwide alert level restrictions to include online zoom sessions when engagement could not occur in person due

7 Community Engagement Summary Report, October 2020, at section 2.1.

to these restrictions. I have been involved in each phase of the engagement programme.

Engagement with iwi

6.4 Following the announcement of the Provincial Growth Fund ("**PGF**") funding for the Freight Hub in 2019, KiwiRail engaged with iwi early and reached out to several iwi groups with interests in the wider Palmerston North area. Three main groups were identified for engagement, being:[8]

(a) Ngāti Kauwhata;

(b) Rangitāne o Manawatū; and

(c) Ngāti Raukawa ki te tonga.

6.5 The initial wide engagement phase identified key iwi interests and subsequent engagement more focused on a core group (although the initial wider iwi contact list was kept updated through project mail outs).

6.6 Since 2019, there has been contact between the parties depending upon the project development phase. This has taken different forms, including zoom and face to face hui. A detailed list of engagement with iwi including meeting dates is included as **Appendix 1** to my evidence. Broadly, this engagement has involved:

(a) **Participation in the MCA workshops** – Ngāti Kauwhata and Rangitāne attended workshops 2 and 3 of the MCA process in 2019. They were invited to rank site locations and provide feedback in a form of their choice. Ngāti Kauwhata provided comments on site options, initially preferring site options in the north east over the southern site options.[9] As we moved through the assessment process, for the northern options there was a clear preference for sites away from the Aorangi Marae, which was a key factor in reducing the short list to three. Of those three sites, Ngāti Kauwhata indicated a preference for Site 4, followed by Site 3.

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8 In identifying these groups, KiwiRail sought advice from both Palmerston North City Council ("**PNCC**") and Waka Kotahi, and supplemented that with local knowledge from representatives from Te Kupenga Mahi (KiwiRail's internal Maori network who ensure Tikanga is upheld), presenting at Manawatu District Council's Nga Manu Taiko.

9 Palmerston North Regional Freight Hub Multi Criteria Analysis and Decision Conferencing Process, June 2020, at page 82.

Rangitāne indicated a preference for Sites 3 and 4, either side of Railway Road near Bunnythorpe, subject to a more detailed assessment of the impact on sites of significance and waterways. Site options to the north and furthest south were considered less acceptable due to their proximity to the Manawatu and Oroua Rivers, respectively.[10]

(b) **Site visits** – KiwiRail was invited to attend site visits, including a joint site visit in September 2020 with Ngāti Kauwhata so that KiwiRail could gain better local and cultural insights in relation to the Site. The project team also visited Aorangi Marae (at which Ngāti Kauwhata representatives were present) in October 2020 to discuss the reasons for the selected site for the Freight Hub, concerns relating to the Aorangi Marae, and how the mutual relationship should be formalised.

(c) **Hui** – KiwiRail has held various hui, including zoom hui where face to face meetings were not possible due to Covid-19 restrictions, to provide updates on the progress of the project and discuss ways to formalise the parties' relationships moving forward. After the Christmas break in 2020, Ngāti Kauwhata suggested the establishment of a formal hui forum where the mana whenua would sit to work on the development of a cooperative working framework. Meetings were scheduled to progress a formal reset hui which culminated in the Ngati Kauwhata and Freight Hub hui at BNZ Partners Centre, Palmerston North in March 2021. This represented the start of a joint partnership forum to address the relationship, values and framework for moving on through the Freight Hub project stages.

6.7 KiwiRail has been exploring ways to formalise the relationships with iwi to foster a positive and effective working relationship going forward.[11] KiwiRail has proposed a condition which requires the development of a formal mana whenua engagement framework, which will then provide for the incorporation of iwi values from the design, through to implementation. KiwiRail intends to enable iwi to determine how they wish to work on the project and ensure that their values are represented throughout.[12]

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10 Palmerston North Regional Freight Hub Multi Criteria Analysis and Decision Conferencing Process, June 2020, at page 82.

11 Section 92 Information Request response, questions 95 and 96 response.

12 Section 92 Information Request response, question 97 response.

6.8 In addition to the proposed NoR mana whenua engagement framework, KiwiRail and iwi are working towards developing a working framework agreement. Iwi engagement will continue throughout the development of the Freight Hub as part of KiwiRail's ongoing commitment towards developing effective and productive iwi partnerships.

Engagement with Councils

6.9 To ensure efficient alignment and integration of initiatives, KiwiRail has been working with PNCC and Horizons Regional Council ("**HRC**"), as key stakeholders in the region.

6.10 Since a very early stage of the project, KiwiRail has been working with PNCC to ensure that the Freight Hub aligns with the PNCC's strategic planning and the city's economic growth aspirations.[13] From the outset, PNCC attended the three workshops held as part of the MCA process and since the Site was selected, KiwiRail has also been working with the PNCC to understand how the Freight Hub can integrate with PNCC's plans for this area, including planned improvements to the transport network as well as the impacts on PNCC's infrastructure assets that are within or near the Site.

6.11 Acknowledging that the Freight Hub will also require regional consents, KiwiRail has also been working with HRC. The HRC has also been involved with the Freight Hub project from its infancy, attending Workshop 3 of the MCA process where the Freight Hub site was identified from a short list of options.[14] KiwiRail has since kept the HRC up to date as the project has progressed and this engagement is ongoing.[15]

Engagement with landowners

6.12 It was important to KiwiRail that we engaged with directly affected landowners as soon as practicable and kept them informed throughout the process.[16]

6.13 Immediately prior to the announcement of the preferred site for the Freight Hub in July 2020 and wider community engagement, letters were sent to all landowners that were identified as being within or immediately adjacent to the Site. These letters offered face to face meetings with a KiwiRail representative and a property specialist. Most landowners requested a face to face meeting,

13 Community Engagement Summary Report, October 2020, at section 3.
14 Community Engagement Summary Report, October 2020, at section 3.2.
15 Community Engagement Summary Report, October 2020, at section 3.2.
16 Community Engagement Summary Report, October 2020, at section 3.

and these meetings took place between 2 July 2020 and 15 August 2020.[17] I attended a number of these meetings.

6.14 Along with funding to consent the project, KiwiRail received funding from the PGF to commence land acquisition. In response to approaches from some landowners within the footprint, we have commenced acquiring land within the footprint. To date, 6 properties (approximately 41% of the Site) have been acquired by KiwiRail.

Engagement with key stakeholders

6.15 As well as the local and regional authorities, KiwiRail recognises that there are a range of other stakeholders that have an interest in the development of the Freight Hub. In particular, KiwiRail has been engaging with Waka Kotahi to ensure that the Freight Hub aligns and can efficiently integrate with the regional road network and the Palmerston North Integrated Transport Initiative. Broader Government transport objectives have also been discussed like mode-neutral decision making and emissions reductions.[18]

6.16 KiwiRail has also worked closely with key business stakeholders in the Palmerston North area, including the Central Economic Development Agency, as well as landowners within the North East Industrial Zone ("**NEIZ**"), including Foodstuffs North Island Limited. As discussed in further detail below, KiwiRail is working closely with these key stakeholders to develop strategies and practical options to realise the potential wider benefits of the Freight Hub for nearby commercial operations.[19]

6.17 KiwiRail has also been engaging with various utility providers who operate within the vicinity of the Freight Hub, such as Transpower, First Gas and Powerco as well as Palmerston North Airport. This engagement has focused around ensuring the protection of and managing potential adverse effects on infrastructure and assets.

Engagement with the wider community

6.18 Following the announcement of the Master Plan concept for the Freight Hub in 2019, KiwiRail held a drop-in session and two presentations at Bunnythorpe School in February 2020. This was designed to give the community an

17 Community Engagement Summary Report, October 2020, at section 4.4.

18 Community Engagement Summary Report, October 2020, at section 3.

19 Community Engagement Summary Report, October 2020, at section 3.2.

overview of the project, the Master Plan and the site selection process. Approximately 300 people attended these sessions.[20]

6.19 Following this, KiwiRail has ensured the community were kept up to date as the project developed and had an opportunity to provide feedback on the Freight Hub. In July 2020, community drop-in sessions were held following the Ministerial announcement of the preferred site. While some of the details of the design and Designation Extent were still being developed at that stage, in line with its engagement objectives, KiwiRail wanted to continue the conversation with the community and provide them with the opportunity to have their say before that work was finalised.

6.20 These drop-in sessions were held at various locations, including Bunnythorpe School, The Plaza, and the Albert Street Market. A zoom session was also held for those who could not attend an in person drop-in session, where information was provided on the Freight Hub and questions could be raised.[21] The community was able to provide input on hard copy forms, which were handed out at the drop-in sessions.[22]

6.21 A Social PinPoint website was also set up to provide an online interactive map, where people could make comments in relation to a specific issue and initiate discussions on particular topics.

6.22 Following the engagement period held in July 2020, KiwiRail further refined the concept design and Designation Extent taking into account the community's input. KiwiRail then presented this updated design to the community in September 2020 with further opportunities for the public to provide feedback directly to the project team. Community drop in sessions were held on 22, 23 and 24 September 2020.[23] Letters were again sent to affected landowners with an opportunity to meet with KiwiRail.[24]

6.23 Interested members of the community could also opt in to receive regular email updates on the project and provide an explanation of how they can get involved. KiwiRail established a project email inbox also to provide a direct point of contact for interested parties to submit feedback and questions to KiwiRail. [25]

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20 Community Engagement Summary Report, October 2020, at section 4.3.
21 Community Engagement Summary Report, October 2020, at section 4.4.
22 Community Engagement Summary Report, October 2020, at section 4.4.
23 Community Engagement Summary Report, October 2020, at Table 6, section 4.5.
24 Community Engagement Summary Report, October 2020, at section 4.4.
25 Community Engagement Summary Report, October 2020, at section 4.4.

6.24 KiwiRail also provided regular media updates at key milestones for the project. These updates were provided online on KiwiRail's website, on KiwiRail social media accounts and in print adverts. This was regularly monitored throughout the project. KiwiRail's website provided a space for the community to view images, videos, FAQs and other digital tools used to provide information on the Freight Hub.[26]

6.25 KiwiRail has and continues to remain accessible to affected landowners and the wider community to discuss concerns in relation to the Freight Hub through the project inbox.

7. RESPONSE TO SUBMISSIONS AND SECTION 42A REPORT

7.1 KiwiRail requested that the PNCC publicly notify the NoR, to ensure the community were provided with an opportunity to comment on the documents lodged as part of the NoR.

7.2 KiwiRail has carefully reviewed each submission and considered the matters raised in those submissions. The submissions have been addressed by the relevant technical expert in their evidence. A number of matters raised in submissions that are relevant to my evidence are also raised in the Section 42A Report and I address these below.

Community engagement

7.3 Various submitters have asserted that there has been a lack of engagement and information provided by KiwiRail and have raised concerns with the way in which KiwiRail has conducted engagement with the local community.[27]

7.4 As noted above, I have personally been involved with each phase of KiwiRail's program for the Freight Hub. Consultation with affected parties, key stakeholders and the Bunnythorpe community has been ongoing since the announcement of the Master Plan concept for the Freight Hub in 2019. As explained in section 6 above, prior to lodgement of the NoR, KiwiRail carried out extensive public consultation.

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26 Community Engagement Summary Report, October 2020, at section 4.4.

27 Submission 26 by Peter Hurly, submission 35 by Robyn Curtis, submission 39 by Letitia Stick, submission 47 by Aaron Fox, submission 72 by Danelle O'Keeffee and Duane Butts.

7.5 Engagement with the community will also be ongoing. As part of the proposed conditions for the Freight Hub attached to Ms Bell's evidence as Appendix 1 ("**Proposed Conditions**"), KiwiRail has proposed to:

(a) establish a Community Liaison Forum to enable KiwiRail to provide information to, and receive feedback from, the community on any matters relating to the construction and operation of the Freight Hub;

(b) appoint a Community Liaison Person as a point of contact for all enquiries relating to the Freight Hub, including land acquisition, construction and operational measures;

(c) prepare a Construction Engagement Plan to outline a process to ensure that the community is provided with information during the construction of the Freight Hub; and

(d) establish a register of any complaints received and action undertaken by KiwiRail to address complaints. Updates on the complaints register shall be provided through the Community Liaison Forum.

7.6 The purpose of these conditions and further refinements that have been made to these conditions is discussed in the evidence of Ms Bell and Ms Austin.

Iwi engagement

7.7 In their submissions, Ngāti Kauwhata, Ngati Turanga, Rangitāne o Manawatū and Ngati Raukawa have requested that a panel be created, which they can be part of, to include tanagata whenua in decision making for the Freight Hub, particularly in relation to natural resources within their rohe.[28]

7.8 KiwiRail is committed to developing effective and productive iwi partnerships. As explained in section 6 of my evidence above, KiwiRail has directly engaged with Ngāti Kauwhata, Rangitāne o Manawatū and Ngāti Raukawa since the announcement of the PGF for the Freight Hub in 2019. Since then, there has been ongoing contact between the parties. Engagement with iwi has taken different forms and both formal and informal feedback has been provided in relation to the Freight Hub.

7.9 KiwiRail has a strong desire for iwi to have an ongoing role in the design and delivery of the Freight Hub. KiwiRail has proposed an NoR condition which

[28] Submission 14 by Ngāti Kauwhata, submission 49 by Ngati Turanga. submission number 69 by Rangitāne o Manawatū, submission 96 by Ngāti Raukawa.

requires the development of a mana whenua engagement framework, which will provide for the incorporation of iwi values from the design, through to implementation. The matters raised in iwi submissions can be addressed through this framework. The framework provides a mechanism for a panel to be established and KiwiRail intends work with iwi to develop the detail of this framework through meetings and hui.

7.10 The Council Officers have raised concerns that proposed condition lacks specificity.[29] KiwiRail proposed this engagement framework as a mechanism to enable iwi to determine how they wish to be involved on the project to ensure their visions and values are represented throughout.[30] KiwiRail did not consider that it was appropriate to pre-empt or require an outcome as part of the proposed conditions while engagement with iwi was ongoing as it is important to KiwiRail that the framework and forum developed reflects the outcomes that both KiwiRail and mana whenua wish to see from it.

7.11 The need for Cultural Values Assessments from mana whenua has also been raised in submissions[31] and by the Council Officers.[32] KiwiRail agrees that the design and mitigation of the Freight Hub should be informed by a comprehensive understanding of the cultural values of the site and the wider area. KiwiRail has had initial conversations with iwi about preparing cultural values assessments. KiwiRail also acknowledges that this has been a particularly busy period for iwi with other commitments, such as Waitangi Tribunal hearings taking place and the resourcing constraints that this presents. KiwiRail will continue to work with iwi to ensure they are appropriately resourced to provide input. It remains our view that it is not appropriate for KiwiRail (on its own) to assess the cultural values of the Site and wider area and we are continuing to work with iwi in this regard.

Integration with the NEIZ

7.12 Some of the Council's technical experts consider that in order to achieve an efficient freight precinct a high degree of integration is required between the Freight Hub and the NEIZ. This is supported by the Council Officers. The Council Officers have proposed a range of mechanisms to address this, including preserving the ability for a dedicated freight corridor between the

29 Section 42A Report, dated 18 June 2021, at paragraph 448.
30 Section 92 Information Request response, question 97 response.
31 Submission 51 by Manawatu District Council.
32 Section 42A Technical Evidence Social Impacts, dated 18 June 2021, at paragraph 71.

Freight Hub and the NEIZ to be established in the future.[33] This is addressed in the evidence of Mr Paling and Mr Georgeson.

7.13 Relevant to my evidence, the Council Officers also suggested that KiwiRail actively engage with stakeholders about potential opportunities for integration and proposed (subject to KiwiRail's agreement) that a condition be imposed requiring the establishment of an NEIZ users' group. The proposed purpose of this group would be to determine the appropriate means to provide for safe and efficient freight connections between the NEIZ and the Freight Hub.[34]

7.14 KiwiRail shares the Council Officers' desire for the Freight Hub and the NEIZ to be efficiently integrated. KiwiRail has been actively engaging with a range of key stakeholders that have interests in the NEIZ, including PNCC, Waka Kotahi NZ Transport Agency and landowners in the NEIZ, to identify potential opportunities for integration. I have personally participated in a number of meetings and workshops with these stakeholders.

7.15 KiwiRail has been invited to participate in a Reference Group and Steering Group to ensure alignment on the Central New Zealand Distribution Hub Strategy and the Palmerston North Integrated Transport Investment Project. The purpose of this group is to provide strategic leadership and an overview to achieve alignment and connection between various strategic projects, organisational collaboration at a governance level, and working together to implement the objectives within the Central New Zealand Distribution Hub Strategy and the Palmerston North Integrated Transport Investment Project.

7.16 In terms of realising the potential benefits of a freight precinct in this area, the Freight Hub is only one piece of the puzzle. The engagement with these stakeholders is ongoing, independent of this NoR process and should continue to occur alongside the development of the Freight Hub. In light of this, I do not consider that it would be appropriate to require an NEIZ users' group to be established as a condition on KiwiRail's designation.

7.17 The Freight Hub proposal has been informed by a well-designed Master Plan as well as a robust site selection and design process, to ensure that it meets KiwiRail's operational requirements and manages the effects on the environment. KiwiRail has worked with, and listened to, key stakeholders and the community in putting this proposal together and is committed to working

33 Section 42A Report, dated 18 June 2021, at paragraph 723.

34 Section 42A Report Planning Companion, dated 18 June 20201, at page 38.

with all interested parties on the delivery of the Freight Hub over the lifetime of the project.

Olivia Poulsen

9 July 2021

Appendix 1 - Iwi Engagement

Iwi	Date	Form	Purpose
Ngāti Kauwhata			
	November 2018	Phone / Kanohi-ki-te-Kanohi	Initial contact with Ngāti Kauwhata CEO
	March 2019	Email out to all local iwi	Project start up
	13 September 2019	Kanohi-ki-te-Kanohi at MDC offices Rarite Mataki	Project introduction and invitation to attend MCA process
	8 October 2019	Kanohi-ki-te-Kanohi KiwiRail representatives and Dennis Emery, Rarite Mataki	MCA process invitation
	25 September 2019	Workshop with KiwiRail and wider project team and stakeholders	MCA workshop 2 – attend and provide commentary
	20 November 2019	Workshop with KiwiRail and wider project team and stakeholders	MCA workshop 3 – attend and provide commentary
	21 February 2020	Kanohi-ki-te-Kanohi 139 South Street FEILDING (Iwi Offices), Denis Emery	Project and relationship agreement – discussion of Ngāti Kauwhata's development interests and concerns with impacts on the Aorangi Marae
	3 April 2020	Teams meeting – during Covid-19 lockdown period	Covid-19 assistance and Kawenata, discussion relating to the preferred site announcement
	20 April 2020	Teams meeting called by Stephen Thomas (KiwiRail)	Relationship agreement, discussion of shortlisted sites north of Palmerston North and Covid-19 updates in relation to the Freight Hub.

Iwi	Date	Form	Purpose
	2 July 2020	Minister's announcement of preferred site	Representatives of Ngāti Kauwhata attended the Minister's announcement of the preferred site
	17 August 2020	Teams meeting Tiratahi Taipana, Dennis Emery, Jeff Rakatau, Sir Mason Durie	Discussion of the site selection process, Iwi Employment matters, local road issues (acknowledging a recent fatality on Railway Road), Kawenata
	18 September 2020	Field trip for KiwiRail staff	Joint Site visit to hear about iwi history and relationship to the area, to gain local and cultural insights in relation to the Site
	24 September 2020	Te Papa catch up with Denis Emery and Goncalo Sintra	Discussion of Freight Hub impacts and mitigations
	8 October 2020	Kanohi-ki-te-Kanohi Ngati Kauwhata offices 139 South Street, Feilding	Ongoing Relationship development and sharing iwi environmental and educational aspirations
	8 October 2020	Visit to Aorangi Marae	KiwiRail visit met marae trustees to discuss reasons for the selected Freight Hub Site and how a mutual relationship should be formalised
	13 November 2020	Kanohi-ki-te-Kanohi Catch up	Discussion between Olivia Poulsen and Meihana Durie about Aorangi Marae safety issues
	27 November 2020	Kanohi-ki-te-Kanohi Catch up KiwiRail offices Palmerston North Rail Yard, Tremaine Avenue	Discussion of a cultural impact assessment report by hapu and Iwi o Ngati Kauwhata, actions from our Aorangi Marae meeting minutes, relationship agreement, confirming the final Freight Hub Site
	12 March 2021	BNZ offices 203 Broadway Avenue	Ngāti Kauwhata and KiwiRail hui to start a formal iwi forum to address the

Iwi	Date	Form	Purpose
			relationship, values and framework for moving on through the Freight Hub project stages
	30 May 2021	Hui Panel at BNZ offices 203 Broadway Avenue	Relationship reset, foundations for moving towards a combined iwi forum, engagement and communications lines
Rangitāne o Manawatū			
	March 2019	Mail out to all local iwi	Project start up
	12 September 2019	Face to face at Rangitane offices, 140 – 148 Maxwells Line, Palmerston North.	Project start up and MCA, start formal engagement
	25 September 2019	Attend and provide commentary	MCA workshop 2 – attend and provide commentary
	20 November 2019	Attend and provide commentary	MCA workshop 3 – attend and provide commentary
	15 May 2020	Teams meeting with Rangitāne, Chris Whaiapu Ruma, Hayden Potaka	Project update and discussion of future opportunities
	18 August 2020	Teams meeting with Rangitāne, Chris Whaiapu	Project update and discussion of the selected Site
	2 October 2020	Rangitāne and KiwiRail Freight Hub Teams catch up, Chris Whaiapu Ruma	Hui was held following the completion of the MCA process to discuss relevant developments of the Freight Hub
	22 October 2020	Hui in Palmerston North with Rangitāne, Chris Whaiapu and KiwiRail, held at the iwi office, Maxwells Line	Hui to provide updates on the Freight Hub, discussion of impacts and mitigations, Cultural Impact Assessment and formal comment options.

Iwi	Date	Form	Purpose
	30 May 2021	Hui panel at BNZ offices 203 Broadway Avenue	Apologies could not attend
Ngāti Raukawa ki te tonga			
	March 2019	Mail out to all local iwi	Project start up
	8 October 2019	Kanohi-ki-te-Kanohi at KiwiRail offices Tremaine Avenue; Lindsay Poutama CEO and Hayden Turoa	Introduction to project details and long list and project phasing
	30 May 2021	Hui panel BNZ offices 20 Broadway Avenue, Lindsay Poutama CEO	Wider iwi Relationship reset, iwi engagement and communication lines values, foundations for moving towards a combined iwi forum

UNDER the Resource Management Act 1991 ("**RMA**")

AND

IN THE MATTER of a notice of requirement ("**NoR**") for a designation by KiwiRail Holdings Limited ("**KiwiRail**") for the Palmerston North Regional Freight Hub ("**Freight Hub**") under section 168 of the RMA

STATEMENT OF EVIDENCE OF MICHAEL SKELTON ON BEHALF OF KIWIRAIL HOLDINGS LIMITED

DESIGN, CONSTRUCTION AND OPERATION

1. SUMMARY

1.1 I was involved in the preparation of the Concept Design of the Freight Hub which has been developed to ensure that the Freight Hub will achieve KiwiRail's operational requirements while also managing effects. The key components that informed the Concept Design included the track work, marshalling and freight forwarding facilities, storage facilities, the building and structure height parameters, and site access. Internal access roads as well as a new perimeter road is proposed to enable access to the Freight Hub. The Concept Design also considers a number of existing roads that will need to be stopped.

1.2 Other elements such as noise mitigation barriers, landscape and amenity planting, and the stormwater management system are required to manage effects from the Freight Hub. These components have shaped the proposed layout for the Freight Hub to provide for functioning and efficient operation of the Site, while minimising effects on the surrounding environment where practicable.

1.3 A number of utilities are identified as being affected by the Freight Hub, given its scale. These have been considered as part of the Concept Design but in some cases will need to be relocated.

1.4 In order to understand how KiwiRail's operational requirements will be achieved, a number of complex technical considerations have been considered. The facilities needed to be designed to accommodate up to 1500m trains, with capacity for electrification. The Site layout also had to be future proofed to accommodate demand growth, which means providing space for the Freight Hub to be developed in stages. Other matters, such as site gradients and a level site for the Freight Hub were required to enable efficient train movements. Track layout, geometry and speeds have also been considered, with a number of different types of tracks leading to various on-site facilities, such as the container storage area and locomotive maintenance.

1.5 The Freight Hub is expected to start operating in 2030, and is anticipated to be constructed in three stages. From confirmation of the NoR, there would be an approximately 3.5 years lead in period where detailed design will be completed and regional consents will be obtained.

1.6 Construction of the Freight Hub is then expected to occur over a 6 year period. Bulk enabling works are expected to occur over three years, with imported material required to level the Site. Once enabling works are complete, the Freight Hub itself is expected to be constructed over three years, after which Stage 1 of its operation will begin in 2030. Stages 2 and 3 will involve expansion of the Freight Hub to accommodate future growth, and are expected to be completed between 2030 and 2050 as demand requires.

2. INTRODUCTION

2.1 My full name is Michael John Skelton. I am a Senior Transportation Engineer at Stantec. I hold the qualifications of BE(Civil) and I am a member of Engineering NZ.

Experience

2.2 I completed my studies in 1980 and graduated in May 1981 from Auckland. I joined NZ Railways Christchurch District Engineers office where I worked until 1990. Toward the later part of my time at NZ Railways I was part of the Repositioning Project Team. This work involved rationalisation of freight facilities and freight handling, relocation of marshalling facilities from Christchurch to a new yard at Middleton, development of the Addington triangle, and a direct connection from the Main North Line to the Main South Line. I also looked at freight handling operations at the Southdown terminal Auckland and facilities in Invercargill.

2.3 From 1990 to 1993 I worked for Rodney District Council having a number of roles as Area Engineer West (one of 3) with management role over the Huapai Council office and responsibility for all Council services in the Helensville, Kumeu, Muriwai, and Riverhead Communities. I also had a management role with responsibility for solid waste management over the Rodney District.

2.4 In 1993 I joined a private Engineering Consultancy Company Payne Sewell Ltd (PSL) based in Whanganui. In 2000 PSL became part of MWH and in 2016, merged with Stantec, my current employer. My experience during this time has principally been in roading. This included project investigation and development, design, construction and contract management, and maintenance management of State Highways. More recently, I have been involved in contract management (NZS:3910 contracts), acting as Engineer to the Contract on a wide variety of works in the lower North Island.

Involvement in the Freight Hub

2.5 My first involvement in the Freight Hub was when I was asked to complete engineering degree of difficulty assessments of potential sites in the wider Palmerston North area as part of the multi-criteria analysis assessment process. Once the preferred site was identified I worked with KiwiRail and the Stantec design team to optimise the concept Freight Hub layout on the preferred site and the Designation Extent.

2.6 As part of this, I assisted in the preparation of the concept design plan (Appendix B of the NoR) ("**Concept Design**"), and the preparation of Cross Sections and Landscape Plan (Appendix C of the NoR).

2.7 I also attended a number KiwiRail Community Engagement events where I explained the construction and operation of the Freight Hub and responded to queries from attendees.

2.8 I prepared the Design, Construction and Operation Report ("**DCO Report**") (Technical Report A) that was included with the Assessment of Environmental Effects for the Freight Hub. I also provided input to KiwiRail's section 92 response dated 15 February ("**First Section 92 Response**").

2.9 As part of the First Section 92 Response, I also assisted with the preparation of the Updated Concept Plan (Attachment 14), and the Updated Landscape Plan and Graphic Sections (Attachment 10).

Code of conduct

2.10 I confirm that I have read the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2014 and that I agree to comply with it. I confirm that I have considered all the material facts that I am aware of that might alter or detract from the opinions that I express, and that this evidence is within my area of expertise, except where I state that I am relying on the evidence of another person.

3. SCOPE OF EVIDENCE

3.1 This statement of evidence will:

(a) provide an overview of the concept design work undertaken to demonstrate construction and operation feasibility of the Freight Hub;

(b) explain the technical considerations that were considered in developing the Concept Design of the Freight Hub;

(c) outline the construction requirements, including the level of earthworks required; and

(d) respond to relevant submissions received address relevant matters raised in the Section 42A Report.

4. CONCEPT DESIGN FOR THE FREIGHT HUB

4.1 The Concept Design of the Freight Hub is broadly made up of the following components:

(a) the key operational elements of the Freight Hub (such as the arrival and departure yard, marshalling yard, container terminal);

(b) the roading changes that are required to service the construction and operation of the Freight Hub;

(c) the building and structure height parameters; and

(d) the safety, security and environmental management components, including landscape and amenity planting.

4.2 As this is a Concept Design, some of the features may be subject to change at the detailed design stage. This is common with a project of this scale and type.

Key functions of the Freight Hub

4.3 The Concept Design was prepared considering the factors outlined in the Master Planning Report.[1] In summary there are three key operational functions of the Freight Hub:

(a) marshalling of trains;

(b) wagon storage, equipment maintenance, network service and yard operations; and

(c) areas for container and commodity storage, rail serviced freight forwarding facilities and specialist traffic such as log handling.

Marshalling of trains

4.4 Facilities required for marshalling of trains include 8 arrival and departure tracks with provision for 4 to be electrified by full build out (if demand requires additional tracks can be electrified recognising that both diesel and electric locomotives can use electrified tracks). These are the longest tracks within the yard suitable for holding up to 1500m long trains and are sited adjacent to the NIMT.

4.5 The marshalling yard will be located alongside the existing Railway Road. It will consist of 12 tracks (including for transiting trains) ranging in length from 900m to 1500m in a split ladder configuration that allows for up to 1500m trains to be built or broken up. For flexibility, the arrival and departure tracks have North and Southbound crossovers off the NIMT approximately 700m from each end. These are connected through to the first marshalling track.

4.6 The existing rail embankment will be modified and used to develop the noise barriers on the eastern side of the Freight Hub, with amenity planting.

Wagon storage, equipment maintenance, network service and yard operations

4.7 The new Freight Hub site affords the opportunity to accommodate growth and deliver a modern hub design which will allow for improved speed, connectivity capacity and reduce double handling.

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[1] Assessment of Environmental Effects, Appendix D: Masterplan Report, dated April 2020.

4.8 The locomotive and wagon maintenance repair facility to be located in a building at the northern end of the Freight Hub (approximately 1700m^2 and up to 16m tall) will contain under floor wheel lathe, 3 wagon maintenance tracks, 7 tracks for engine maintenance (two of which are electrified and 4 for service or track maintenance plant). Supporting this facility are external tracks for repair to curtain side wagons and container repair.

4.9 Adjacent facilities include network services buildings including workshops (approximately 4,000m^2) heavy plant storage, material storage areas (approximately 6,000m^2) and ballast storage track for 8 wagons. Located between the container yard and maintenance depot is a main administration and terminal operation building. Ancillary facilities such as the train control and rail operation centre, are provided at the end of the marshalling yard.

Container and commodity storage

4.10 To the west of the marshalling yard is the container yard. The container yard is serviced by 3 tracks allowing simultaneous loading / unloading of containers either to storage or direct to road. The storage capacity of 200, 40foot containers includes refrigeration and controlled Hazard Analysis and Critical Control Point ("**HACCP**") plug in capability.[2] For efficient storage of refrigerated containers "reefer towers" are expected to provide for three high stacking at two areas, with capacities of 120 and 60 TEU units respectively. It will provide for up to 12m high stacks of 3 container units over 880m.

4.11 The tracks within the container yard are located so they can accept direct arrival and departures of short (900m) unit trains. Longer trains will be broken up on arrival before container traffic is taken to the container yard.

Freight Forwarding facilities

4.12 The Concept Design has four co-joined rail-served facilities for major freight forwarders with each individual section having a built floor space and storage totalling some 22,000m^2. A further six covered areas will provide for smaller freight forwarding operations, each being rail served and having an area of 11,600m^2. These facilities are proposed to be set back from the new perimeter road and from Roberts Line by at least 40m with a maximum height of 14m, stepping up from a road edge height of 11m.

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[2] HACCP is an internationally recognized system of identifying and managing food safety related risk. In transportation this revolves around safe handling, avoidance of contamination, and maintaining the food at the requisite temperatures.

Log handling yard

4.13 Specialised rail serviced facilities for log traffic will be provided. These facilities include two 450m long log loading tracks, with a similar length log wagon storage track.

Storage tanks

4.14 Four storage tanks for bulk liquids (such as for example diesel fuel for locomotives) are also provided for in the Concept Design, with each having a maximum capacity of approximately 1570m^3. These will be contained within a bunded area to manage spills or leakages.

Other facilities

4.15 Other facilities within the Freight Hub required for operation include:

(a) a turning triangle to turn engines and wagons;

(b) a number of "run around" tracks to permit engine (and wagon) movements through and to various sections of the Freight Hub;

(c) two "bad order" tracks (to hold wagons identified during shunting that require minor repairs);

(d) four wagon storage tracks at either end of the marshalling tracks each approximately 565m long;

(e) locomotive setoff track at either end of the arrival and departure tracks (to allow engine to hold after disconnecting or before connecting to a train);

(f) four storage tracks to hold engines and wagons pre and post service in the locomotive and wagon depot;

(g) loading tracks for network services;[3]

(h) adjacent to material storage areas at the northern end of the Site;

(i) a short loop track with engine service – fuelling, sanding and oiling facilities at the Northern end of the Site; and

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[3] Network services refers to maintenance teams this includes: Track, Structures Signals and Electrification.

(j) a weigh in motion bridge ("**WIM**") with wagon identification at the south end of the Hub to weigh south and east bound trains. Note there is an existing facility that near Bunnythorpe that weighs North (and West) arrivals and departures; and a short loop track with engine service – fuelling, sanding and oiling facilities.

Roading changes to enable construction and operation

4.16 The Freight Hub has three planned connections to the external roading network. One of the key components of the Master Plan was a zero-harm philosophy for safety and environmental requirements. As part of achieving this, KiwiRail sought to minimise the number of level crossings (road vehicle / train conflict points) within the Freight Hub. This influenced the layout and location of entry / exit points, with three proposed road entrances:

(a) Entry 1 is the southern and main access to the Container Yard and the freight forwarding facilities. This access joins the external roading network at the proposed new roundabout on the Roberts line-Richardson Line intersection.

(b) Entry 2 is the western access located on the western side of the Freight Hub and north of the freight forwarding facilities. Access will be via the new perimeter road. Entry 2 provides access to the tank farm area, container yard, freight forwarders and the terminal and administration and operations building areas.

(c) Entry 3 is the northern access off the new perimeter road. Located at the northern end of the Freight Hub Entry 3 provides access to the log yard, storage areas, engine and wagon maintenance building, network services workshops and the administration and operations building. This entry point also provides access to the locomotive sand and fuelling facility in the north eastern corner of the Site.

4.17 Detailed planning will determine how the internal roading network will operate. For example, if a one-way network will be used for commercial vehicles using the Site. For safety reasons, general public entry to the Site is expected to be restricted.

4.18 The Site overlays a number of local roads that will be partially stopped to enable the Site to be developed. The affected roads are:

(a) Railway Road – A section of Railway Road will be stopped from north of the intersection with Roberts Line to Maple Street, Bunnythorpe. The length of the stopped section is 3km;

(b) Richardsons Line – Richardsons Line will be stopped from Roberts Line to Railway Road (approximately 425m). The intersection with Roberts Line will be reconfigured from a crossroad to a roundabout with the fourth leg (closed section of Richardsons Line) becoming the main southern entrance road to the Freight Hub;

(c) Clevely Line – Clevely Line will be stopped approximately 400m north east of Robert Line and then again on the Eastern side of the NIMT at Sangsters Rd. The stopped section will be approximately 1160m long; and

(d) Te Ngaio Road – The connection between Kairanga Bunnythorpe Road and Railway Road along Te Ngaio Road will be stopped from between approximately 180m on the eastern side of the Maple Street intersection through to 730m towards Railway Road.

Other closures

4.19 In addition to the closure of local roads, two public level crossings at Clevely Line and Roberts Line will be closed. Although on the margins of the Site, additional tracks (increased safety risk) and changes in ground level mean that level crossing cannot be retained at these locations.

4.20 A private level crossing located on the unformed section of Richardson Line will also be closed. A new access road will be constructed along the Sangsters paper road exiting to Roberts Line East.

Building and structure height parameters

4.21 As set out in Ms Bell's evidence, approximately 50% of the Site is located in the NEIZ and is subject to the restrictions on height imposed to protect flights accessing the Palmerston North Airport.[4]

4.22 The relevant control for buildings (and structure heights) in the NEIZ specifies height shall be the lesser of the airport protection surface or 9m.[5] The airport protection surface over the Site is 90m above mean sea level ("**AMSL**"). The proposed level of the Freight Hub is 50m with all buildings and most fixed

4 PNCC District Plan Section 13: Airport Zone.

5 Rule R12A.4.1 performance standards part (a) maximum heights.

structures not exceeding the 9m height restriction (being 59m AMSL). The Freight Hub will also include light structures which, will be approximately 20m in height and tilted to reduce visibility from the air.

4.23 Specific building materials can be chosen to reduce heavy metal contamination of stormwater systems. The details around the type of "neutral" building material are to be addressed as part of the detailed design of the buildings. The purpose of this is to minimise contaminants downstream in addition to the other measures proposed as part of the stormwater management system for the Freight Hub. Further detail on the stormwater management system of the Freight Hub is outlined in the evidence of Mr Leahy.

Safety, Security and Environmental management components

4.24 Designated safe working zones will be identified in all yards and areas where both moving equipment and staff will be managed appropriately.

4.25 Perimeter site security will be a mix of a 2m high security fencing (integrated with noise walls where possible) and vertical noise walls with security-controlled gates at the three site access points. The noise walls commence from Entry 1 at Richardsons Line and extend along the western boundary stopping at approximately Te Ngaio Road. The balance of the perimeter of the Freight Hub on the northern and southern side will be surrounded by a 2m high security fence. For the greater part of the eastern boundary, the noise wall will provide perimeter security. The exception being a section of security fence will separate the Freight Hub and the NIMT from Sangsters Road and Te Araroa Trail near the culverted area.

4.26 A provisional lighting design has been completed to meet KiwiRail's operational standard for outdoor activities and other relevant lighting standards. In addition to site flood lighting, security lighting and CCTV are proposed although specific details will not be addressed at detailed design stage. The evidence of Mr McKensey outlines the lighting design for the Freight Hub.

4.27 Spill containment measures are applicable at the tank farm where the area is to be enclosed in a containment bund. In other areas, concrete surfaces will be provided to contain, collect, and allow treatment. This applies particularly at the fuelling stations adjacent to the arrival and departure track at the northern end of the Freight Hub and approaches to the maintenance facility work bays. The evidence of Mr Heveldt outlines the management of contamination from of the Freight Hub. Surface water runoff from the site

during construction and operation will be collected and managed though the ponds to remove contaminants before being discharged to the Mangaone stream.

Landscape and amenity planting

4.28 As discussed in Ms Rimmer's evidence, extensive landscape planting is proposed in a number of areas as indicated in Appendix B and Appendix C to her evidence. These areas are adjacent to the two stormwater ponds to the west of the Site, the naturalised channel on the northern side of the Site, the area below the houses on Maple Street and the western side of the tank farm. Buffer screen planting is provided around the Site perimeter to reduce visibility of the perimeter fence and / or noise walls where they exist.

4.29 At the construction stage there may be opportunities for early development of landscape works and planting, particularly around the Western and Northern sides of the Site as the ponds and the perimeter road are part of the initial earthworks stage allowing these area to be planted as earthworks and development take place further into the site.

4.30 The potential for early planting along the eastern (Sangsters Road) boundary is minimal and cannot take place until the NIMT has been relocated. The existing rail formation will form the base of the noise bund, newly formed Te Araroa Trail / share pathway and landscaped planted area.

5. TECHNICAL CONSIDERATIONS

5.1 The following sections of my evidence focus on the key technical inputs and considerations that have influenced the Concept Design of the Freight Hub, including:

(a) KiwiRail's operational standards, including:

(i) site gradients and elevation; and

(ii) track alignment geometry, structure, and speeds.

(b) roads and connectivity;

(c) utilities and infrastructure; and

(d) other geotechnical and stormwater considerations.

KiwiRail's operational requirements

5.2 KiwiRail's operational requirements were established early in the masterplanning phase and were used to initially identify an appropriate location for a central North Island Freight Hub, and as a strategic document for the development of any future freight hubs across New Zealand. For that reason, the operational standards are expected to be adjusted to meet the needs of a particular project and to accommodate local conditions. For example, in fitting the elements of the Freight Hub to the Site tracks, some radii were required to be changed to avoid PNCC's existing water bore.

Gradients and Elevation

5.3 Generally, landforms fall away from the NIMT in a south-to-south westerly direction. The existing NIMT rises away from Palmerston North toward Bunnythorpe. However, the track is not evenly graded and contains rolling features known as "the Bunnythorpe dips", with low points where the NIMT drops to cross two watercourses.[6]

5.4 The Site contours also vary, with high ground located between water courses and flood plains.

5.5 Maximum specified gradients for a connection from the NIMT to the arrival and departure yards was 1:200 (0.5%). This was particularly important when determining the level of the Freight Hub as the level of the Freight Hub is constrained by the grades and level on the NIMT at the connection points and by other physical constraints (such as bridge levels).

5.6 Leads or connections between sections of the Freight Hub also have similar maximum grade constraints. However, these are generally not problematic as the Freight Hub will be built level (0% grade).

5.7 The Site level of 50RL was determined considering the following factors:

(a) sufficient height to allow passage of overland flows through the Site by culverting or construction of open channels;

(b) the ability to provide connections to the NIMT at each end of the Site (avoiding the need to construct the 1500m pull backs for the longer trains until required by demand);

6 Further detail on the uneven grade is outlined at Table 2 of the DCO Report.

(c) ability to increase operational flexibility by constructing midpoint crossovers;[7] and

(d) ability to optimise earthworks so that all suitable cut material is reused in order to minimise the amount of imported fill.

Track Alignment Geometry, Structure and Speeds

5.8 Tracks will be spaced at a minimum of 4m between pairs. This increases to 7m when a maintenance road is required. All tracks across the Site are adjacent to a maintenance road on at least one side.

5.9 Where coupling and uncoupling of rolling stock takes place a minimum curve radius of 140m is required. In all other cases the desired minimum curve radius is 150m. Tracks will be laid on concrete sleepers and all joints (including turnouts) will be welded to minimise noise.

5.10 Ballast (a specialised product produced for KiwiRail) will also be required for the construction of track work.

5.11 The Freight Hub design will allow for a range of train speeds for operations within the Freight Hub, with maximum speeds being:

(a) 40km/h in the arrival and departure tracks with 1:12 mainline turnouts;

(b) 30Km/hr within the marshalling yard, backshunts and leads. Connecting turnouts 1:9 for leads; and

(c) 25 km/hr for all other tracks within the Freight Hub. Standard 1:7.5 turnouts used.

Roads and connectivity

5.12 Paragraph 4.16 of my evidence details those parts of the local roading network that will be stopped. Of the three road entrances to the Freight Hub by road, the western and northern accesses are not directly serviced by existing roads. Therefore, the concept plan proposes a new perimeter road connecting Roberts Line to Railway Road at Maple Street.

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[7] These are additional connections from the NIMT into and through the arrival and departure road ending at the first marshalling track. There are two such connections allowing for movements from North and South. The connection points on The NIMT are at kilometrage 142.250 and 143.100.

5.13 For heavy commercial vehicle needing to enter and exit the Freight Hub the option of using Kairanga Bunnythorpe Road and in particular the section between Te Ngaio and Railway Road at Bunnythorpe was deemed unsuitable because of the two narrow and weight restricted bridges. In the absence of specific PNCC programmes to replace or upgrade these structures, KiwiRail considered that the perimeter road option was the most efficient and effective roading connection for the Freight Hub. Notwithstanding the above, it was also recognised that the perimeter road option does not preclude connections to future upgrades to the wider regional network. Further detail on the transport network and transport effects is outlined in the evidence of Mr Georgeson.

5.14 There are a number of properties that gain access across the NIMT from Railway Road that will need alternate access. A new section of Sangsters Road. Sangsters Road will be constructed to provide access to affected properties runs parallel with Railway Road, but on the eastern side of the NIMT. The road is only partially formed (from Clevely Line to 420m South of Tutaki Road). The remaining 1330m is unformed road. The intention is to form the last 700m providing access out to Roberts Line for affected properties.

5.15 Sangsters Road (formed and unformed section) also serves as part of Te Araroa Trail and has also been identified at a critical part of the PNCC and MDC active mode proposals for walking and cycling between Palmerston North and Feilding.[8] In recognition of this, the concept plan provides opportunity to retain Te Araroa Trail along the eastern boundary of the Designation Extent.

Utilities and infrastructure

5.16 The Concept Design recognises there are a number of utilities (being power, gas, water and sewer) that will be impacted by the Freight Hub. These were considered to be either critical (requiring to be addressed as part of the concept planning and design), or noncritical and (could be addressed during the detail design phase). Critical utilities included gas and water (in particular the PNCC Bore and sewer). Non-critical utilities included transmission lines local power reticulation and stormwater reticulation.

Gas

5.17 The First Gas transmission pipeline crosses diagonally through the southern corner of the Site from a point approximately 400m west of the Richardsons

[8] Active Mode Connectivity Palmerston North to Fielding SSBC – for PNCC & MDC – BECA 2019.

Line intersection on Roberts Line. It then crosses under the NIMT 50m North of the Richardson Railway Road intersection. The 300mm diameter pipeline feeds the East Coast of the North island and is a critical service. The pipeline is protected with a 10m wide easement.

5.18 Although the pipeline crosses under the NIMT, the Freight Hub cannot avoid the pipeline. Furthermore, it poses a significant safety risk and maintenance accessibility for First Gas would be compromised. As a result, relocation of the pipeline was determined to be the only available option. The details of when and where the pipeline is being relocated to is being addressed between KiwiRail and First Gas.

Water bore

5.19 PNCC has a water bore located at the south eastern corner of the Site. The Concept Design was developed to ensure the trackwork avoided the water bore area and this has been excluded from the Designation Extent.

Other technical considerations

5.20 As well as the matters listed above, a range of other factors have influenced the design, including geological, stormwater and ecological considerations. These matters are outlined in detail in the evidence of Messrs Mott, Leahy, and Garrett-Walker.

Geotechnical

5.21 At this stage a desktop geotechnical assessment has been undertaken but more detailed geotechnical investigations are required at a later stage. These will determine suitability and quantity of site material that can be reused as fill and the bearing capacity (strength) that can be expected at formation level. These will guide the design of foundations for the Freight Hub. The investigation will also look at settlement on the Site and the need for any ground improvement including preloading. This could become a time critical aspect as preloading could require up to two years. Further detail on geotechnical aspects of the Freight Hub is outlined in the evidence of Mr Mott.[9]

Stormwater

5.22 The Site level has been set sufficiently high to provide a stormwater discharge gradient across the Site. In constructing the Site, some 23Ha of flood plain will

[9] Evidence of Andrew Mott, dated 9 July 2021, at paragraphs [7.1] to [7.5].

be lost. Together with increased runoff from the Site, due to reduced surface permeability, there is potential risk of downstream flooding impacts. These effects are to be managed by two stormwater attenuation wetland ponds located between the perimeter road and the Mangaone stream.

5.23 The North Catchment will pass through a twin box culvert under the NIMT, discharging into a naturalised channel and then to the Mangaone stream is the same location as present. Track layouts has been modified to provide space within the Designation Extent for this. The Central Catchment running through the middle of the Freight Hub will be culverted for the whole length (some 650m) using two box culverts and will exit to west of the Site. The discharge point will be also at the same downstream location as present.

5.24 Further detail on stormwater design is outlined in the evidence of Mr Leahy.

6. CONSTRUCTION OF THE FREIGHT HUB

6.1 While a detailed construction programme cannot be confirmed until detailed design, I have prepared an indicative construction programme to assist with understanding the likely timings of various aspects of the construction of the Freight Hub. This programme outlines the expected timings from detailed design and regional consenting through to completion of the first stage of the Freight Hub.[10]

6.2 The indicative construction programme covers from commencement of detail design through to Stage 1 operation when KiwiRail is able to transfer all operational functions from the Existing Freight Yard to the Freight Hub. The draft / indicative programme has construction works taking about 3.5 years with an 18 month lead-in period before construction commences. This would have the site operational in the second quarter of 2030.

Regional consenting and detailed design stage

6.3 The lead-in period largely comprises the regional consenting stage together with the preparation and approval of relevant construction management plans, and other plans required to be approved and in place before construction commences. Land acquisition will also need to be completed. Running in parallel with these processes is the Site geotechnical assessment and site survey to confirm levels which are precursors for detailed earthworks design as outlined at paragraph 5.21 of my evidence.

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10 The indicative construction programme is set out at 4.2 of the DCO Report.

Construction of enabling works

6.4 The enabling works are then expected to start in the second quarter of 2024 and expected to be completed in the second quarter of 2027. This stage involves:

(a) bulk earthworks, including first stripping the topsoil and unsuitable material, excavation of the stormwater ponds and cut and fill to level the Site;

(b) construction of the perimeter road;

(c) placing of box culverts; and

(d) construction of noise bunds and planting.

Bulk Earthworks

6.5 Although the proposed finished yard level is RL50m, the formation level or top of the bulk earthworks level is currently assumed at 700mm below, that is RL49.3m. This lower level has been used to determine bulk earthwork volumes.

6.6 The bulk earthworks phase includes levelling the Site, construction of the two large stormwater ponds, northern noise bunds, construction of the perimeter road and boundary formation, installation of culverts, construction of security fencing and noise wall where appropriate, and planting of these areas where possible.

6.7 The first step of enabling works will be earthworks to allow roading network connections to be developed and noise bunding and planting to occur particularly on the western and northern boundaries. Bulk earthworks within the Freight Hub footprint to develop the site to formation level (RL49.3m) will then follow.

6.8 Formation level will be achieved by cutting the high points and filling the low points, with up to 5-6m of fill expected in some locations. Site earthworks are not balanced, and imported fill will be required to complete construction to formation level. A drawing showing the location of cuts and fills for the Site is outlined at Figure 1 below.

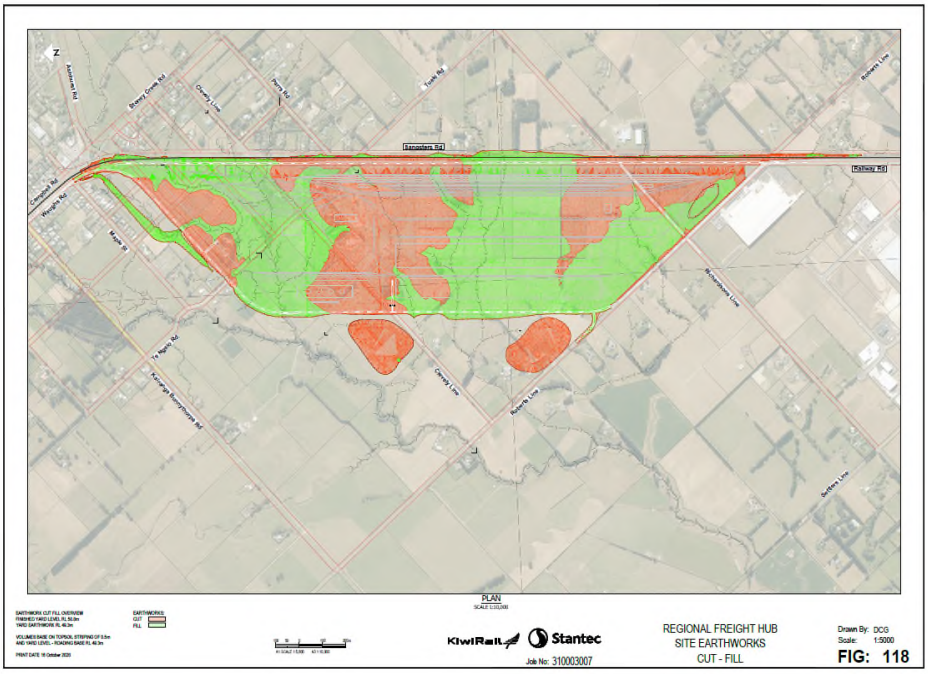

Figure 1: Earthworks

6.9 Approximately 45% of bulk fill material is expected to be available from within the Site (cut to fill) with the balance 55% or 1,550,000m3 to be imported. 11 Identifying sources and routes to Site will be determined once a earthworks contractor has been engaged.

6.10 Once construction to formation level has been completed, a layer of granular fill will be placed over the Site to provide base working surface which will also act to suppress dust. Areas that lie outside of functional area can be shaped and grassed or if appropriate planted. Works will be able to commence on multiple fronts to provide assets and facilities required for initial site operation.

6.11 For construction up to the required level it is expected that the imported material required will be a range of granular material (AP65 and AP40) for use in building foundations and under paved areas such as roads and concrete hard stands. The sources of these materials have not been determined, but the closest sources to Palmerston North are from the Manawatu River between Palmerston North and Ashhurst. This material is likely to be trucked to Site.

11 Table 6 of the Design, Construction and Operation Report provides further detail on the estimated bulk earthworks volumes for the Site.

6.12 For rail tracks, ballast will be sourced from KiwiRail specialist suppliers likely to be Otaki. Initially it is expected ballast will be trucked to Site. Railing ballast will require track access into the site as a minimum.

Construction of perimeter road and road closures

6.13 The closure of Railway Road requires completion of the first step of the enabling works, a functional perimeter road, construction of the new section of Sangsters Road to replace the lost private level crossing access together with completed intersection upgrades at, Roberts / Richardsons and Roberts / Perimeter Road.

6.14 Closing Railway Road will also close the Clevely Line level crossing. Timing of the closure of the Roberts Line level crossing and reconfiguration of the Roberts / Railway intersection must occur before the NIMT[12] is temporarily relocated as the track will be lowered approximately 1.5m through the level crossing. Access to the eastern side of the temporary relocated main to construct the new track formation, build noise bunds and permit landscape works will be from Roberts Line South. Construction access to the main site area will be from Roberts / Richardson Intersection, Entry Point 1 and nominally Entry Point 2 on the western Boundary. To reduce construction traffic on the Perimeter Road it is proposed to use the Southern section of Clevely Line as the second site access crossing the Perimeter Road near the Northern stormwater pond. No construction accesses are proposed from the Northern side of the Site.

Culverting

6.15 An estimated 650 box culvert units are required to complete the twin culvert through the middle of the site and a further 60 units for the northern end. There will be a long lead in supply period (estimated over a period of 2 years) and ordering of these units is essential as soon as funding is in place to avoid delay to the Site works.

Noise bunds and planting

6.16 The draft programme shows that up to a two-year lead is possible for the first planting and longer for other areas if started in the fourth quarter of 2023.

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12 Further detail on the potential timing and options for the relocation of the NIMT is detailed in Appendix 2 of Attachment 3 of the First Section 92 Response.

6.17 The relocation of the NIMT will leave safe working room on the east side for construction of the new track formation and noise bunds. As soon as this work is complete, noise mitigation and planting can be undertaken, with priority being given to the north eastern corner being closest to the most populated area along the eastern boundary.

Construction of the Freight Hub

6.18 Below I summarise the expected construction programme of the Freight Hub to the completion of Stage 3. The Concept Design layout identifies all components of the Freight Hub that are expected to be included by Stage 3. A table outlining the key components of the Freight Hub and the stages of development is attached at Appendix A to my evidence.

Freight Hub construction to Stage 1 operation

6.19 Once enabling works are complete, construction of the Freight Hub will start and take approximately 3 years (from 2027 to 2030).

6.20 The key elements of the construction of the Freight Hub to Stage 1 will include:

(a) the rail trackwork for the yard, including:[13]

(i) two 1500m arrival and departure tracks, both electrified;

(ii) 12 marshalling tracks; and

(iii) one 900m wagon storage track;

(b) the freight forwarding buildings (this includes 2 of the 4 major freight forwarders building and supporting trackwork, and 2 of 6 of the secondary freight forwarders facilities);

(c) the container terminal (full development including refrigerated storage, and support facilities offices and truck parking);

(d) log loading (one 450m track plus wagon storage);

(e) wagon and locomotive maintenance (full development of the main facility plus 50% of supporting storage buildings);

(f) the parking and roading; and

[13] For an indicative outline of how the Freight Hub will be expanded from Stage 1 to Stage 3, please refer to Appendix 4 of Attachment 3 of the First Section 92 Response.

(g) other ancillary structures (such as administration, network services, terminal operation buildings, and 75% of network equipment storage of facilities).

6.21 Construction of the footprint of the Freight Hub itself from formation level 49.3m to a finished level of 50m and all above ground facilities including tracks, buildings, utilities, roadways and parking areas as required for Stage 1 will commence in the second quarter of 2027 and is tentatively programmed to finish 3 years later in the second quarter of 2030.

6.22 The Site affords the opportunity to have a number of concurrent construction areas. For example, the marshalling yard will be constructed in parallel with the arrival and departure tracks. Building works for major freight forwarders and maintenance facility are expected to occur at the same time with secondary freight forwarder building and a number of other structures.

Construction of Stages 2 and 3 of the Freight Hub

6.23 At this stage, it is anticipated that the Freight Hub will be constructed in three stages, but the Freight Hub will become operational after Stage 1. Stages 2 and 3 will be constructed between 2030 and 2050, as demand requires. Further detail on the expected development for Stages 2 and 3 is outlined at **Appendix A**.

7. RESPONSE TO SUBMISSIONS

7.1 I comment below on submissions relating to the design, construction and operational effects of the Freight Hub.[14] I respond to these submissions by way of themes.

Sequencing of construction works, noise mitigation, roading and site access

7.2 A number of submitters raised concerns about the location of the perimeter road and how this has been determined. During early consultation with the community the perimeter road was shown exiting to Kairanga–Bunnythorpe Road near Te Ngaio Road. However, this route was not considered feasible

[14] These include Glen & Karen Woodfield (No. 6), Tutaki 2019 Ltd (No. 13), Martin Jones (No. 16), Kevin And Yvonne Stafford (No. 18), Bunnythorpe Community Committee (No.43), Aaron Fox (No.47), PowerCo Ltd (No.48), Foodstuffs North Island (No. 58), Peter Gore & Dale O'Reilly (61), Mary Anne Chapman (No. 62), Danelle O'Keeffe & Duane Butts (No. 72), Gordon H Malcolm (No. 83), Corinne Dingwall (No.88), Owen Reid (No.95).

because of the two weight limited bridges, preventing its use by heavy commercial vehicles.

7.3 Taking this into account, KiwiRail shifted the perimeter road connecting to the remaining section of Railway Road joining just south of Maple St. It is possible that the removal of the weight restriction on these bridges would allow the perimeter road route to be reassessed. This is something that would be considered as part of the Road Network Integration Plan outlined in the Proposed Conditions, in consultation with relevant regional and local authorities and Waka Kotahi NZ Transport Agency.

7.4 Some submitters also seek early implementation of noise reduction measures and roading developments. As detailed my evidence (section 6), the works are programmed to advance the noise bunds and roading alteration as early as possible in the construction. The western and northern sides along with the stormwater ponds will be constructed early in the programme. Before noise bunding works along the eastern boundary can occur, the perimeter road needs to be operational, Railway Road needs to be closed, and the NIMT needs to be relocated into the Site to provide room for construction along the Eastern (Sangsters Road) boundary. The Proposed Conditions will ensure that the perimeter road will be constructed before Railway Road is closed, unless an alternative access (for example through wider transport network upgrades) means that the perimeter road or a relevant part of it is no longer required to be built.

Size of site and facilities

7.5 Some submitters have raised questions about the size of the Designation Extent. The process of sizing the Designation Extent was carefully informed by the layout of the Freight Hub in the concept design (in addition to other matters such as the stormwater management system discussed in the evidence of Mr Leahy). The layout of the Freight Hub was also carefully informed by the size and relationship of each of its individual components.

7.6 A number of configurations were considered. Once the preferred site and a concept layout for the key operational facilities was identified, minor changes were made to the concept design. For example, adjusting trackwork to avoid Roberts Line Railway Road intersection and the PNCC water bore. The operational components were also shifted westward to allow for relocation of the NIMT and construction of noise mitigation bunds and walls, and alterations were made to ensure there was sufficient land for stormwater management. The base Freight Hub facilities area is about 130ha, but there are other

components needed to support the Freight Hub which support the proposed layout. I consider that the Designation Extent has been appropriately sized to accommodate the range of complex operational requirements and mitigation measures.

7.7 One submitter suggests that KiwiRail could use the proposed site if it was limited to 40ha (the equivalent area to the Existing Freight Yard) and contained within the existing NEIZ. I do not agree. There would be no benefit to a similar sized site even with layout flexibility for a number of reasons including that the current site cannot make up a 900m train without building on several tracks and then joining up to depart. The constraints of the Existing Freight Yard are also discussed in Mr Moyle's evidence.

Location and / or selection of the Site

7.8 A number of submissions sought to have an alternative site chosen. The MCA process is discussed in Ms Bell's evidence. From an engineering perspective, sites between Bunnythorpe and Feilding all had engineering issues that would need addressing. Although those sites appear level, the NIMT climbs steadily from Bunnythorpe and the natural ground falls from the north-west to the south-east this creates significant challenges and earthworks for these sites.

7.9 The MCA assessment looked at connectivity to PNCC and the NEIZ recognising that the existing roading infrastructure would require investment to support the Freight Hub as well as changes to the local roading network. The impacts of relocation of transmission lines and other service such as Manawatu District Council water supply assets were also factored into the engineering side of the MCA assessment, with several kilometres of water reticulation impacted for site 2. In terms of my component of the Engineering Degree of Difficulty, these sites ranked lower that the chosen Site.

8. RESPONSE TO SECTION 42A REPORT

8.1 I have reviewed the sections of the Section 42A Report relevant to my evidence, particularly the PNCC Infrastructure Assets[15] Report and the Technical Evidence: Railway Track Design, Construction and Operation.[16]

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15 Section 42A Technical Evidence: Palmerston North City Council infrastructure assets, dated 18 June 2021.

16 Section 42A Technical Evidence: Railway track design, construction and operation, dated 18 June 2021, p

PNCC Infrastructure Assets

8.2 Mr van Bentum has raised a number of concerns with PNCC infrastructure assets that are relevant to the design of the Freight Hub, which I respond to below.

8.3 Mr van Bentum notes that the perimeter road also includes a pathway and that the Council's expectation is that the minimum width for the pathway must be 2.5m. He also notes that the Council's preference is for connection for active transport users to be preserved between both sides of the railway line, possibly as an underpass.[17]

8.4 The provision of a shared path along the perimeter road was not included in the concept details. The concept plan allows for a nominally 30m wide road reserve. This provides adequate width to allow for a 2.5m separated path, two traffic lanes, with room for local widening for turning bays if required. The details of any shared path are expected to be subject to detailed design.

8.5 No allowance has been made for an underpass beneath the railway line at or near the Roberts Line Railway Road Intersection. There are some practical challenges to providing an underpass in terms of having sufficient room (width and length) to get deep enough to pass under the rail and road, while also being clear of underground services. I understand that these types of details can be explored further through the Road Network Integration Plan included in the Proposed Conditions, which will include the location, timing and form of any changes and upgrades to pedestrian walkways and cycleways.

8.6 Mr van Bentum has also raised concerns regarding a PNCC bore located on the Site. It is also noted that this bore will be able to service the KiwiRail site which will require potable water. There is a technical solution to this issue and KiwiRail is working through this with PNCC.

Rail Design, Construction and Operation

8.7 Mr Than acknowledges the constraints and functional inefficiencies of the Existing Freight Yard.

8.8 Mr Than generally supports for the Freight Hub. However, there is an underlying concern that the configuration might be suboptimal and that to confirm the concept design meets scale and scope of future operation a

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17 Section 42A Technical Evidence: Palmerston North City Council infrastructure assets, dated 18 June 2021, at paragraphs [49] and [50].

detailed simulation should be undertaken. Mr Than has indicated the benefits that a simulation might bring to the project. It is my view that simulation will not materially change the basic size of the components or the footprint of the site and as such is not necessary at this stage of the process.

8.9 Together with operation staff I have tested layout changes to see the impact on operations. This includes the number and type of tracks provided for Stage 1, access to the arrival and departure yard from the North without the pull back, marshalling only from the south end, operation of the log yard, the addition of North and South crossovers. I consider that sufficient work has been done at this stage to test the design and layout of the Freight Hub without the need for simulations.

8.10 Mr Than has expressed concern that the concept design has not been put through a safety in design assessment in accordance with KiwiRail's own requirements. My understanding is that Safety In Design will become part of subsequent phases of work, starting with the development of the detailed design.

Michael Skelton

9 July 2021

Appendix A

The following table extracted from the DCO report provided an overview of development of the Site

Functional Areas	**Stage 1** **2030** Full demobilization from Tremaine Ave	**Stage 2** **2040**	**Stage 3** **2050** Full implementation	**Area m^2**
Arrival / Departure Yard	2 Tracks (1500m trains); no pull backs required	4 Tracks (1500m trains); south (PN) pull back should be considered	8 tracks	83,100
Marshalling Yard	12 Tracks	15 Tracks	15 tracks	106,500
Wagon Storage Yard	1 track 900m long 50% - of capacity. marshalling tracks can be used to cover storage shortfall if required	2 tracks (100%)	2 tracks	14,400
Container Terminal	Full development. Refrigerated containers included. 3 Pad Tracks. Office, Truck and Car Parking.	Full development. Refrigerated containers included. 3 Pad Tracks. Office, Truck and Car Parking.	Full development with 8000 TEUs pa / 180 refrigerated	176,000
Wagons, Locomotives	Main maintenance Building + 50% supporting buildings(storage)	Full implementation	Full implementation	130,000
Network work Equipment	75% supporting buildings and shed areas	100% supporting buildings and shed areas	100%	43,000
Network Services Maintenance Depot and Terminal Operations	100% (see appendices for details)	100%	Depot and terminal building	2,700
Freight Forwarding Sidings- Prime Facilities	2 Warehouses (50% of full capacity) plus 50% of track required to service area	3 Warehouses (75% of full capacity) plus 100% of trackwork required to service area	4 Warehouses	90,000
Freight Forwarding Sidings: Secondary Facilities	2 Warehouses (33% of full capacity) plus Trackwork	4 Warehouses (66% of full capacity)	6 Warehouses	60,000
Log Loadings	1 track 450m long (50% of planned max capacity)	2 tracks each 450m (100%) includes northern connection to main	2 tracks	51,600
Tanks	0 Tanks	2 Tanks (accordingly to needs)	4 tanks Diameter 20m 5m tall	87,500

UNDER the Resource Management Act 1991 ("**RMA**")

AND

IN THE MATTER of a notice of requirement ("**NoR**") for a designation by KiwiRail Holdings Limited ("**KiwiRail**") for the Palmerston North Regional Freight Hub ("**Freight Hub**") under section 168 of the RMA

STATEMENT OF EVIDENCE OF JOHN MCKENSEY
ON BEHALF OF KIWIRAIL HOLDINGS LIMITED

LIGHTING

1. SUMMARY

1.1 I have peer reviewed the Lighting Report that was included with the Design, Construction and Operation Report as part of the Assessment of Environmental Effects ("**AEE**") for the Freight Hub. That report has subsequently been updated ("**Updated Lighting Design**") and is attached to my evidence at **Appendix 1**.

1.2 The Updated Lighting Design has been adjusted in terms of luminaire selection, height, location and tilt to ensure that the design now satisfies the obtrusive light limits recommended in AS / NZS 4282:2019,[1] for environmental zone A2.[2] This includes spill light, glare and sky glow effects.

1.3 As shown in the Updated Lighting Design, the exterior lighting for the Freight Hub will comprise 20m columns with asymmetric floodlights, 12m high building-mounted floodlights and 7.5m columns with roadway lights. The lights will all be LED. Almost all of the lights will be installed with zero upward tilt. The remainder will be installed at a maximum of 5 degree tilt and will be located no higher than 12m. The lighting will have a colour temperature of 4000K.

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1 Control of the obtrusive effects of outdoor lighting.

2 "Low District Brightness" – such as sparsely inhabited rural and semi-rural areas.

1.4 Based on Updated Lighting Design, I am of the opinion that the lighting effects will be suitably addressed as the calculated values comply with AS / NZS 4282:2019 zone A2 recommended limits for spill light, glare and sky glow. On that basis, in my opinion, the lighting effects will be low to negligible – ie less than minor.

2. INTRODUCTION

2.1 My full name is John Kinross McKensey. I am an Executive Engineer for LDP Ltd (Independent Electrical and Illumination Engineers).

Qualifications

2.2 I hold a Bachelor of Engineering (Electrical) degree from the Queensland Institute of Technology. I have completed the Consulting Engineering Practice and Management programme at the University of Melbourne.

2.3 I am a member of several relevant associations including Illuminating Engineering Society of Australia and New Zealand (MIES); Chartered Member of Engineering New Zealand (CMEngNZ); Chartered Member of the Institution of Engineers Australia (MIE Aust); Chartered Professional Engineer Australia (CPEng Aust); National Engineers Register, Australia (NER); APEC Engineer; International Professional Engineer, Australia (IntPE); Member of the Resource Management Law Association; Member of the International Dark Sky Association; and New Zealand Green Star Accredited Professional (GSAP).

Experience

2.4 I have over 40 years' experience in lighting design, providing consultancy services for a wide range of clients including local authorities, developers, road controlling authorities and infrastructure sectors. My experience includes:

(a) lighting advisor to Auckland Council during the Proposed Auckland Unitary Plan process;

(b) lighting advisor to Christchurch City Council during the Replacement District Plan process;

(c) author or co-author of five local government codes of practice with respect to exterior lighting, each containing environmental considerations;

(d) author of the Auckland Council Sportsfield Lighting Guidelines;

(e) lighting advisor to Auckland Transport; and

(f) lighting advisor to Waka Kotahi NZ Transport Agency.

2.5 I also have over 20 years' experience advising as to environmental lighting effects. I have provided consultancy services for private client applicants and local government regarding the assessment of lighting effects of an activity. In particular, I have prepared lighting assessment of effects for exterior lighting installations for the following projects:

(a) Waikato Expressway Cambridge to Tamahere, which included consideration of the effects of lighting on residents, motorists and biota other than people.

(b) Kennedy Point Marina Waiheke which included consideration of the effects of lighting on residents, motorists, navigation and biota other than people.

(c) Tekapo Drainage Canal which included consideration of lighting effects on Mt John Observatory.

(d) Lake Pukaki Development which was to be located in an intrinsically dark environment.

2.6 I have also reviewed lighting effects for local government in regards to sportsfields, signage and digital billboards, roads, pathways and carparks and private development exterior lighting for buildings, quarry, greenhouse and service stations. I have provided lighting advice to local government for the Devonport Domain, Vauxhall Park, Stanmore Bay League Fields, Waitakere Stadium, Replacement Wynyard Crossing Bridge and Auckland Harbour Bridge Skypath.

2.7 I have previously prepared and presented evidence in the Environment Court and for Independent Hearings Panels for lighting effects for a number of clients, including local government for the following projects:

(a) Michaels Avenue Reserve for Auckland Council;

(b) Waikeria Prison Expansion for Otorohanga District Council;

(c) Matiatia Marina – Waiheke Island for Auckland Council;

(d) Kennedy Point Marina – Waiheke Island for Kennedy Point Boat Harbour Ltd;

(e) Americas Cup AC36 Facilities – Auckland for Panuku Development Auckland (an Auckland Council CCO);

(f) Waste Management NZ proposed landfill at Wayby Valley for Auckland Council;

(g) Auckland Unitary Plan for Auckland Council;

(h) Christchurch Replacement District Plan for Christchurch City Council; and

(i) Amberfield Development for Hamilton City Council and the Applicant (common interest privilege).

Involvement in the Freight Hub

2.8 I was engaged by KiwiRail May 2021 to peer review the Lighting Report which was prepared by Stantec (dated October 2020) and included as part of the AEE for the Freight Hub. I have also reviewed KiwiRail's responses to Palmerston North City Council's ("**PNCC**") First Section 92 Request dated 14 December 2020, and agree with the responses relating to lighting matters (identified as item numbers 3, 4, 5 and 6).

2.9 With regard to KiwiRail's responses to the First Section 92 Request, I note that the calculated lighting effects have reduced since KiwiRail's response was provided. In particular, the maximum luminous intensity (ie Glare to Residents) has been reduced from over 60,000 candelas to 906 candelas and will now comply with the recommendations in AS / NZS 4282:2019 (as I explain further in detail below).

2.10 Improvements have also been achieved through changes to optic selection, tilt, and mounting height. This has enabled the glare effects to be contained within the site sufficient to achieve the limits recommended in AS / NZS 4282:2019.

2.11 In response to a query regarding potential train headlight sweep to residents (in the First Section 92 response), it is considered that the proposed 5m high site perimeter noise barrier will effectively mitigate such effects. I have considered the degree of coverage afforded as indicated in Figure 1 and I agree with this opinion.

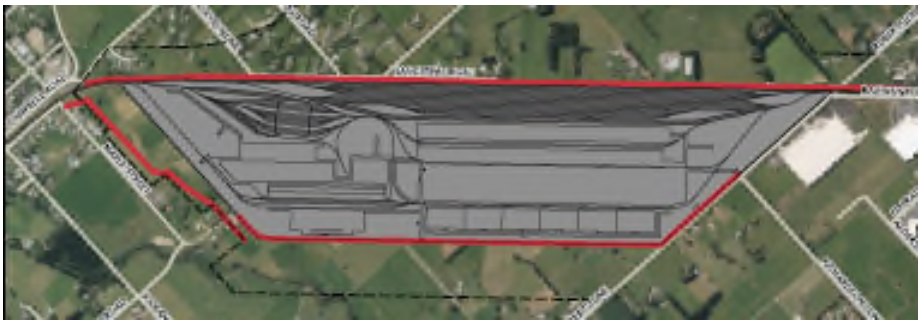

Figure 1. Proposed noise management barrier[3]

2.12 In the course of peer reviewing the Lighting Report I noted that the concept lighting design appended to that report at Appendix B[4] indicated potential lighting effects that were in some cases, above standard levels. I recommended that the lighting design for the Freight Hub be further developed to demonstrate that the lighting could be designed to suitably address those effects and to address concerns raised by submitters.

2.13 The lighting design was further developed and is shown in the Updated Lighting Design at **Appendix 1** to my evidence. I have based my assessment of the lighting effects of the Freight Hub on this Updated Lighting Design.

2.14 I have reviewed concerns regarding lighting effects raised by submitters, considered matters regarding lighting effects raised in the Section 42A Report ("**Section 42A Report**"), and the technical lighting evidence of Mr Wright, and address these matters later in my evidence.

Code of conduct

2.15 I confirm that I have read the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2014 and that I agree to comply with it. I confirm that I have considered all the material facts that I am aware of that might alter or detract from the opinions that I express, and that this evidence is within my area of expertise, except where I state that I am relying on the evidence of another person.

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3 Stephen Chiles Memo dated 12 February 2021 – Fig. 1 – Proposed Noise Management Boundary.

4 Stantec Report – Design, Construction and Operation – October 2020, Appendix B – Lighting Design, drawing set labelled as figures 67 - 76.

3. SCOPE OF EVIDENCE

3.1 This statement of evidence will:

(a) outline the key features of the Updated Lighting Design for the Freight Hub;

(b) set out the existing environment and potential receivers;

(c) consider the Updated Lighting Design against applicable standards;

(d) consider the lighting effects of the Freight Hub;

(e) respond to the submissions received that relate to lighting matters; and

(f) address relevant matters raised in the Section 42A Report.

4. UPDATED LIGHTING DESIGN

4.1 The Updated Lighting Design has been tailored to be as near as practicable to the minimum performance necessary for safe operation. Internal access roads are designed to category PR5 per AS / NZS 1158.3.1:2020 (target 0.85 lux average), car parking is designed to category PC3 per AS / NZS 1158.3.1:2020 (target 3.5 lux average) and the rail freight yard is designed in accordance with KiwiRail standard E-ST-EL-0131 for load / unload areas (target 30 lux average) and other areas (target 20 lux average).

4.2 The design has been adjusted in terms of luminaire optic selection, height and tilt to ensure that the design now satisfies the obtrusive light limits recommended in AS / NZS 4282:2019,[5] for environmental zone A2.[6] This includes spill light, glare and sky glow effects. The obtrusive lighting calculations were undertaken using initial light output with a maintenance factor of 1.0 to demonstrate the worst case effects.

4.3 To aid in understanding the nature of the proposed lighting I have included a number of images of comparable installations. Figure 2 shows tall column lighting similar to that proposed for the Freight Hub, with zero tilt lights. Figure 3 shows the style of luminaire proposed. The columns have been lowered

5 Control of the obtrusive effects of outdoor lighting.

6 "Low District Brightness" – such as sparsely inhabited rural and semi-rural areas.

approximately 2m from the original lighting design, but cannot be lowered further without increasing tilt and thereby increasing obtrusive light effects.

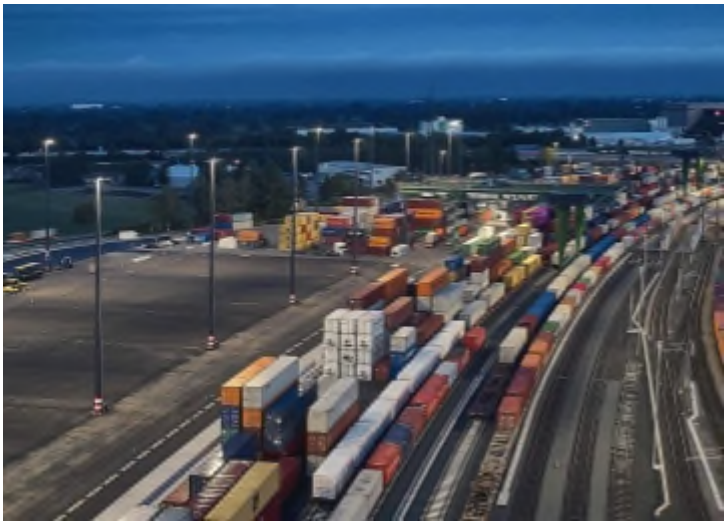

Figure 2. Indicative installation – freight yard lighting

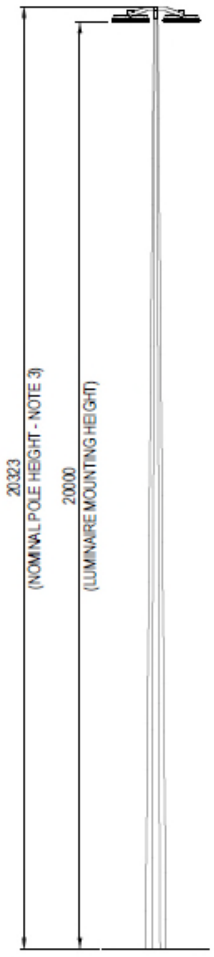

Figure 3. Proposed luminaire – freight yard lighting

4.4 I note that the lighting towers in the container terminal at KiwiRail's existing rail yard on Tremaine Avenue are approximately 36.5m in height. In my view the proposed lighting structures at the Freight Hub will look less imposing during the day than those at the Existing Freight Yard for a number of reasons, including that they will have a lower height and are proposed to be a thinner structure.

4.5 Figure 4 is representative of the expected appearance of the wall mounted floodlights with zero to 5 degree tilt. Figure 5 shows the style of luminaire proposed.

Figure 4. Indicative installation – wall mount area lighting

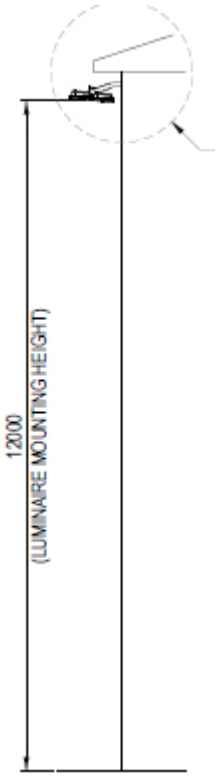

Figure 5. Proposed luminaire – wall mount area lighting

4.6 Figure 6 is representative of type of lighting proposed for access roads and car parking with zero to 5 degree tilt. Figure 7 shows the style of luminaire proposed.

Figure 6. Indicative – road / car park lighting

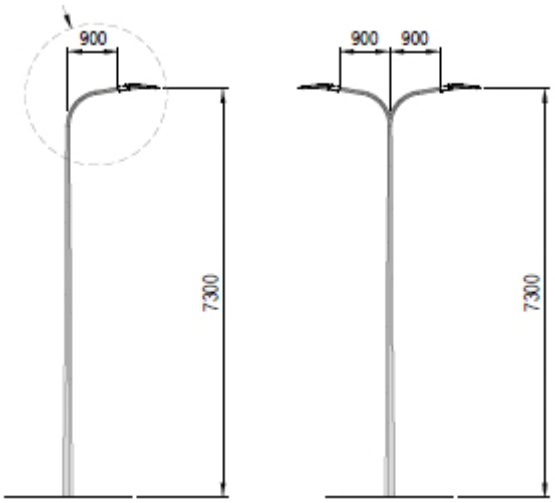

Figure 7. Proposed luminaire – road / car park lighting

5. EXISTING ENVIRONMENT AND RECEIVERS

5.1 The Freight Hub is located approximately 1km north of the Palmerston North Airport with Palmerston North City beyond. It is just south of the township of Bunnythorpe and it is bordered mostly by semi-rural properties with a residential component.

5.2 Part of the land to the south is zoned Industrial and there is an industrial neighbour to the south. The topography is generally flat. The elevation of surrounding properties is similar to the average site elevation, within a few metres.

5.3 The principal receivers are the surrounding residential buildings, the Palmerston North Airport and motorists on surrounding roads.

5.4 The existing environment for the residential buildings is relatively dark with generally no road lighting or other nearby lighting except neighbouring residential building lights and the more distant lights and skyglow effects of Palmerston North city and Bunnythorpe township. In my opinion, this would constitute Low District Brightness.

5.5 The Palmerston North Airport is close to Palmerston North residential and industrial buildings and most nearby roads appear to include lighting. A number of the nearby industrial buildings have roof skylights and exterior area lighting, with varying degrees of upward tilt. The airport itself has lighting. In my opinion, this would constitute Medium to High District Brightness.

6. LIGHTING EFFECTS ASSESSMENT

Applicable standards

6.1 In assessing the lighting effects of the Freight Hub, I have assessed the Updated Lighting Design in relation to:

(a) alignment with recommendations in the standard AS / NZS 4282:2019 (Control of the Obtrusive Effects of Outdoor Lighting); and

(b) compliance with the PNCC District Plan ("**District Plan"**) permitted activity lighting standards.

AS/NZS 4282:2019

6.2 The stated objective of AS / NZS 4282:2019 is "*to provide a common basis for assessment of the likely effects of developments that involve the provision of outdoor lighting*". In the context of this application, it recommends limits for spill light and glare to adjacent residential properties, and limits for glare to nearby motorists and sky glow effects that could affect public amenity (ie the visibility of the sky at night). It is the only current New Zealand and / or Australian standard addressing such matters and is therefore directly applicable to the Freight Hub. In addition, its predecessor (now superseded) AS4282:1997, is referenced in the District Plan.

6.3 The calculation summary accompanying the Updated Lighting Design sets out the recommended obtrusive light limits for the proposed site for the Freight Hub ("**Site**") and it shows that the limits in Standard AS / NZS 4282:2019 can be achieved.[7]

6.4 Spill light and glare calculations have been undertaken for each adjacent residential property as listed below:

(a) Clevely Line – 22A, 41A, 41B, 163;

(b) Nathan Place – 1, 3, 4, 5, 6, 7;

(c) Parrs Road – 27, 55D, 58, 59;

(d) Sangsters Road – 9, 11, 15, 25, 43, 73, 91, 95;

(e) Stoney Creek Road – 819, 821;

(f) Railway Road – 422;

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7 Stantec Report – Lighting Design – Revision D, dated 29 April 2021, at section 4.6.

(g) Roberts Line – 761, 771, 787, 803, 814, 824, 824A;

(h) Tukatai Road – 428;

(i) Maple Street – 1, 1A, 3, 5, 7, 7A, 9, 9A, 11, 11A, 13, 15, 17, 19, 21, 57; and

(j) Te Ngaio Road – 241, 242, 245.

6.5 Glare to motorists (ie Threshold Increment ("**TI**")) has been calculated for the western boundary perimeter – representing the closest and therefore most likely affected roads adjacent the Site.

6.6 Sky glow (analysed as the upward waste light ratio) has also been calculated.

6.7 My assessment of the Freight Hub's lighting effects against the limits in Standard AS / NZS 4282:2019 is set out in Table 1 below. This summarises the relevant parameters, limits and calculated results for the Freight Hub lighting effects. Note: The term 'cd' used in Table 1 is an abbreviation for 'candela'. This is a unit used to express luminous intensity. A common candle emits light with approximately 1 cd luminous intensity.

Table 1. Obtrusive Light Analysis – Current Standard

[(*) – Note: Based on "Low District Brightness" (eg sparsely inhabited rural and semi-rural areas)]

AS / NZS 4282:2019 OBTRUSIVE LIGHT ANALYSIS		
PARAMETER	**RECOMMENDED MAXIMUM LIMIT (*)**	**CALCULATED MAXIMUM VALUE**
Spill Light Vertical Illuminance at residential windows – curfew times[8]	1 lux	0.2 lux (at 422 Railway Rd)
Glare – Residents Luminous Intensity at residential windows – curfew times	1,000 cd	906 cd (at 9 Sangsters Rd)
Glare – Motorists TI for 0.2 Adaption Level	20 %	0 %
Sky Glow Upward Light Ratio	0.01	0.000

[8] AS / NZS 4282:2019 refers to curfew (11pm–dawn) & non-curfew (dawn–11pm) times and sets limits accordingly. Curfew limits are more stringent than non-curfew limits.

6.8 As demonstrated in Table 1, each of the calculated maximum values are within the recommended limits in Standard AS / NZS 4282:2019. Spill light and glare have been calculated for every adjacent residential property and the location where the maximum value occurs is noted. In my opinion, based on compliance with this Standard, the obtrusive light effects of the Freight Hub will be less than minor.

District Plan

6.9 While the NoR seeks a new designation for the Site and, I have analysed the lighting effects of the Freight Hub for compliance with the applicable rules under the existing zoning for completeness, particularly as they relate to adjacent residential use. The Site presently falls within both the Rural Zone and North East Industrial Zone ("**NEIZ**").

Rules relevant to the Rural Zone

6.10 The District Plan rules for the Rural Zone do not contain lighting rules directly relevant to the proposed Freight Hub activity. However, there is a requirement at Rule R9.5.3(f) (Permitted Activity – Performance standards for home occupations (without retailing from the Site) – Lighting) to limit light spill at residential windows to 8 lux vertical illuminance.

6.11 While this is not specifically required for an Industrial activity, the Updated Lighting Design confirms that the light spill from the Freight Hub at any adjacent residential window will be no more than 0.2 lux and therefore less than 8 lux.[9]

Rules relevant to the NEIZ

6.12 The District Plan rules for the NEIZ do contain lighting rules that are relevant to the Freight Hub with respect to lighting effects. Rule R12A.4.1 provides for a range of Permitted Activities (including Industrial activities) provided that they comply with the relevant performance standards. Performance Standard (f) requires that an activity:

(a) complies with R11.6.1.1(a)(iv); and

(b) any artificial lighting must be shielded from the approach and take-off paths to and from the Palmerston North Airport.

6.13 With respect to the first requirement, compliance with Rule R11.6.1.1(a)(vi) requires compliance with Australian standard AS 4282-1997, which has now

[9] Stantec Report – Lighting Design – Revision D ,dated 29 April 2021, at section 4.6.1.

been superseded by the Australia / New Zealand standard AS / NZS 4282:2019. Even though AS 4282-1997 has been superseded, I have assessed the Freight Hub for compliance against that standard given its reference in the Rule R11.6.1.1(a)(vi).

6.14 The now superseded standard AS 4282-1997 has different environmental descriptions and a different luminous intensity limit for compliance as summarised in Table 2 below.

Table 2. Obtrusive Light Analysis – Superseded Standard

[(*) – Note: Based on a "residential area with dark surrounds"]

(SUPERSEDED) AS 4282-1997 OBTRUSIVE LIGHT ANALYSIS		
PARAMETER	**RECOMMENDED MAXIMUM LIMIT (*)**	**CALCULATED MAXIMUM VALUE**
Spill Light Vertical Illuminance at residential windows – curfew times	1 lux	0.2 lux (at 422 Railway Rd)
Glare - Residents Luminous Intensity at residential windows – curfew times	500 cd	906 cd (at 9 Sangsters Rd)
Glare – Motorists Threshold Intensity (TI) for 0.2 Adaption Level	20 %	0 %
Sky Glow Upward Light Ratio	No specified limit	0.000

6.15 The limits for spill light to residents and glare to motorists in AS 4282-1997 are the same as those in the current standard, so it follows that the Updated Lighting Design complies.

6.16 AS 4282-1997 does not specify a limit for sky glow.

6.17 The AS 4282-1997 limit for glare to residents (ie luminous intensity) for dark surrounds at curfew times is 500cd. There are seven properties where the Updated Lighting Design may exceed this figure. These are:

(a) Clevely Line – 41A;

(b) Sangsters Road – 9, 43, 73;

(c) Stoney Creek Road – 819, 821; and

(d) Railway Road – 422.

6.18 However, of the seven properties affected, four have vegetation and / or buildings that would screen most or all of the glare effects. One is located in 'light surrounds' (ie next to a lit road) which would attract a 1,000cd limit and therefore comply with the superseded 1997 standard.

6.19 The remaining two properties are 819 and 821 Stoney Creek Road. The calculated glare at these properties is 530cd and 707cd respectively. The former is very close to the 500cd limit in the 1997 standard. The latter is mid-way between the 500cd limit in the 1997 standard and the 1,000cd limit in the 2019 standard. In my opinion, the 1,000cd figure in the most recent version of the standard (AS / NZS 4282:2019) is a more appropriate limit and the Updated Lighting Design demonstrates that this limit can be achieved.[10] I consider, effects on these properties will be less than minor.

6.20 The second requirement of the Performance Standard for Rule R12A.4.1 states that:

> Any artificial lighting must be shielded from the approach and take-off paths to and from the Palmerston North Airport.

6.21 The proposed lighting fixtures as shown in Figures 2 to 7 of my evidence emit all light downwards from the face of the fixture and the design is based on zero upward tilt for the majority of the lights with a maximum of 5 degree tilt. The maximum mounting height proposed is 20m. In my opinion, this design will effectively shield any direct view of the light source in relation to the approach and take-off paths for the Palmerston North Airport and as such will satisfy this part of the Performance Standard. I address this further in response to submissions below.

Airport Zone

6.22 The Freight Hub is also subject to the provisions in the Palmerston North Airport Zone (Rule 13.4.7) as it is in the Airport Protection Surface.

6.23 Lighting is identified as a Restricted Discretionary Activity under section R13.4.2.1. The Assessment Criteria are contained in R11.6.2.1(a)(i), (iii) and (iv) which provide:

(a) R11.6.2.1(a)(i): The extent to which exterior lighting is lit to an appropriate standard to ensure public and user safety, security and comfort;

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10 Stantec Report – Lighting Design – Revision D, dated 29 April 2021, at section 4.6.2.

(b) R11.6.2.1(a)(iii): The extent to which residents in any zone, or other nighttime property users, are not adversely affected by the obtrusive effects of exterior lighting; and

(c) R11.6.2.1(a)(iv): The extent to which road users are not adversely affected by the obtrusive effects of exterior lighting.

6.24 The closest point of the Site is more than 1.2km from the Palmerston North Airport runway and more than 2km from the air traffic control tower.

6.25 With respect to R11.6.2.1(a)(i) the Updated Lighting Design has been prepared to satisfy the recommendations in AS / NZS 1158.3.1:2020,[11] AS / NZS 4282:2019[12] and E-ST-EL-0131.[13] The latter document defines the target lighting requirements for outdoor operational areas.[14]

6.26 In addition, the Updated Lighting Design proposes the use of well controlled lighting fixtures with no more than 5 degrees upward tilt, proposes that all light be projected downwards and 0% Upward Waste Light Ratio ("**UWLR**").[15] Therefore, in practical terms, the light source will not be directly visible from airborne aircraft and will therefore not generate glare to pilots.

6.27 The majority of the outdoor space at the Freight Hub will be lit to an average of approximately 30 to 40 lux with a minimum overall uniformity of 0.4. In my opinion, the proposed lighting is not expected to cause confusion to a pilot as it will appear as distinctly different to the lighting that would be associated with an airstrip.

6.28 Based on the above, it is my opinion that R11.6.2.1(a)(i) is satisfied.

6.29 With respect to R11.6.2.1(a)(iii) the Updated Lighting Design satisfies the recommended obtrusive light limits defined in AS / NZS 4282:2019 (refer paragraphs 6.2– 6.8 of my evidence). Thus, in my opinion, R11.6.2.1(a)(iii) is satisfied.

6.30 Finally, with respect to R11.6.2.1(a)(iv) the Updated Lighting Design confirms the concept lighting design will satisfy the recommended limits in AS /

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11 Lighting for roads and public spaces – Part 3.1: Pedestrian area (Category P) lighting – Performance and design requirements.

12 Control of the obtrusive effects of outdoor lighting.

13 Traction and electrical standard.

14 Stantec Report – Lighting Design – Revision D, dated 29 April 2021, at section 3.

15 Stantec Report – Lighting Design – Revision D, dated 29 April 2021, at section 4.1.

NZS4282:2019 for glare to motorists.[16] Therefore, in my opinion, R11.6.2.1(a)(iv) is satisfied.

Navigation

6.31 Exterior lighting can potentially produce effects which are harmful to navigation. Typically this might be the case if the lighting could be confused with navigation lighting in terms of colour or disposition or if it could potentially create a veiling effect reducing navigation light visibility through diminished contrast. Navigation relates to water, air and land-based craft. While there are no District Plan requirements nor specific obtrusive light standards governing these matters, I have included this in my assessment for completeness.

6.32 There are no nearby navigable waterways. The Updated Lighting Design demonstrates that glare to motorists will be a maximum of 0% TI, versus a recommended limit of 20%. Hence, in my opinion, effects to motorists will be negligible.

6.33 Since the purpose of this facility is to service rail transport, lighting effects to train operators will be addressed by the designer as an internal matter. Nonetheless, considering the low glare effects to road traffic already noted, I would expect a similar level of effect to train operators. In my opinion, effects to train operators will be negligible.

6.34 I have considered the activities related to the Palmerston North Airport and have addressed the effects in my evidence, in the sections titled District Plan and Submissions. I consider that the lighting as proposed will result in negligible effects with respect to aircraft operations, control and safety.

6.35 However, I also recommend that during detailed design, the applicant confirm agreement with the Civil Aviation Authority (with respect to Palmerston North Airport).

6.36 There is also a local airfield approximately 4km to the north-northwest (ie Fielding Aerodrome), but I understand that this airport does not have night operation facilities and as such lighting effects would not be relevant.

Recommendations

6.37 While I have concluded above that the lighting effects of the Freight Hub will be less than minor, the lighting for the Freight Hub will be subject to further detailed design at a later stage of the process. In that regard, I consider that

16 Stantec Report – Lighting Design – Revision D, dated 29 April 2021, at section 4.6.3.

lighting conditions are required to ensure that lighting effects remain acceptable to the surrounding receivers. I reviewed the proposed Operational Lighting Design Plan Condition as lodged with the NoR and have recommended a number of changes, including that the condition be updated to require compliance with the latest standards rather than the District Plan. I address the changes to conditions further in response to the Section 42A Report.

6.38 My recommendations on the conditions have been included in the conditions in Appendix 1 to Ms Bell's evidence ("**Proposed Conditions**") and I support these conditions.

7. RESPONSE TO SUBMISSIONS

Air safety

7.1 Two submitters (Palmerston North Airport and Airways Corporation) have raised concerns regarding the potential for light and glare of the Freight Hub to cause air traffic controllers and pilots to have visibility, identification or perception issues. This includes exterior lighting as well as interior lighting emitted through skylights.

7.2 As demonstrated below at paragraph 7.3 of my evidence, the external lighting for the Freight Hub will be below the horizontal surface control. The lights will be aimed downwards with no more than 5 degrees of upward tilt. As such, the glare towards airborne craft will be negligible to nil. Aircraft at an altitude greater than 20m will have no direct visibility of the light source and thus no direct glare.

7.3 Aircraft below 20m will logically be on or very close to the airstrip, which is more than 1km from the Site and aligned perpendicular to the site. Hence, the lighting will not be in the direct line of sight of the aircraft pilot on take-off or final landing approach. Regardless, at that distance, the vertical angle of the light from an observer would be near 90 degrees and the glare would be negligible to nil.

7.4 In addition, the Site is not in direct line with the Palmerston North Airport runways, approach surfaces or take-off surfaces. It lies beneath the horizontal surface of the Airport Protection Surface which, at 90m AMSL, is more than 40m above the level of the runway. Also, the light sources will not be directly visible from the air above 20m and only to a very minor degree below 20m as

noted in paragraph 7.3. As such, the lighting will not cause any issues for pilot's navigating aircraft in my opinion.

7.5 The air traffic control tower is more than 2km from the Site. Considering the minimal tilt of the lights and the relative height of the lights to the air traffic controllers, the air traffic controllers will not have direct visibility of the light sources. As such, they are not expected to have any significant issues with respect to glare in my opinion.

7.6 While there would likely be some upward glow from building skylights at night, the size, shape, diffused nature of any emissions and the separation distance from the airport will result in negligible effects to aircraft pilots in my opinion.

7.7 Palmerston North Airport and Airways Corporation have sought confirmation that Civil Aviation Rules Part 77 will be complied with. Rule 77.7(b) of the CAA Rules – Objects and activities affecting navigable airspace – addresses lighting effects and reads as follows:

> (b) A person proposing to operate a light or a laser must notify the Director in accordance with rule 77.13 if—
>
> (1) because of its glare or affect on a pilot's vision, the light or laser is liable to endanger aircraft; or
>
> (2) for a laser, it would produce exposures in navigable air space exceeding the maximum permissible exposure defined for that laser in NZS / AS 2211; or
>
> (3) it is likely to endanger aircraft by being mistaken for—
>
> (i) a light or part of a system of lights established or approved for display at or near an aerodrome; or
>
> (ii) a light marking a hazard in navigable airspace.

7.8 Laser lighting is not proposed as part of the Freight Hub.

7.9 The proposed lighting will be selected and installed in a manner which will ensure that a pilot will not have a direct view of any light source. In that regard, and for the reasons set out at paragraph 6.21 of my evidence, any glare effects will be negligible in my opinion.

7.10 Navigation lights associated with the Palmerston North Airport will be aligned with the ends of the runway and are of a type that the light source is visible to

the pilot. Since the proposed lighting is not in line with the runway and the light sources will be screened from the view of pilot, in my opinion, it is unlikely that the proposed lighting could be mistaken for navigation lighting.

7.11 No red lights are proposed that could potentially be confused with navigable airspace hazard lights.

7.12 In my opinion, the proposed lighting will satisfy CAA Rule 77.7(b). I recommended that this be included in the Operational Lighting Design Plan.

Light spill

7.13 Some submitters have raised concerns relating to the potential for light spill to trespass into adjacent residential properties.

7.14 Light spill can be carefully controlled to ensure that light spill at any property is within the best practice recommendations in AS / NZS 4282:2019.[17] This standard has recently been updated from AS 4282-1997 which was world-leading when published. In my opinion, the latest iteration is best practice. The Updated Lighting Design has suitably addressed these requirements by careful selection of optical distributions and minimising upward tilt, which is now zero for some 98% of the lights and no more than 5% tilt for the remainder.

7.15 My extensive experience in applying this standard and its predecessor is that lighting designed to satisfy these requirements is very well controlled in terms of lighting effects. The Updated Lighting Design demonstrates compliance can be achieved. As such, in my opinion, a detailed lighting design will similarly be capable of compliance and will result in negligible spill light effects to the surrounding environment.

Glare

7.16 Some submitters have expressed concerns regarding traffic safety effects when exiting private property (eg the potential for veiling glare to obscure oncoming traffic). Glare from the Freight Hub has also been raised by submitters as a concern for residents (eg potential loss of amenity in terms of night time views).

7.17 Glare to motorists is termed TI with units expressed as a percentage. It is a term which indicates the degree to which glare impairs the visibility of objects. The maximum TI recommended in AS / NZS 4282:2019 is 20%.

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17 Control of the obtrusive effects of outdoor lighting.

7.18 Glare to residents is termed Luminous Intensity with units expressed in units of candela. As mentioned earlier, a common candle emits light with approximately 1 candela ("**cd**") luminous intensity. Luminous Intensity is assessed as the highest value experienced from any light and as such is evaluated separately for every light as seen from a selected observer location – in this case, the windows of each house adjacent to the site. The recommended limit is graduated in the standard to suit the nature of the receiving environment. The darker the environment, the lower the limit. In addition, the standard sets two limits – one pre-curfew and another post-curfew – and recommends a curfew time of 11pm. The post-curfew limit is lower than the pre-curfew limit with a view to limiting sleep disturbance, particularly post-curfew. Hence, the post-curfew limit is the most stringent. The standard lists Environmental Zone A2 as Low District Brightness (eg sparsely inhabited rural and semi-rural areas). The maximum post-curfew Luminous Intensity recommended in AS / NZS 4282:2019 for Zone A2 is 1,000cd.

7.19 The maximum glare from the Freight Hub to motorists has been calculated as a maximum TI of 0% (versus a limit of 20%) and the glare to residents has been calculated as a maximum Luminous Intensity of 906 candelas (versus a limit of 1,000 candelas). Hence, the Updated Lighting Design demonstrates that glare effects to traffic and residents will be within the best practice recommendations of AS / NZS 4282:2019.

7.20 The proposed lighting will be well controlled with the majority of lights installed with zero upward tilt and a small number with no more than 5 degree upward tilt. In my opinion, glare effects on traffic and adjacent residents will be low to negligible.

Night sky light pollution

7.21 Some submitters have raised concerns about how lighting from the Freight Hub will impact the night sky. Many related submissions simply cite "light pollution" as a potential concern. Some specifically mention "the night sky" and others just mention "lighting", which I presume infers light pollution.

7.22 Any exterior lighting installation will generate some amount of sky glow. This is most apparent when there is moisture or pollution in the atmosphere reflecting and refracting light. Sky glow is subjective. It is usually more of concern to astronomers than other people, but it does have the ability to reduce visibility and thus enjoyment of the night sky.

7.23 The lighting proposed for the Freight Hub is predominantly directed downwards and the Updated Lighting Design has calculated the sky glow as 0.000%.[18] This is the maximum value from any luminaire. AS / NZS 4282:2019 recommends a maximum of 1% for environmental zone A2 (low district brightness – eg sparsely inhabited rural and semi-rural areas). The standard addresses exterior lighting. There will also be a small component of light emitted upwards through building skylights. However, the interior lighting will be directed downwards such that only reflected light is emitted through the skylights. Hence, the Updated Lighting Design represents very good control with respect to light pollution and effects on the night sky. In my opinion, added sky glow effects will be negligible.

Sleep disturbance and health effects

7.24 Some submitters have also raised concerns regarding potential for lighting to disturb sleep and thereby potentially lead to health concerns. Some raised concerns around the increased perceived risk for specific conditions such as hearing impaired or autistic persons.

7.25 While stray light at night can increase sleep disturbance,[19] in my opinion, the spill light limits recommended in AS / NZS4282:2019 are appropriate to minimise this effect. In addition, the maximum spill light calculated for this Site at any residential location is well below the recommended limit at 0.2 lux compared with a limit of 1 lux.

7.26 As noted above, the obtrusive light effects have been proven by the Updated Lighting Design to be capable of satisfying the best practice obtrusive light guidelines recommended by AS / NZS 4282:2019. In my experience, satisfying those limits results in conditions that people generally consider to be satisfactory.

Operating hours

7.27 Some submitters have raised concerns regarding the impact of the proposed operating hours for the Freight Hub.

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18 Stantec Report – Lighting Design – Revision D – dated 29 April 2021 at section 4.6.4.

19 CIE Position Statement on Non-Visual Effects of Light – Recommending Proper Light at the Proper Time – 2nd edition – 3 October 2019 (https://cie.co.at/files/CIE%20Position%20Statement%20-%20Proper%20Light%20at%20the%20Proper%20Time%20(2019)_0.pdf).

7.28 As discussed in Mr Moyle's evidence, KiwiRail proposes that the facility will operate 7 days a week and 24 hours a day.[20]

7.29 As set out in my evidence above, the lighting design can comply with recommended best practice obtrusive lighting control and as such, in my opinion, the duration of the proposed operating hours will not be of particular concern with respect to lighting effects.

Potential for increased theft

7.30 There has been a concern raised regarding the potential for lighting leading to increased theft in the area surrounding the Freight Hub. In particular, submitter no. 53 states:

> In relation to light, the height of the light towers will make it difficult to sleep at night and will increase the risk of theft as the surrounding area will be more visible at night.

7.31 The majority view of professional opinion and research I have seen indicates that increased lighting most often has the opposite effect. A study undertaken in New York in 2019[21] established that a significant reduction in crime followed when outdoor (street) lighting was improved at selected housing developments compared with similar developments where the lighting was not improved.

7.32 In my opinion, the potential for increased theft due to the introduction of the lighting as proposed is unlikely.

7.33 Lighting effects are related to the intensity and optical characteristics of the light fixture (luminaire). As the height of the luminaire is reduced, it typically needs to increase in tilt to spread the light to where it is required. This increases obtrusive effects such as glare. In my opinion, the nominal height of the luminaires in the Updated Lighting Design has been optimised to the lowest height consistent with the performance requirements and the obtrusive lighting constraints.

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20 Evidence of Todd Moyle, dated 9 July 2021, at section 7.

21 Reducing Crime Through Environmental Design: Evidence from a Randomized Experiment of Street Lighting in New York City – A Chalfin et al, 24 April 2019 (https://urbanlabs.uchicago.edu/attachments/e95d751f7d91d0bcfeb209ddf6adcb4296868c12/store/cca92342e666b1ffb1c15be63b484e9b9687b57249dce44ad55ea92b1ec0/lights_04242016.pdf)

Effects from headlights from road and rail traffic

7.34 One submitter has raised a concern regarding the potential impact of vehicle headlights. The submission specifically related to road traffic. I have considered the potential for headlight sweep from both road vehicles and locomotives and in my opinion, any potential effects can be satisfactorily addressed during detailed design as proposed in conditions.[22] In my opinion, any such effects will be less than minor.

8. RESPONSE TO SECTION 42A REPORT

8.1 I have reviewed the sections of the Section 42A Report relevant to my evidence, particularly the Effects and Recommendations Summary Table at Section 9.9 – Lighting ("**Section 42A Summary Table**"). I have also reviewed the technical evidence of Mr Wright. I respond to each of the items raised as follows.

8.2 The Section 42A Report has been prepared on the basis of the Lighting Report which was included with the Design, Construction and Operation Report as part of the AEE for the Freight Hub. As set out above, the lighting design has now been updated to better address the lighting effects and demonstrate compliance with AS / NZS 4282:2019 zone A2 recommendations for obtrusive light which includes spill light, glare and sky glow. In my view, the Updated Lighting Design already addresses a number of concerns raised in the Section 42A Report.

Obtrusive effects from glare and spill light

8.3 The Section 42A Report raises an issue regarding glare to residential dwellings.[23] To address, this the Section 42A Summary Table recommends that:

> KiwiRail should submit the final lighting design for expert peer review and certification. The detailed lighting design should:
>
> a) Demonstrate reduction in glare to meet curfew limits
>
> b) Satisfy R12A.4(f), road user glare effects via Threshold Increment calculations in accordance with recommendations of AS / NZS4282:2019
>
> c) Include details of under carriage lighting and low level security lighting

22 Evidence of Karen Bell, dated 9 July 2021, at Appendix 1.

23 Section 42A Report, dated 18 June 2021, at paragraph 592(a).

> d) Consider selective dimming of offending floodlights to reduce their brightness.
>
> To ensure that obtrusive lighting effects are adequately mitigated, we recommend that the lighting design is required to comply with AS / NZS 4282:2019, Zone A2 limits.

8.4 As noted above, the Updated Lighting Design demonstrates that the complete outdoor lighting installation for the Freight Hub satisfies the best practice recommendations in AS / NZS 4282.2019 (Control of the obtrusive effects of outdoor lighting) for zone A2. I nonetheless address each point in turn:

(a) The lighting effects will be the same both pre-curfew and post-curfew. The Updated Lighting Design has demonstrated compliance with the more stringent post-curfew limits.

(b) The Updated Lighting Design demonstrates compliance with AS / NZS 4282:2019 in terms of Threshold Limit (ie glare to motorists).

(c) I support the requirement for detailed lighting design to include details of under carriage lighting.

(d) The ability to comply with the obtrusive light limits recommended by AS / NZS 4282:2019 has now been established by the Updated Lighting Design. Hence, dimming or switching is not required to achieve compliance.

8.5 I agree that once detailed design has been undertaken, the lighting design should be submitted to the Council for certification that it meets the relevant standards. The Section 42A Summary Table recommends amendments to the proposed designation conditions. I have considered the proposed amendments to the conditions as recommended by the Council Officers and my recommendations on the conditions have been included in the conditions attached to Ms Bell's evidence and I agree with those conditions.[24]

Sky glow effects

8.6 The Section 42A Report also raises concerns regarding sky glow effects. The Council Officers have recommended in the Section 42A Summary Table that KiwiRail adopt the following measures to reduce sky glow where practicable:

> a) Use lights with 3000K colour temperature LEDs in lieu of the proposed 4000K LED's, this can be expected to

[24] Evidence of Karen Bell, dated 9 July 2021, at Appendix 1.

reduce the blue light content within the white light by up to 25%.

b) Minimise the light projected at or above the horizontal, ideally no lights should be tilted above the horizontal and no lights should project light above the horizontal.

c) Do not overlight, only provide the lighting level required for the user/task.

d) Turn off lights when not required. We recommend appropriate lighting control systems are incorporated into the lighting design so that lights are turned off when not required for operational safety.

8.7 I agree with these recommendations in part, as addressed below:

(a) Higher colour temperatures are typically used for working environments and lower values for residential amenity or similar. The primary reason for choosing 4000K for the Freight Hub lighting is that the higher values tend to increase alertness. It is important to ensure that the lighting is selected to suit to maximise safety. There are numerous similar installations throughout New Zealand and they invariably use 4000K lighting. A recent example is the Ports of Auckland Inland Freight Terminal in Horotiu. That has a similar surrounding environment to this project. Therefore, in my opinion, the lighting should have a 4000K colour temperature as currently proposed.

(b) I agree that luminaire tilt should be minimised. However, the Updated Lighting Design has already addressed the suggestion to minimise tilt, with most lights at zero tilt and a small number at no more than 5 degree tilt. The latter represents a total of 9 out of 382 lights or approximately 2% of the total.

(c) I agree that the Site should not be over lit. However, the Updated Lighting Design has been optimised. It is not over lit.

(d) I agree that it would be desirable to turn off lights when not required and encourage the designer to do so, if practical. However, I understand that there may be complicating variable arrival, departure and duration aspects that might make this impractical and potentially unsafe to automate.

8.8 The Section 42A Summary Table recommends a new condition be included on the designation which requires skyglow caused by artificial lighting have a Sky

Glow Upward Light Ratio of no greater than 0.003, calculated in accordance with AS / NZS 4282.2019. I support this condition, however I consider that the limit should be 0.01 rather than 0.003 to reflect the limit prescribed in the Standard for Zone A2. This has been incorporated into the Proposed Conditions.[25]

Effects from headlights from road and rail traffic

Construction effects

8.9 The Section 42A Summary Table recommends that:

> The Construction Traffic Management Plan and Operational Traffic Management Plan conditions be amended to require consideration of the effects of headlight sweep on residential dwellings and mitigation of any identified adverse effects.

8.10 I agree with these recommendations and I consider that the conditions at Appendix 1 to Ms Bell's evidence addresses this matter.[26]

8.11 I have reviewed the proposed Site and surrounding environment and in my opinion, placing a condition on the detailed design to address any such issues will be adequate to ensure any such effects associated with the construction of the Freight Hub are less than minor.

8.12 The selection of construction access points will be considered as part of the Construction Traffic Management Plan, which will include consideration of whether that they can be located remote from residential properties thereby reducing the effects of headlight sweep on those properties.

Operational effects

8.13 In regards to headlights from rail traffic once the Freight Hub is operational, I consider that the proposed noise walls will also suffice to ensure that locomotive headlights, approaching and operating within the Site, will be suitably screened to ensure that any added effects are negligible to the receiving environment.

8.14 Similarly, in my opinion, the noise walls will also screen vehicle headlight effects from vehicles manoeuvring within the Site when the Freight Hub is operational.

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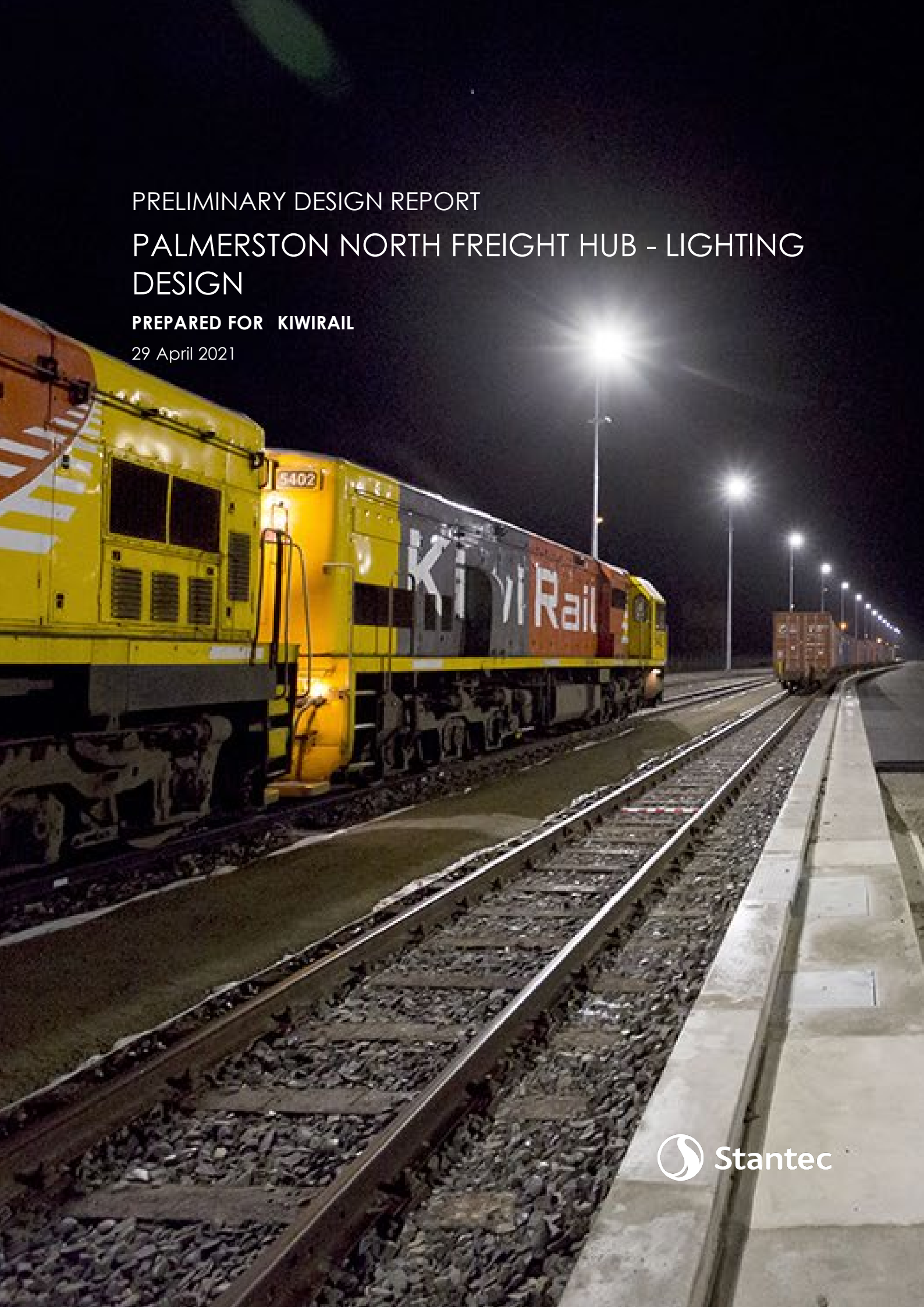
25 Evidence of Karen Bell, dated 9 July 2021, at Appendix 1.

26 Evidence of Karen Bell, dated 9 July 2021, at Appendix 1.

8.15 With regards to headlight sweep from vehicles entering and exiting the Site, the minor permanent egress points are clear from nearby residential properties and the main entry / exit point roundabout is some distance from the nearest residences and there is also intervening foliage. In my opinion, headlight sweep effects from vehicles entering and existing the Site are likely be less than minor.

John McKensey
9 July 2021

APPENDIX 1



PRELIMINARY DESIGN REPORT

PALMERSTON NORTH FREIGHT HUB - LIGHTING DESIGN

PREPARED FOR KIWIRAIL

29 April 2021

Stantec

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QUALITY STATEMENT

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REVISION SCHEDULE

Rev No.	Date	Description	Signature or Typed Name (documentation on file)			
			Prepared by	Checked by	Reviewed by	Approved by
A	28/07/2020	FINAL	IC			
B	22/09/2020	FINAL - LAYOUT CHANGES	IC			
C	04/02/2021	FINAL - OBTRUSIVE LIGHTING CALCULATIONS ADDED	IC			
D	29/04/2021	FINAL - LIGHTING RE-DESIGN TO MITIGATE OBTRUSIVE LIGHTING EFFECTS	IC			

KiwiRail

Palmerston North Freight Hub - Lighting DESIGN

CONTENTS

APPENDICES

1. Background

In conjunction with the proposed Regional Freight Hub (Freight Hub) north of Palmerston North, new lighting is required for the internal access roads, car parks and outdoor operational areas. The outdoor operational areas include the maintenance facilities, network service depot, log loading siding, tank siding, rail marshalling yard, container terminal and freight forwarding private sidings.

2. Scope

This report specifies the performance and light technical parameters (LTPs) of the lighting design required to achieve compliance with specific KiwiRail requirements as well as relevant AS/NZS standards.

Power supply requirements associated with the proposed lighting are excluded from this design report.

3. Applicable Lighting Levels

The standards applicable are:

AS/NZS 1158.3.1:2020 (Part 3.1) - Pedestrian area (Category P) lighting - Performance and design requirements

AS/NZS 4282:2019 - Control of the obtrusive effects of outdoor lighting

E-ST-EL-0131 - Traction and Electrical Standard

As requested by KiwiRail the lighting for the internal access roads and car parks has been designed in accordance with the relevant parts of AS/NZS 1158.3.1; and the outdoor operational areas have been designed in accordance with E-ST-EL-0131.

Obtrusive lighting (spill light and glare) calculations were completed (for the closest residential buildings to the proposed Freight Hub) against the requirements of AS/NZS 4282:2019.

3.1 Basis of Design - Access Roads

Based on the selection criteria from Table 2.1 of AS/NZS 1158.3.1 the lighting subcategory PR5 was applied to the internal access roads. Refer highlighted portions of the table below.

Table 2.1 from AS/NZS 1158.3.1:

TABLE 2.1

LIGHTING SUBCATEGORIES FOR ROAD RESERVES IN LOCAL AREAS

1	2	3	4	5	6
Type of road or pathway		Selection criteria[a,b]			Applicable lighting subcategory[c,d]
General description	Basic operating characteristics	Pedestrian/ cycle activity	Fear of crime	Need to enhance amenity	
Collector roads or non-arterial roads which collect and distribute traffic in an area, as well as serving abutting properties	Mixed vehicle and pedestrian traffic	N/A	High	N/A	PR1
		High	Medium	High	PR2
		Medium	Low	Medium	PR3[f] or PR4[f]
		Low	Low	Low	PR5
Local roads or streets used primarily for access to abutting properties, including residential, commercial and industrial precincts		N/A	High	N/A	PR1
		High	Medium	High	PR2
		Medium	Low	Medium	PR3[f] or PR4[f]
		Low	Low	Low	PR5
		N/A	N/A	N/A	PR6[e]
Common area, forecourts of cluster housing		N/A	High	N/A	PR1
		High	Medium	High	PR2
		Medium	Low	Medium	PR3[f] or PR4[f]
		Low	Low	Low	PR5

The lighting of the internal roads was designed to achieve the PR5 requirements from Table 3.3 of AS/NZS 1158.3.1. Refer highlighted portions of the table below:

TABLE 3.3

VALUES OF LIGHT TECHNICAL PARAMETERS FOR ROADS IN LOCAL AREAS

1	2	3	4
Lighting subcategory	Light technical parameters (LTP)		
	Average horizontal illuminance[a,b] $(\bar{E}_h)$ lx	Point horizontal illuminance[a,b] (E_{Ph}) lx	Illuminance (horizontal) uniformity[c] Cat. P (U_{E2})
PR1	7	2	8
PR2	3.5	0.7	8
PR3[e]	1.75	0.3	8
PR4[d,e]	1.3	0.22	8
PR5[d,e]	0.85	0.14	10
PR6[d]	0.7	0.07	10

3.2 Basis of Design - Car Parks

Based on the selection criteria from Table 2.5 of AS/NZS 1158.3.1 the lighting subcategory PC3 was applied to the internal car parks. Refer highlighted portions of the table below.

Table 2.5 from AS/NZS 1158.3.1:

TABLE 2.5

LIGHTING SUBCATEGORIES FOR OUTDOOR CAR PARKS (INCLUDING ROOF-TOP CAR PARKS)

1	2	3	4
Type of area	Selection criteria[a,c]		
	Night time vehicle and/or pedestrian movements	Fear of crime	Applicable lighting subcategory[b]
Parking spaces, aisles and circulation roadways	High	High	PC1
	Medium	Medium	PC2
	Low	Low	PC3
Designated parking spaces specifically intended for people with disabilities	N/A	N/A	PCD
For any designated areas for pedestrians to cross	N/A	N/A	PCX

The lighting of the internal car parks was designed to achieve the PC3 requirements from Table 3.7 of AS/NZS 1158.3.1. Refer highlighted portions of the table below:

TABLE 3.7

VALUES OF LIGHT TECHNICAL PARAMETERS FOR OUTDOOR CAR PARKS (INCLUDING ROOF-TOP CAR PARKS)

1	2	3	4	5
Lighting subcategory	Light technical parameters (LTP)			
	Average horizontal illuminance[a,b] $(\bar{E}_h)$ lx	Point horizontal illuminance[a,b] (E_{Ph}) lx	Illuminance (horizontal) uniformity[c] Cat. P (U_{E2})	Point vertical illuminance[a,b] (E_{Pv}) lx
PC1	14	3	8	3
PC2	7	1.5	8	1
PC3	3.5	0.7	8	—
PCD[d]	—	≥14 and ≥$(\bar{E}_h)$ [d]	—	—
PCX[e]	21	5	8	—

3.3 Basis of Design - Outdoor Operational Areas

The lighting of the outdoor operational areas was designed to achieve the applicable requirements from Table 6.1 of E-ST-EL-0131. Refer highlighted portions of the table below:

Table 6.1 Lighting levels and quality

Type of area	E_m	U_o	GR_L	R_a	U_d
Railway Marshalling Yards - Anywhere shunting operations are carried out	≥ 10 lux	≤ 0.40	≤ 50	≥ 20	≥ 1/5
Freight Track, short duration operations - The portion of a rail siding where loading and unloading does not occur. Rail movements are infrequent.	≥ 10 lux	≤ 0.25	≤ 50	≥ 20	≥ 1/8
Freight Track, continuous operations - The portion of a rail freight yard where loading and unloading does not occur. Rail movements are frequent. Road traffic and pedestrians are likely to be present.	≥ 20 lux	≤ 0.40	≤ 50	≥ 20	≥ 1/5
Railway Yards Handing Areas - Anywhere that wagons are being loaded with cranes or forklifts. This includes most of the main freight sidings and the Interisland Line terminal areas where wagons are loaded/unloaded	≥ 30 lux	≤ 0.40	≤ 50	≥ 20	≥ 1/5

3.4 Basis of Design - Obtrusive Lighting

The applicable levels of maximum obtrusive light (spill light and glare), threshold increment (TI) and sky glow (Upward Waste Light Ratio - UWLR) are based on what particular environment zone the residential properties are within. Zone A2 was selected based on low district brightness associated with sparsely inhabited rural / semi-rural areas. Refer highlighted portions of table below.

Table 3.1 from AS/NZS 4282 - Environmental Zones:

TABLE 3.1

ENVIRONMENTAL ZONES

Zones	Description	Examples
A0	Intrinsically dark	UNESCO Starlight Reserve. IDA Dark Sky Parks. Major optical observatories No road lighting -unless specifically required by the road controlling authority
A1	Dark	Relatively uninhabited rural areas No road lighting - unless specifically required by the road controlling authority
A2	Low district brightness	Sparsely inhabited rural and semi-rural areas
A3	Medium district brightness	Suburban areas in towns and cities
A4	High district brightness	Town and city centres and other commercial areas Residential areas abutting commercial areas

Spill Light:

The maximum level of spill light (vertical illuminance - Lux), threshold increment (TI) and sky glow (UWLR) for Zone A2, during curfew, is provided in the following table:

TABLE 3.2

MAXIMUM VALUES OF LIGHT TECHNICAL PARAMETERS

Zones	Vertical illuminance levels (E_v) lx		Threshold increment (TI)		Sky glow
	Non-curfew	Curfew	%	Default adaptation level (L_{ad})	Upward light ratio
A0	See Note 1	0	N/A	N/A	0
A1	2	0.1	N/A	N/A	0
A2	5	1	20%	0.2	0.01
A3	10	2	20%	1	0.02
A4	25	5	20%	5	0.03
TV	See Table 3.4	N/A	20%	10	0.08

Glare:

The maximum level of glare (maximum luminous intensity per luminaire - cd) for Zone A2, during curfew, is provided in the following table:

TABLE 3.3

MAXIMUM LUMINOUS INTENSITIES PER LUMINAIRE

Zone	Luminous intensity (*I*), cd		
	Non-curfew L1	Non-curfew L2	Curfew
A0	See Note	See Note	0
A1	2 500	5 000	500
A2	7 500	12 500	1 000
A3	12 500	25 000	2 500
A4	25 000	50 000	2 500
TV	100 000	150 000	0

NOTE: For A0, *I* shall be as close to zero as practicable without impacting safety considerations.

4. Design Modelling Results

In accordance with AS/NZS 1158.3.1 and E-ST-EL-0131 illuminance and uniformity calculations were carried out for the internal access roads, car parks and outdoor operational areas.

In accordance with AS/NZS 4282:2019 obtrusive lighting calculations have been completed to identify any residential properties that may be adversely affected by the proposed Freight Hub lighting.

All calculations were completed using the lighting software program AGi32, version 2.31, supplied by Lighting Analysts, Inc.

The photometric files (used in the illuminance and luminance calculations) were provided by the luminaire suppliers TECHLIGHT (AEC Italo) and ENERGYLIGHT (EWO R4).

4.1 Luminaire and Mounting Parameters

Refer to Appendix A for details of the new luminaires and Appendix B for details of the new lighting poles.

The new lighting poles shall be located where shown on the layout drawings.

The design results were achieved using a maintenance factor of 0.8, and the following luminaire and mounting parameters:

Type A

Luminaire: AEC Italo 1 (STAN0 4000K 350mA 3M) 27W (3320 lm) LED.

Mounting: 7.3m mounting height with 0º tilt on new ground planted tapered octagonal steel lighting pole complete with 0.9m curved outreach arm.

Type B

Luminaire: AEC Italo 1 (STAN0 4000K 525mA 4M) 51W (6020 lm) LED.

Mounting: 7.3m mounting height with 5º tilt on new ground planted tapered octagonal steel lighting pole complete with 0.9m curved outreach arm.

Type C

Luminaire: AEC Italo 1 (S05 4000K 350mA 2M) 27W (3400 lm) LED.

Mounting: 7.3m mounting height with 0º tilt on new ground planted tapered octagonal steel lighting pole complete with 0.9m curved outreach arm.

Type D

Luminaire: AEC Italo 1 (S05 4000K 350mA 2M) 27W (3400 lm) LED (2 off).

Mounting: 7.3m mounting height with 0º tilt on new ground planted tapered octagonal steel lighting pole complete with double 0.9m curved outreach arms.

Type E

Luminaire: AEC Italo 1 (S05 4000K 350mA 3M) 39W (4970 lm) LED.

Mounting: 7.3m mounting height with 0º tilt on new ground planted tapered octagonal steel lighting pole complete with 0.9m curved outreach arm.

Type F

Luminaire: AEC Italo 1 (S05 4000K 350mA 3M) 39W (4970 lm) LED (2 off).

Mounting: 7.3m mounting height with 0º tilt on new ground planted tapered octagonal steel lighting pole complete with double 0.9m curved outreach arms.

Type G

Luminaire: EWO R4 (Gen 3 EP09 LR FCO Optic 4000K 1850mA) 1614W (166642 lm) LED Floodlight.

Mounting: 20m mounting height with 0º tilt on new flange based tapered octagonal steel flood lighting pole complete with 0.6m horizontal cross arm. Luminaire mounted to front face of cross arm using proprietary over-frame bracket.

Type H

Luminaire: EWO R4 (Gen 3 EP09 LR FCO Optic 4000K 1850mA) 1614W (166642 lm) LED Floodlight (2 per pole).

Mounting: 20m mounting height with 0º tilt on new flange based tapered octagonal steel flood lighting pole complete with 0.6m horizontal cross arm. Luminaires mounted to front faces of cross arm, using proprietary over-frame brackets, to form opposing (180°) aiming directions.

Type J

Luminaire: EWO R4 (Gen 3 EP09 LR RBL-FCO Optic 4000K 1850mA) 1614W (118881 lm) LED Floodlight.

Mounting: 20m mounting height with 0º tilt on new flange based tapered octagonal steel flood lighting pole complete with 0.6m horizontal cross arm. Luminaire mounted to front face of cross arm using proprietary over-frame bracket.

Type K

Luminaire: EWO R4 (Gen 3 EP09 LR RBL-FCO Optic 4000K 1850mA) 1614W (118881 lm) LED Floodlight (2 per pole).

Mounting: 20m mounting height with 0º tilt on new flange based tapered octagonal steel flood lighting pole complete with 0.6m horizontal cross arm. Luminaire mounted to front face of cross arm using proprietary over-frame bracket.

Type L

Luminaire: EWO R2 (Gen 3 EP09 LR RBL-FCO Optic 4000K 400mA) 168W (17036 lm) LED Floodlight.

Mounting: 6m mounting height with 0º tilt secured to front face of building using propriety stirrup bracket.

Type M

Luminaire: EWO R4 (Gen 3 EP09 LR RBL-FCO Optic 4000K 800mA) 683W (63953 lm) LED Floodlight.

Mounting: 12m mounting height with 5º tilt secured to front face of building using propriety stirrup bracket.

Type N

Luminaire: EWO R4 (Gen 3 EP09 LR FCO Optic 4000K 1850mA) 1614W (166642 lm) LED Floodlight.

Mounting: 12m mounting height with 0º tilt secured to front face of building using propriety stirrup bracket.

4.2 Maintenance Factor - Italo Luminaires

A design maintenance factor (MF) is used in the calculations to account for the combined light losses resulting from depreciation in the LED's lumen output and accumulation of dirt on the luminaire.

The MF is calculated as the product of the following depreciation factors:

(a) *Luminaire Maintenance Factor (LMF):* The factor selected from table B.1 of BS 5489-1 which considers the environmental zone, mounting height and cleaning interval. An environmental zone of E3/E4 was selected (corresponding to moderate/high ambient luminance areas), the mounting heights are not more than 6m and a maximum luminaire cleaning interval of 72 months (6 years or 25,200 hours operation) was selected resulting in an LMF of 0.84.

Table B.1 **Luminaire maintenance factors**

Environ-mental zone	Mounting height	Maintenance factor					
		Cleaning frequency 12 months	Cleaning frequency 24 months	Cleaning frequency 36 months	Cleaning frequency 48 months	Cleaning frequency 60 months	Cleaning frequency 72 months
E1/E2	≤6 m	0.96	0.96	0.95	0.94	0.93	0.92
E1/E2	>6 m	0.96	0.96	0.95	0.94	0.93	0.92
E3/E4	≤6 m	0.94	0.92	0.90	0.88	0.86	0.84
E3/E4	>6 m	0.96	0.96	0.95	0.94	0.93	0.92

(b) *Light Source Lumen Depreciation Factor (LLD):* The amount of light (lumen output) available at the end of a nominated operating period, as a proportion of the initial lumen output (when the LED was new), expressed as a decimal fraction. An LLD of 0.98 was provided by the LED supplier.

(c) *Luminaire Survival Factor (LSF):* This is the expected number of failures after 85,000 hours of operation (including electronic components, drivers, lenses, premature failures or mechanical failure). An LSF of 0.99 was provided by the LED supplier.

Table B.1 of BS 5489-1 and the manufacturer supplied data has provided in an LMF of 0.92, an LLD of 0.92 and an LSF of 0.99.

MF = LMF x LLD x LSF

MF = 0.84 x 0.98 x 0.99

MF = 0.815

A design maintenance factor of 0.8 was applied to the calculations.

It is important to note that the design results are based on a maintenance interval (luminaire cleaning cycle) of 6 years. At the end of 6 years the lighting should still comply with the road lighting standards (AS/NZS 1158), but the luminaires will require cleaning before the performance of the lighting installation degrades below the requirements of the standards. If the luminaires are not routinely cleaned the gradual accumulation of dirt will eventually compromise the optical performance of the installation.

4.3 Maintenance Factor - EWO R4 LED Flood Lights

A design maintenance factor (MF) is used in the calculations to account for the combined light losses resulting from depreciation in the LED's lumen output and accumulation of dirt on the luminaire.

The MF is calculated as the product of the following depreciation factors:

(d) *Luminaire Maintenance Factor (LMF):* The amount of light (lumen output) available at the end of a nominated period (cleaning interval) where the output has fallen due to the accumulation of dirt. An LMF of 0.92 was provided by the LED supplier based on an 8 year cleaning cycle, glass visor and PMMA lens.

(e) *Light Source Lumen Depreciation Factor (LLD):* The amount of light (lumen output) available at the end of a nominated operating period as a proportion of the initial lumen output (when the LED was new). An LLD of 0.99 was provided by the LED supplier based on 85,000 hours of operation and an ambient temperature of 25°C.

(f) *Luminaire Survival Factor (LSF):* This is the expected number of failures after 85,000 hours of operation (including electronic components, drivers, lenses, premature failures or mechanical failure). An LSF of 1.0 was provided by the LED supplier based on no reported failures.

MF = LMF x LLD x LSF

MF = 0.92 x 0.99 x 1.0

MF = 0.91

A conservative design maintenance factor of 0.8 was applied to the calculations.

It is important to note that the design results are based on a maintenance interval (luminaire cleaning cycle) of 8 years. At the end of 8 years the lighting should still achieve the maintained average illuminance, but the luminaires will require cleaning before the output of the lighting installation falls below current design levels. If the luminaires are not routinely cleaned the gradual accumulation of dirt will eventually compromise the optical performance of the installation.

4.4 Illuminance Design Results - Access Roads and Car Parks

An illuminance based design was carried out to determine the average horizontal illuminance (E_h), point horizontal illuminance (E_{Ph}) and horizontal uniformity (U_{E2}) using the lighting software program AGi32, version 2.31, supplied by Lighting Analysts, Inc.

The applicable design areas are the internal roads and parking spaces.

Design area boundaries and calculation points were established in accordance with AS/NZS 1158.2. Refer to the design results below:

Illuminance Calculation Summary Table - AS/NZS 1158.3.1:2020						
Label	CalcType	Units	Avg	Min	Max/Avg	Description
Access Roads	Illuminance	Lux	2.2	0.14	9.7	Cat PR5 - 0.85 Lux (Avg), 0.14 Lux (Min) and Uniformity (Max/Avg) of 10 (Max)
Container Terminal Car Park 1	Illuminance	Lux	3.8	0.8	3.1	Cat PC3 - 3.5 Lux (Avg), 0.7 Lux (Min) and Uniformity (Max/Avg) of 8 (Max)
Container Terminal Car Park 2	Illuminance	Lux	4.8	0.8	3.3	Cat PC3 - 3.5 Lux (Avg), 0.7 Lux (Min) and Uniformity (Max/Avg) of 8 (Max)
Container Terminal Car Park 3	Illuminance	Lux	3.8	0.9	4.0	Cat PC3 - 3.5 Lux (Avg), 0.7 Lux (Min) and Uniformity (Max/Avg) of 8 (Max)
Freight Forwarding Car Park	Illuminance	Lux	4.6	0.8	4.9	Cat PC3 - 3.5 Lux (Avg), 0.7 Lux (Min) and Uniformity (Max/Avg) of 8 (Max)
Network Services Car Park 1	Illuminance	Lux	3.9	0.9	3.1	Cat PC3 - 3.5 Lux (Avg), 0.7 Lux (Min) and Uniformity (Max/Avg) of 8 (Max)
Network Services Car Park 2	Illuminance	Lux	3.6	0.9	3.5	Cat PC3 - 3.5 Lux (Avg), 0.7 Lux (Min) and Uniformity (Max/Avg) of 8 (Max)
Network Services Car Park 3	Illuminance	Lux	3.5	0.7	3.4	Cat PC3 - 3.5 Lux (Avg), 0.7 Lux (Min) and Uniformity (Max/Avg) of 8 (Max)
Network Services Car Park 4	Illuminance	Lux	5.3	0.9	3.4	Cat PC3 - 3.5 Lux (Avg), 0.7 Lux (Min) and Uniformity (Max/Avg) of 8 (Max)
Network Services Car Park 5	Illuminance	Lux	4.6	0.8	3.8	Cat PC3 - 3.5 Lux (Avg), 0.7 Lux (Min) and Uniformity (Max/Avg) of 8 (Max)

4.5 Illuminance Design Results - Outdoor Operational Areas

An illuminance based design was carried out to determine the average horizontal illuminance (E_m), illuminance uniformity (U_o) and illuminance diversity (U_d) using the lighting software program AGi32, version 2.31, supplied by Lighting Analysts, Inc.

The applicable design areas include the network services depot, log loading siding, tank siding, rail marshalling yard (including maintenance facilities and general areas), container terminal and freight forwarding private sidings.

Design area boundaries and calculation grid points were established in accordance with E-ST-EL-0131. Refer to the design results below:

Illuminance Calculation Summary Table - KiwiRail Traction and Electrical Standard E-ST-EL-0131						
Label	CalcType	Units	Avg	Uo (Min/Avg)	Ud (Min/Max)	Design Requirements
Container Terminal Handling Area	Illuminance	Lux	34.8	0.5	0.4	Table 6.1 - Avg >= 30 Lux, Uo >= 0.4 and Ud >= 0.2
Freight Forwarding Area 1	Illuminance	Lux	35.6	0.4	0.2	Table 6.1 - Avg >= 30 Lux, Uo >= 0.4 and Ud >= 0.2
Freight Forwarding Area 2	Illuminance	Lux	37.6	0.4	0.2	Table 6.1 - Avg >= 30 Lux, Uo >= 0.4 and Ud >= 0.2
Log Loading Area and Tank Siding	Illuminance	Lux	32.1	0.4	0.2	Table 6.1 - Avg >= 30 Lux, Uo >= 0.4 and Ud >= 0.2
Network Services Handling Areas	Illuminance	Lux	32.2	0.4	0.2	Table 6.1 - Avg >= 30 Lux, Uo >= 0.4 and Ud >= 0.2
Railway Marshalling Areas	Illuminance	Lux	21.3	0.4	0.2	Table 6.1 - Avg >= 20 Lux, Uo >= 0.4 and Ud >= 0.2

4.6 Obtrusive Lighting Calculation Results

In accordance with AS/NZS 4282:2019 all obtrusive lighting calculations were carried out using a maintenance factor (MF) of 1.0 to represent the lighting installation when new.

4.6.1 Spill Light

Spill light calculations were caried out to determine the maximum point vertical illuminance (Lux) on the front faces of residential buildings in close proximity of the proposed Fright Hub. The existing trees and vegetation (between the properties and proposed Freight Hub) were not considered therefore the actual spill light should be less than the results indicate.

Refer to the design results below:

North East Properties:

SPILL LIGHT CALCULATION RESULTS - NORTH EAST PROPERTIES		
Maximum Vertical Illuminance of 1 Lux (Zone A2 Curfew Hours)		
Location	**Maximum Calculated Value**	**Complies (Y/N)**
22A Clevely Line	0.0	Y
41A Clevely Line	0.0	Y
41B Clevely Line	0.0	Y
1 Nathan Place	0.0	Y
2 Nathan Place	0.0	Y
3 Nathan Place	0.0	Y
4 Nathan Place	0.0	Y
5 Nathan Place	0.0	Y
6 Nathan Place	0.0	Y
7 Nathan Place	0.0	Y
27 Parrs Road	0.1	Y
55D Parrs Road	0.0	Y
58 Parrs Road	0.0	Y
59 Parrs Road	0.0	Y
9 Sangsters Road	0.0	Y
11 Sangsters Road	0.0	Y

15 Sangsters Road	0.0	Y
25 Sangsters Road	0.1	Y
43 Sangsters Road	0.1	Y
819 Stoney Creek Road	0.0	Y
821 Stoney Creek Road	0.0	Y

South East and South West Properties:

SPILL LIGHT CALCULATION RESULTS - SOUTH EAST AND SOUTH WEST PROPERTIES		
Maximum Vertical Illuminance of 1 Lux (Zone A2 Curfew Hours)		
Location	**Maximum Calculated Value**	**Complies (Y/N)**
163 Clevely Line	0.0	Y
422 Railway Road	0.2	Y
761 Roberts Line	0.0	Y
771 Roberts Line	0.0	Y
787 Roberts Line	0.0	Y
803 Roberts Line	0.0	Y
814 Roberts Line	0.0	Y
824 Roberts Line	0.0	Y
824A Roberts Line	0.0	Y
73 Sangsters Road	0.1	Y
91 Sangsters Road	0.1	Y
95 Sangsters Road	0.1	Y
428 Tutaki Road	0.0	Y

North West Properties:

SPILL LIGHT CALCULATION RESULTS - NORTH WEST PROPERTIES		
Maximum Vertical Illuminance of 1 Lux (Zone A2 Curfew Hours)		
Location	**Maximum Calculated Value**	**Complies (Y/N)**
1 Maple Street	0.0	Y
1A Maple Street	0.0	Y
3 Maple Street	0.0	Y
5 Maple Street	0.0	Y
7 Maple Street	0.0	Y
7A Maple Street	0.0	Y
9 Maple Street	0.0	Y
9A Maple Street	0.0	Y
11 Maple Street	0.0	Y
11A Maple Street	0.0	Y
13 Maple Street	0.0	Y
15 Maple Street	0.0	Y
17 Maple Street	0.0	Y
19 Maple Street	0.0	Y

21 Maple Street	0.0	Y
57 Maple Street	0.0	Y
241 Te Ngaio Road	0.0	Y
242 Te Ngaio Road	0.0	Y
245 Te Ngaio Road	0.0	Y

The calculations indicate that spill light will not be an issue as the values are under the Zone A2 limit of 1 Lux during curfew hours.

4.6.2 Glare

Glare calculations were caried out to determine the maximum luminous intensity (cd) per luminaire on the front faces of residential buildings in close proximity of the proposed Fright Hub. The existing trees and vegetation (between the properties and proposed Freight Hub) were not considered therefore the actual glare values should be less than the results indicate.

Refer to the design results below:

North East Properties:

GLARE CALCULATION RESULTS - NORTH EAST PROPERTIES		
Maximum Luminous Intensity of 1,000 cd (Zone A2 Curfew Hours)		
Location	**Maximum Calculated Value**	**Complies (Y/N)**
22A Clevely Line	349	Y
41A Clevely Line	649	Y
41B Clevely Line	383	Y
1 Nathan Place	363	Y
2 Nathan Place	349	Y
3 Nathan Place	39	Y
4 Nathan Place	40	Y
5 Nathan Place	361	Y
6 Nathan Place	42	Y
7 Nathan Place	446	Y
27 Parrs Road	402	Y
55D Parrs Road	192	Y
58 Parrs Road	262	Y
59 Parrs Road	188	Y
9 Sangsters Road	906	Y
11 Sangsters Road	99	Y
15 Sangsters Road	199	Y
25 Sangsters Road	293	Y
43 Sangsters Road	573	Y
819 Stoney Creek Road	530	Y
821 Stoney Creek Road	707	Y

South East and South West Properties:

SPILL LIGHT CALCULATION RESULTS - SOUTH EAST AND SOUTH WEST PROPERTIES		
Maximum Luminous Intensity of 1,000 cd (Zone A2 Curfew Hours)		
Location	**Maximum Calculated Value**	**Complies (Y/N)**
163 Clevely Line	79	Y
422 Railway Road	515	Y
761 Roberts Line	222	Y
771 Roberts Line	75	Y
787 Roberts Line	29	Y
803 Roberts Line	43	Y
814 Roberts Line	28	Y
824 Roberts Line	37	Y
824A Roberts Line	49	Y
73 Sangsters Road	504	Y
91 Sangsters Road	401	Y
95 Sangsters Road	379	Y
428 Tutaki Road	79	Y

North West Properties:

SPILL LIGHT CALCULATION RESULTS - NORTH WEST PROPERTIES		
Maximum Luminous Intensity of 1,000 cd (Zone A2 Curfew Hours)		
Location	**Maximum Calculated Value**	**Complies (Y/N)**
1 Maple Street	30	Y
1A Maple Street	0	Y
3 Maple Street	0	Y
5 Maple Street	57	Y
7 Maple Street	31	Y
7A Maple Street	32	Y
9 Maple Street	0	Y
9A Maple Street	56	Y
11 Maple Street	30	Y
11A Maple Street	33	Y
13 Maple Street	31	Y
15 Maple Street	31	Y
17 Maple Street	31	Y
19 Maple Street	32	Y
21 Maple Street	463	Y
57 Maple Street	147	Y
241 Te Ngaio Road	96	Y

242 Te Ngaio Road	246	Y
245 Te Ngaio Road	96	Y

The calculations indicate that glare will not be an issue as the values do not exceed the Zone A2 limit of 1,000 cd during curfew hours.

4.6.3 Threshold Increment (TI)

The TI was calculated, using a default adaption luminance of 0.2 (as per Table 3.2 of AS/NZS 4282:2019), along the western boundary perimeter of the proposed Freight Hub site.

Refer to the design results below:

AS/NZS 4282:2019 Control of Obtrusive Lighting Effects - Calculation Summary - Threshold Increment (TI)				
Label	CalcType	Units	TI	Description
ObtrusiveLight_TI_West Bdy N	Obtrusive - TI	%	0	Maximum TI of 20% (Zone A2 - Adaption Luminance of 0.2 cd/m2)
ObtrusiveLight_TI_West Bdy S	Obtrusive - TI	%	0	Maximum TI of 20% (Zone A2 - Adaption Luminance of 0.2 cd/m2)

The results indicate that the calculated TI of 0% is well below the Zone A2 maximum limit of 20%.

4.6.4 Sky Glow (Upward Waste Light Ratio - UWLR)

The UWLR was calculated for the proposed Freight Hub site for all luminaires.

Refer to the design results below:

UWLR Area Summary	
Label	UWLR
LPDArea_1	0.000

The results indicate that the calculated UWLR of 0.000 is well below the Zone A2 maximum limit of 0.01.

5. Flood Lighting Poles

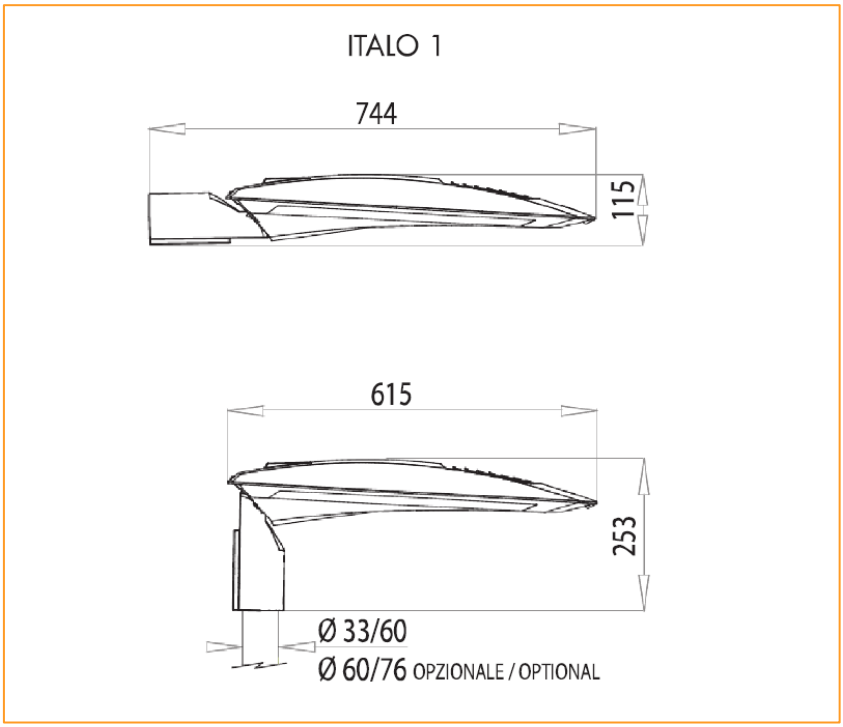
All new access road / car parking poles shall be Spunlite Subdivisional (or equal) hot dip galvanised tapered octagonal steel ground planted poles complete with curved outreach arms.

The new outdoor operational area poles shall be Spunlite (or equal) flange based general purpose flood lighting poles fabricated and assembled to provide a luminaire mounting height of 20m complete with 0.6m long cross arms.

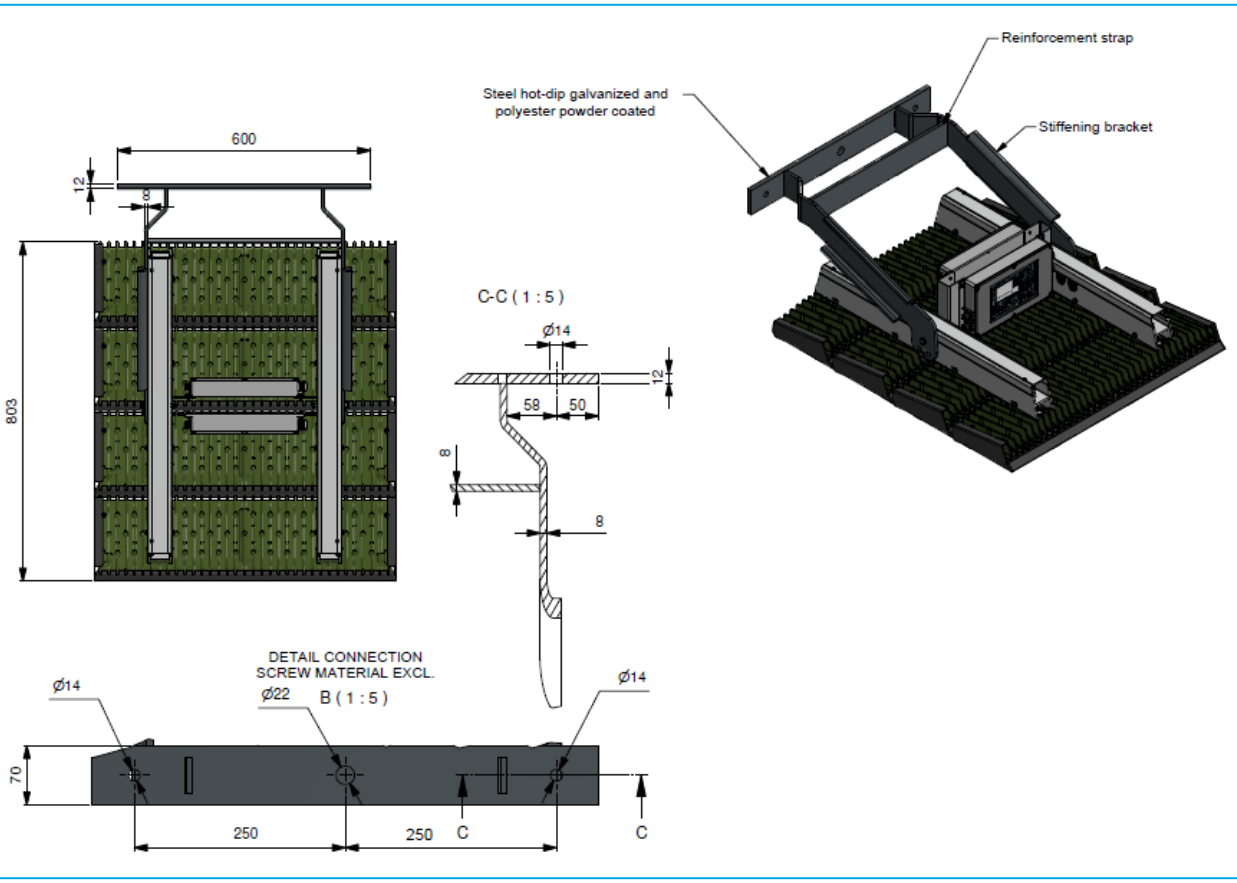
Refer to Appendix B for typical lighting pole details.

Appendix A LED Floodlight Luminaire Details

A.1 AEC Italo 1 Luminaire

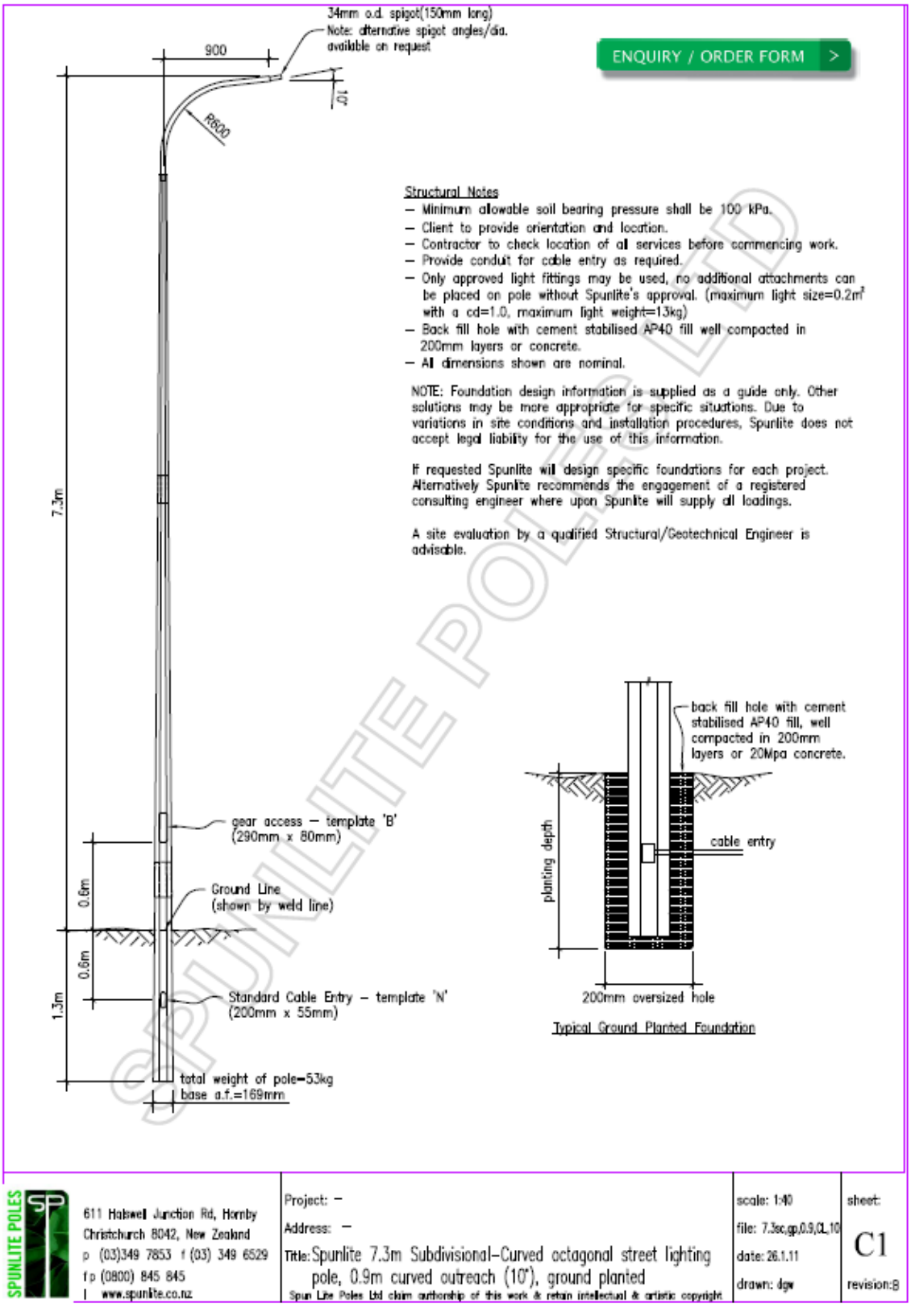


A.2 EWO R4 LED Floodlight

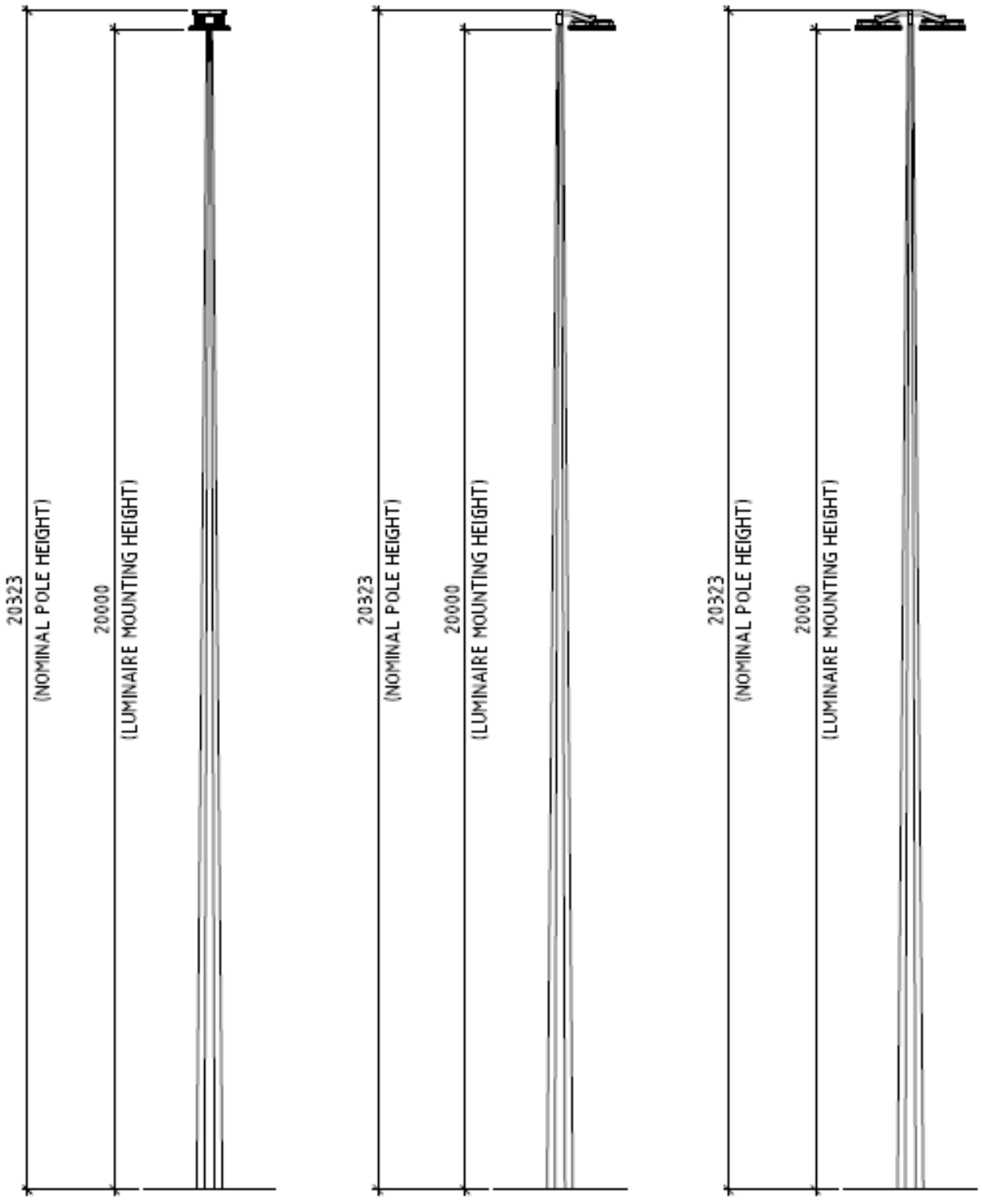


Appendix B Lighting Pole Details

B.1 Spunlite 7.3m Subdivisional Lighting Pole



B.2 Spunlite 22.4m Flange Based Flood Lighting Pole



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Stantec

LUMINAIRE AND POLE LIST

TYPE	LED LUMINAIRE DESCRIPTION	POLE / MOUNTING DESCRIPTION	MOUNTING HEIGHT	OUTREACH ARM / BRACKET MOUNTING DETAILS	TILT ANGLE	LUMINAIRE QTY
A	AEC ITALO 1 STAN0 4000K 350mA 3M 27W LED	SPUNLITE SUBDIVISIONAL GP LIGHTING POLE C/W SINGLE ARM	7.3m	0.9M SINGLE CURVED OUTREACH ARM	0	123
B	AEC ITALO 1 STAN0 4000K 525mA 4M 51W LED	SPUNLITE SUBDIVISIONAL GP LIGHTING POLE C/W SINGLE ARM	7.3m	0.9M SINGLE CURVED OUTREACH ARM	5	3
C	AEC ITALO 1 S05 4000K 350mA 2M 27W LED	SPUNLITE SUBDIVISIONAL GP LIGHTING POLE C/W SINGLE ARM	7.3m	0.9M SINGLE CURVED OUTREACH ARM	0	27
D	AEC ITALO 1 S05 4000K 350mA 2M 27W LED (2 PER POLE)	SPUNLITE SUBDIVISIONAL GP LIGHTING POLE C/W DOUBLE ARMS	7.3m	0.9M DOUBLE CURVED OUTREACH ARMS	0	4
E	AEC ITALO 1 S05 4000K 350mA 3M 39W LED	SPUNLITE SUBDIVISIONAL GP LIGHTING POLE C/W SINGLE ARM	7.3m	0.9M SINGLE CURVED OUTREACH ARM	0	16
F	AEC ITALO 1 S05 4000K 350mA 3M 39W LED (2 PER POLE)	SPUNLITE SUBDIVISIONAL GP LIGHTING POLE C/W DOUBLE ARMS	7.3m	0.9M DOUBLE CURVED OUTREACH ARMS	0	4
G	EWO R4 GEN 3 EP09 LR FCO 4000K 1850mA 1614W	SPUNLITE 20m FLB FLOOD LIGHTING POLE C/W 0.6m CROSS ARM	20m	PROPRIETARY OVER-FRAME BRACKET MOUNTED TO POLE CROSS ARM (VERTICAL FACE)	0	22
H	EWO R4 GEN 3 EP09 LR FCO 4000K 1850mA 1614W (2 PER POLE)	SPUNLITE 20m FLB FLOOD LIGHTING POLE C/W 0.6m CROSS ARM	20m	PROPRIETARY OVER-FRAME BRACKET MOUNTED TO POLE CROSS ARM (VERTICAL FACE)	0	14
J	EWO R4 GEN 3 EP09 LR RBL-FCO 4000K 1850mA 1614W	SPUNLITE 20m FLB FLOOD LIGHTING POLE C/W 0.6m CROSS ARM	20m	PROPRIETARY OVER-FRAME BRACKET MOUNTED TO POLE CROSS ARM (VERTICAL FACE)	0	31
K	EWO R4 GEN 3 EP09 LR RBL-FCO 4000K 1850mA 1614W (2 PER POLE)	SPUNLITE 20m FLB FLOOD LIGHTING POLE C/W 0.6m CROSS ARM	20m	PROPRIETARY OVER-FRAME BRACKET MOUNTED TO POLE CROSS ARM (VERTICAL FACE)	0	106
L	EWO R2 GEN 3 EP09 LR RBL-FCO 4000K 400mA 168W	BUILDING MOUNTED	6m	PROPRIETARY STIRRUP BRACKET MOUNTED TO BUILDING (VERTICAL FACE)	0	4
M	EWO R4 GEN 3 EP09 LR RBL-FCO 4000K 800mA 683W	BUILDING MOUNTED	12m	PROPRIETARY STIRRUP BRACKET MOUNTED TO BUILDING (VERTICAL FACE)	5	6
N	EWO R4 GEN 3 EP09 LR FCO 4000K 1850mA 1614W	BUILDING MOUNTED	12m	PROPRIETARY STIRRUP BRACKET MOUNTED TO BUILDING (VERTICAL FACE)	0	22

LEGEND

A	NEW LED LUMINAIRE MOUNTED ON NEW GROUND PLANTED LIGHTING POLE (LETTER DENOTES PARTICULAR LUMINAIRE TYPE AND MOUNTING PARAMETERS AS PER THE LUMINAIRE AND POLE LIST)
D D	NEW LED LUMINAIRES (2 OFF) MOUNTED ON NEW GROUND PLANTED LIGHTING POLE (LETTER DENOTES PARTICULAR LUMINAIRE TYPE AND MOUNTING PARAMETERS AS PER THE LUMINAIRE AND POLE LIST)
G	NEW LED FLOODLIGHT MOUNTED ON NEW FLANGE BASED LIGHTING POLE (LETTER DENOTES PARTICULAR LUMINAIRE TYPE AND MOUNTING PARAMETERS AS PER THE LUMINAIRE AND POLE LIST)
H H	NEW LED FLOODLIGHTS (2 OFF) MOUNTED ON NEW FLANGE BASED LIGHTING POLE (LETTER DENOTES PARTICULAR LUMINAIRE TYPE AND MOUNTING PARAMETERS AS PER THE LUMINAIRE AND POLE LIST)
	PROPOSED LIGHTING ISOLUX CONTOUR LINES
	SPILL LIGHTING ISOLUX CONTOUR LINES (1 LUX AT MF = 1.0)

CALCULATION RESULTS - ACCESS ROADS AND CAR PARKS - ILLUMINANCE LEVELS AND UNIFORMITIES

Illuminance Calculation Summary Table - AS/NZS 1158.3.1:2020

Label	CalcType	Units	Avg	Min	Max/Avg	Description
Access Roads	Illuminance	Lux	2.2	0.14	9.7	Cat PR5 - 0.85 Lux (Avg), 0.14 Lux (Min) and Uniformity (Max/Avg) of 10 (Max)
Container Terminal Car Park 1	Illuminance	Lux	3.8	0.8	3.1	Cat PC3 - 3.5 Lux (Avg), 0.7 Lux (Min) and Uniformity (Max/Avg) of 8 (Max)
Container Terminal Car Park 2	Illuminance	Lux	4.8	0.8	3.3	Cat PC3 - 3.5 Lux (Avg), 0.7 Lux (Min) and Uniformity (Max/Avg) of 8 (Max)
Container Terminal Car Park 3	Illuminance	Lux	3.8	0.9	4.0	Cat PC3 - 3.5 Lux (Avg), 0.7 Lux (Min) and Uniformity (Max/Avg) of 8 (Max)
Freight Forwarding Car Park	Illuminance	Lux	4.6	0.8	4.9	Cat PC3 - 3.5 Lux (Avg), 0.7 Lux (Min) and Uniformity (Max/Avg) of 8 (Max)
Network Services Car Park 1	Illuminance	Lux	3.9	0.9	3.1	Cat PC3 - 3.5 Lux (Avg), 0.7 Lux (Min) and Uniformity (Max/Avg) of 8 (Max)
Network Services Car Park 2	Illuminance	Lux	3.6	0.9	3.5	Cat PC3 - 3.5 Lux (Avg), 0.7 Lux (Min) and Uniformity (Max/Avg) of 8 (Max)
Network Services Car Park 3	Illuminance	Lux	3.5	0.7	3.4	Cat PC3 - 3.5 Lux (Avg), 0.7 Lux (Min) and Uniformity (Max/Avg) of 8 (Max)
Network Services Car Park 4	Illuminance	Lux	5.3	0.9	3.4	Cat PC3 - 3.5 Lux (Avg), 0.7 Lux (Min) and Uniformity (Max/Avg) of 8 (Max)
Network Services Car Park 5	Illuminance	Lux	4.6	0.8	3.8	Cat PC3 - 3.5 Lux (Avg), 0.7 Lux (Min) and Uniformity (Max/Avg) of 8 (Max)

CALCULATION RESULTS - OUTDOOR OPERATIONAL AREAS - ILLUMINANCE LEVELS AND UNIFORMITIES

Illuminance Calculation Summary Table - KiwiRail Traction and Electrical Standard E-ST-EL-0131

Label	CalcType	Units	Avg	Uo (Min/Avg)	Ud (Min/Max)	Design Requirements
Container Terminal Handling Area	Illuminance	Lux	34.8	0.5	0.4	Table 6.1 - Avg >= 30 Lux, Uo >= 0.4 and Ud >= 0.2
Freight Forwarding Area 1	Illuminance	Lux	35.6	0.4	0.2	Table 6.1 - Avg >= 30 Lux, Uo >= 0.4 and Ud >= 0.2
Freight Forwarding Area 2	Illuminance	Lux	37.6	0.4	0.2	Table 6.1 - Avg >= 30 Lux, Uo >= 0.4 and Ud >= 0.2
Log Loading Area and Tank Siding	Illuminance	Lux	32.1	0.4	0.2	Table 6.1 - Avg >= 30 Lux, Uo >= 0.4 and Ud >= 0.2
Network Services Handling Areas	Illuminance	Lux	32.2	0.4	0.2	Table 6.1 - Avg >= 30 Lux, Uo >= 0.4 and Ud >= 0.2
Railway Marshalling Areas	Illuminance	Lux	21.3	0.4	0.2	Table 6.1 - Avg >= 20 Lux, Uo >= 0.4 and Ud >= 0.2

NOTES

1. THE ACCESS ROAD LIGHTING HAS BEEN DESIGNED TO COMPLY WITH THE SUBCATEGORY PR5 REQUIREMENTS OF AS/NZS 1158.3.1:2020 (PEDESTRIAN AREA (CATEGORY P) LIGHTING - PERFORMANCE AND DESIGN REQUIREMENTS), AND THE CAR PARK LIGHTING HAS BEEN DESIGNED TO COMPLY WITH THE SUBCATEGORY PC3 REQUIREMENTS OF AS/NZS 1158.3.1:2020. REFER TO THE CALCULATION RESULTS SUMMARY TABLE. THE CALCULATIONS WERE COMPLETED WITHOUT ANY CONTRIBUTION FROM THE OUTDOOR WORK AREA LED FLOODLIGHTING.
2. THE OUTDOOR OPERATIONAL AREAS (FREIGHT MARSHALLING YARDS, RAIL MOVEMENTS AND FREIGHT HANDLING AREAS) ARE DESIGNED TO COMPLY WITH THE RELEVANT LIGHTING REQUIREMENTS FROM TABLE 6.1 OF THE KIWIRAIL TRACTION AND ELECTRICAL STANDARD E-ST-EL-0131.
3. THE ACCESS ROAD AND CAR PARK LUMINAIRES SHALL BE AEC ITALO LEDs WITH MODULES AND WATTAGES AS SPECIFIED IN THE LUMINAIRE AND POLE LIST. THE QUALITY OF MANUFACTURE AND OPTICAL PERFORMANCE OF ANY ALTERNATIVE LUMINAIRES SHALL MATCH OR EXCEED THAT OF THE ITALO (INCLUDING THE CURRENT DESIGN ILLUMINANCE LEVELS) AND SUPPORTING CALCULATIONS SHALL BE REQUIRED TO BE SUBMITTED ALONG WITH ANY ALTERNATIVE LUMINAIRES OFFERED.
4. THE LED FLOODLIGHTS SHALL BE EWO R4 GENERATION 3 LED FLOODLIGHTS (OR EQUAL), SUPPLIED BY ENERGYLIGHT LTD, WITH OPTICS AND WATTAGES AS SPECIFIED IN THE LUMINAIRE AND POLE LIST. THE QUALITY OF MANUFACTURE AND OPTICAL PERFORMANCE OF ANY ALTERNATIVE LED FLOODLIGHTS SHALL MATCH OR EXCEED THAT OF THE EWO R4 (INCLUDING THE CURRENT DESIGN ILLUMINANCE LEVELS) AND SUPPORTING CALCULATIONS (ILLUMINANCE AND OBTRUSIVE LIGHT) SHALL BE REQUIRED TO BE SUBMITTED ALONG WITH ANY ALTERNATIVE LUMINAIRES OFFERED.
5. WHEN INSTALLED ALL NEW LUMINAIRES SHALL HAVE THE MOUNTING HEIGHTS AND TILT ANGLES AS SPECIFIED IN THE LUMINAIRE AND POLE LIST. THE NEW FLOODLIGHTING LUMINAIRES SHALL BE ATTACHED TO THE FRONT FACE OF THE LIGHTING POLE CROSS ARMS (0.6m LONG - SUPPLIED WITH THE LIGHTING POLES) IN ACCORDANCE WITH THE LED MANUFACTURES INSTRUCTIONS USING PROPRIETARY EWO R4 STANDARD STIRRUP BRACKETS (SUPPLIED WITH THE NEW LUMINAIRES). ALL LUMINAIRES SHALL BE AIMED IN ACCORDANCE WITH THE ORIENTATIONS DEPICTED ON THE LAYOUT DRAWINGS.
6. A LIGHTING CONTROL SYSTEM SHALL BE SPECIFIED DURING DETAILED DESIGN, HOWEVER THE ACCESS ROAD AND CAR PARK LIGHTING SHALL BE CONTROLLED INDEPENDENTLY FROM THE OUTDOOR WORK AREA FLOODLIGHTS. THE OUTDOOR FLOODLIGHTS SHALL BE MANUALLY CONTROLLED FROM WITHIN EACH SPECIFIC WORK AREA. LOW LEVEL SECURITY LIGHTING SHALL BE PROVIDED FROM SELECTED ACCESS ROAD LIGHTS THAT WILL OPERATE DURING THE HOURS OF DARKNESS WHEN OPERATIONS HAVE STOPPED.
7. THE COMPLETE LIGHTING UPGRADE REQUIRES NEW LED LUMINAIRES TO BE MOUNTED ONTO NEW LIGHTING POLES.
8. ALL MATERIALS (INCLUDING LUMINAIRES, POLES, CROSS ARMS, BRACKETS AND MOUNTING HARDWARE) SHALL COMPLY WITH THE DURABILITY REQUIREMENTS OF KIWIRAIL.
9. THIS DRAWING ONLY DEPICTS THE LUMINAIRES AND MOUNTING REQUIREMENTS ASSOCIATED WITH THE LIGHTING DESIGN. ANY WORK ASSOCIATED WITH PROVIDING POWER SUPPLY INFRASTRUCTURE (TO SUPPLY THE NEW LUMINAIRES) IS OUTSIDE THE SCOPE OF THIS DESIGN.
10. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY POWER SUPPLY DESIGN AND INSTALLATION (REQUIRED TO PROVIDE POWER AND CONTROLS TO THE NEW LIGHTING) AND SHALL PAY ANY ASSOCIATED LOCAL ELECTRICITY NETWORK FEES. THE CONTRACTOR SHALL COMPLY WITH THE ELECTRICITY (SAFETY) REGULATIONS, AS/NZS 3000 (NZ WIRING RULES) AND ANY SPECIFIC KIWIRAIL RULES AND PROCEDURES AS APPLICABLE.
11. EACH NEW STEEL LIGHTING POLE SHALL BE EARTHED / BONDED TO THE FREIGHT HUB ELECTRICAL EARTHING SYSTEM IN ACCORDANCE WITH KIWIRAIL REQUIREMENTS.

OBTRUSIVE LIGHTING NOTES

1. ACCORDING TO AS/NZS 4282:2019 (CONTROL OF THE OBTRUSIVE EFFECTS OF OUTDOOR LIGHTING) THE FREIGHT HUB IS WITHIN ZONE A2 (SPARSELY INHABITED RURAL / SEMI-RURAL AREAS WITH LOW DISTRICT BRIGHTNESS) WHERE SPILL LIGHT, THRESHOLD INCREMENT, SKY GLOW AND GLARE HAVE TO BE CONTROLLED TO SPECIFIED LEVELS IN ACCORDANCE WITH ZONE A2 REQUIREMENTS.
2. REFER TO FIG 210 FOR THE SPILL LIGHT, THRESHOLD INCREMENT AND SKY GLOW CALCULATIONS AND FIG 211 FOR THE GLARE CALCULATIONS AT SPECIFIED RESIDENTIAL BUILDINGS.

REFERENCE DRAWINGS

FIG: 201	LIGHTING LAYOUT SHEET 1 OF 8
FIG: 202	LIGHTING LAYOUT SHEET 2 OF 8
FIG: 203	LIGHTING LAYOUT SHEET 3 OF 8
FIG: 204	LIGHTING LAYOUT SHEET 4 OF 8
FIG: 205	LIGHTING LAYOUT SHEET 5 OF 8
FIG: 206	LIGHTING LAYOUT SHEET 6 OF 8
FIG: 207	LIGHTING LAYOUT SHEET 7 OF 8
FIG: 208	LIGHTING LAYOUT SHEET 8 OF 8
FIG: 209	LIGHTING POLE AND LUMINAIRE MOUNTING DETAILS
FIG: 210	SPILL LIGHT & LTP CALCULATION RESULTS
FIG: 211	GLARE CALCULATION RESULTS

REV: B

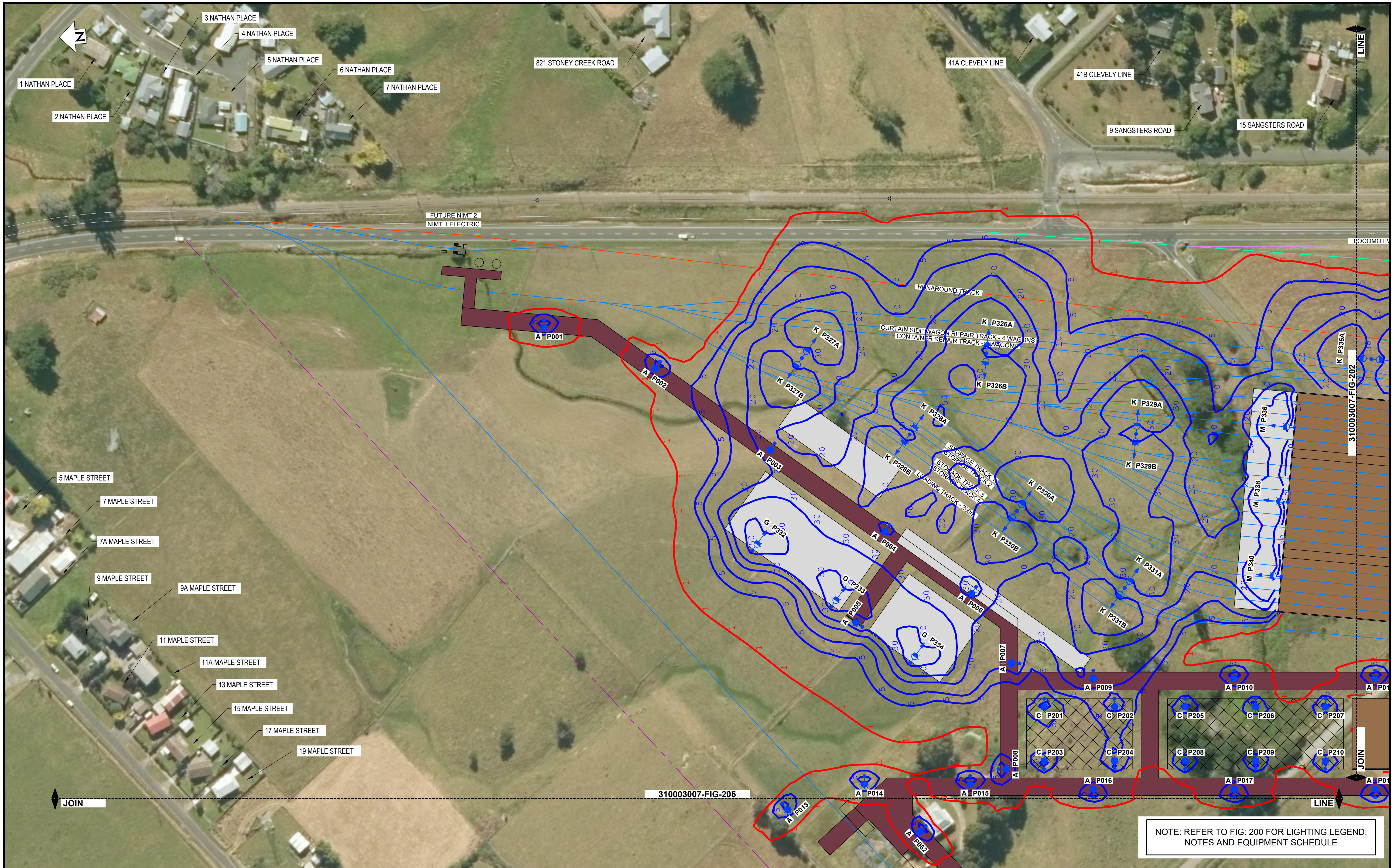
KiwiRail
Backbone of integrated transport networks
Stantec

Job No: 310003007

KIWIRAIL HUB
SITE 3-G2 LIGHTING
INFORMATION SHEET

Drawn By: IAN CAMPBELL
Scale:

FIG: 200


N
1 NATHAN PLACE
2 NATHAN PLACE
3 NATHAN PLACE
4 NATHAN PLACE
5 NATHAN PLACE
6 NATHAN PLACE
7 NATHAN PLACE
821 STONEY CREEK ROAD
41A CLEVELY LINE
41B CLEVELY LINE
9 SANGSTERS ROAD
15 SANGSTERS ROAD
LINE
FUTURE NIMT 2
NIMT 1 ELECTRIC
LOCOMOTIV
RUNAROUND TRACK
CURTAIN SIDE WAGON REPAIR TRACK - 4 WAGONS
CONTAINER REPAIR TRACK - 4 WAGONS
STORAGE TRACK 1
STORAGE TRACK 2
STORAGE TRACK 3
LOADING TRACK - 200m
310003007-FIG-202
5 MAPLE STREET
7 MAPLE STREET
7A MAPLE STREET
9 MAPLE STREET
9A MAPLE STREET
11 MAPLE STREET
11A MAPLE STREET
13 MAPLE STREET
15 MAPLE STREET
17 MAPLE STREET
19 MAPLE STREET
A P001
A P002
A P003
A P004
A P005
A P006
A P007
A P008
A P009
A P010
A P013
A P014
A P015
A P016
A P017
A P062
K P326A
K P326B
K P327A
K P327B
K P328A
K P328B
K P329A
K P329B
K P330A
K P330B
K P331A
K P331B
K P335A
M P336
M P338
M P340
G P332
G P333
G P334
C P201
C P202
C P203
C P204
C P205
C P206
C P207
C P208
C P209
C P210
JOIN
310003007-FIG-205
LINE
JOIN
NOTE: REFER TO FIG: 200 FOR LIGHTING LEGEND, NOTES AND EQUIPMENT SCHEDULE

PLAN
SCALE 1:1,000

10 0 10 20 30 40 50m
A1 SCALE 1:1,000 A3 1:2,000

REV: B

KiwiRail — Backbone of integrated transport networks

Stantec

Job No: 310003007

KIWIRAIL HUB
SITE 3-G2 LIGHTING LAYOUT
SHEET 1 OF 8

Drawn By: IAN CAMPBELL
Scale: 1:1000

FIG: 201

58 PARRS ROAD
59 PARRS ROAD
55D PARRS ROAD
25 SANGSTERS ROAD
27 SANGSTERS ROAD
43 SANGSTERS ROAD
73 SANGSTERS ROAD
91 SANGSTERS ROAD
LINE
N
LOCOMOTIVE SETOFF TRACK -100m ELECTRIC
FUTURE NIMT 2
NIMT 1 ELECTRIC
J P301 J P302 J P303 J P304 J P305 J P306 J P307 J P308 J P309 J P310
K P335A K P335B
310003007-FIG-201
310003007-FIG-203
L P342 L P343
K P348A K P348B K P349A K P349B K P350A K P350B K P351A K P351B K P352A K P352B K P353A K P353B K P354A K P354B K P355A K P355B
K P346A K P346B K P347A K P347B
M P337 M P339 M P341
A P031 A P032 A P033 A P034 A P035
K P384A K P384B K P385A K P385B K P386A K P386B K P387A K P387B K P388A K P388B K P389A K P389B
J P380 K P381A K P381B K P382A K P382B
A P027 A P030
A P011 A P012 A P018 A P019 A P020 A P021 A P023 A P024 A P025 A P026 A P028 A P029 A P090
P207 P210
C P211 C P212 C P213
E P214 E P215 E P216 E P217 E P218 E P219
A P047 A P048 A P049
G P404 G P405 G P406 G P407 G P408 G P409
JOIN
SERVICE TRACK
310003007-FIG-206
NOTE: REFER TO FIG: 200 FOR LIGHTING LEGEND, NOTES AND EQUIPMENT SCHEDULE

PLAN
SCALE 1:1,000

10 0 10 20 30 40 50m
A1 SCALE 1:1,000 A3 1:2,000

KiwiRail
Stantec
Job No: 310003007

KIWIRAIL HUB
SITE 3-G2 LIGHTING LAYOUT
SHEET 2 OF 8

REV: B

Drawn By: IAN CAMPBELL
Scale: 1:1000

FIG: 202

95 SANGSTERS ROAD

422 RAILWAY ROAD

LINE

LINE

310003007-FIG-202

310003007-FIG-204

310003007-FIG-207

JOIN

JOIN

JOIN

LINE

NOTE: REFER TO FIG: 200 FOR LIGHTING LEGEND, NOTES AND EQUIPMENT SCHEDULE

PLAN
SCALE 1:1,000

10 0 10 20 30 40 50m
A1 SCALE 1:1,000 A3 1:2,000

KiwiRail

Stantec

Job No: 310003007

KIWIRAIL HUB
SITE 3-G2 LIGHTING LAYOUT
SHEET 3 OF 8

REV: B

Drawn By: IAN CAMPBELL
Scale: 1:1000

FIG: 203

4/28/2021 11:46 am

N

LINE

310003007-FIG-203

FUTURE NIMT 2
NIMT 1 ELECTRIC

LOCOMOTIVE SET-OFF TRACK -100m ELECTRIC

PULLBACK TRACK -1500m

J P321 J P322 J P323 J P324 J P325

L P344 L P345

K P366A K P366B K P367A K P367B K P368A K P368B K P369A K P369B J P370

A P046 J P403

C P234 C P235 C P236 C P237 C P238 C P239

K P371A K P371B

C P240 C P241 C P242

D P243A D P244A D P243B D P244B

C 245 C P246 C P247

JOIN

A P060 JOIN A P061

310003007-FIG-208

LINE

NOTE: REFER TO FIG: 200 FOR LIGHTING LEGEND, NOTES AND EQUIPMENT SCHEDULE

PLAN
SCALE 1:1,000

10 0 10 20 30 40 50m
A1 SCALE 1:1,000 A3 1:2,000

KiwiRail

Stantec

Job No: 310003007

KIWIRAIL HUB
SITE 3-G2 LIGHTING LAYOUT
SHEET 4 OF 8

REV: B

Drawn By: IAN CAMPBELL
Scale: 1,1000

FIG: 204

C:\pwworkdir\wp_projects\011\01170463\310003007-FIG-204-SITE 3-G2 Lighting Layout.dwg

4/28/2021 11:47 am

JOIN

310003007-FIG-201

LINE

LINE

21 MAPLE STREET

57 MAPLE STREET

245 TE NGAIO ROAD

241 TE NGAIO ROAD

242 TE NGAIO ROAD

A P013

A P014

A P015

A P016

A P017

A P082

A P083

A P064

A P065

A P066

A P074

A P075

H P373A

H P374A

J P372

H P373B

H P374B

A P076

310003007-FIG-206

JOIN

N

NOTE: REFER TO FIG: 200 FOR LIGHTING LEGEND, NOTES AND EQUIPMENT SCHEDULE

PLAN
SCALE 1:1,000

10 0 10 20 30 40 50m
A1 SCALE 1:1,000 A3 1:2,000

KiwiRail

Stantec

Job No: 310003007

KIWIRAIL HUB
SITE 3-G2 LIGHTING LAYOUT
SHEET 5 OF 8

Drawn By: IAN CAMPBELL
Scale: 1:1000

REV: B

FIG: 205

C:\pwworkdir\sap_projects\id\d0117046\i310003007-FIG-205-SITE 3-G2 Lighting Layout.dwg

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310003007-FIG-202

LINE JOIN

LINE

310003007-FIG-205

310003007-FIG-207

JOIN

JOIN

163 CLEVELY LINE

NOTE: REFER TO FIG: 200 FOR LIGHTING LEGEND, NOTES AND EQUIPMENT SCHEDULE

N

PLAN
SCALE 1:1,000

10 0 10 20 30 40 50m
A1 SCALE 1:1,000 A3 1:2,000

KiwiRail

Stantec

Job No: 310003007

KIWIRAIL HUB
SITE 3-G2 LIGHTING LAYOUT
SHEET 6 OF 8

REV: B

Drawn By: IAN CAMPBELL
Scale: 1:1000

FIG: 206

C:\pwworkdir\sap_projects\01\d01170463\310003007-FIG-206-SITE 3-G2 Lighting Layout.dwg

G P413 G P414 G P415 G P416 G P418 G P419 G P420 G P421 G P422

LINE JOIN

310003007-FIG-203

E P222 LINE LINE E

E P225 E F P226A

E P228 E F P229A

E P231 E

N P436 N P438 N P440

A P101 A P102 A P103 A P104 A P105 A P106 P107

N P434 N P435 N P437 N P439 N P441 N P442 N P443 N P444 J P44

310003007-FIG-206

310003007-FIG-208

LOADING TRACK
SERVICE TRACK
LOADING TRACK

A P12

A P122

A P121

P114 A P115 A P116 A P117 A P118 A P119 A P120

JOIN JOIN

787 ROBERTS LINE

803 ROBERTS LINE

N

NOTE: REFER TO FIG: 200 FOR LIGHTING LEGEND, NOTES AND EQUIPMENT SCHEDULE

PLAN
SCALE 1:1,000

REV: B

10 0 10 20 30 40 50m
A1 SCALE 1:1,000 A3 1:2,000

KiwiRail Stantec

Job No: 310003007

KIWIRAIL HUB
SITE 3-G2 LIGHTING LAYOUT
SHEET 7 OF 8

Drawn By: IAN CAMPBELL
Scale: 1:1000

FIG: 207

PLAN
SCALE 1:1,000

10 0 10 20 30 40 50m
A1 SCALE 1:1,000 A3 1:2,000

KiwiRail
Backbone of integrated transport networks

Stantec

Job No: 310003007

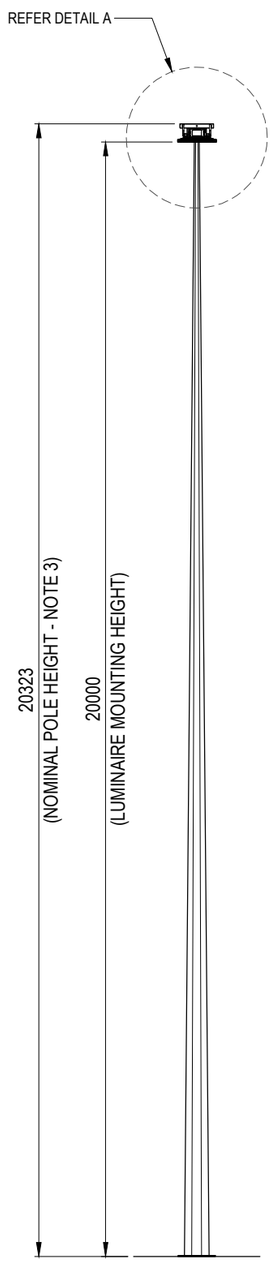
KIWIRAIL HUB
SITE 3-G2 LIGHTING LAYOUT
SHEET 8 OF 8

REV: B

Drawn By: IAN CAMPBELL
Scale: 1:1000

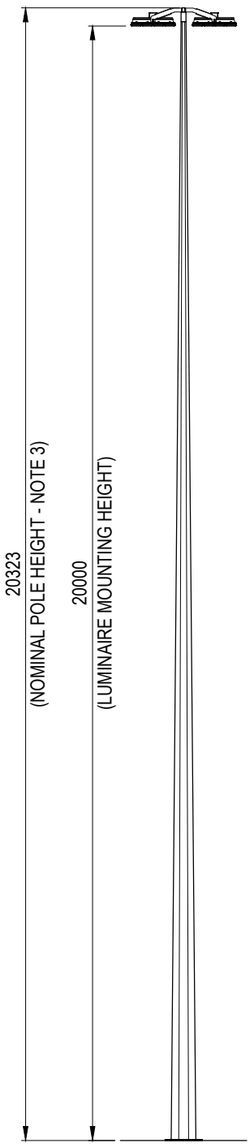
FIG: 208

4/28/2021 11:50 am



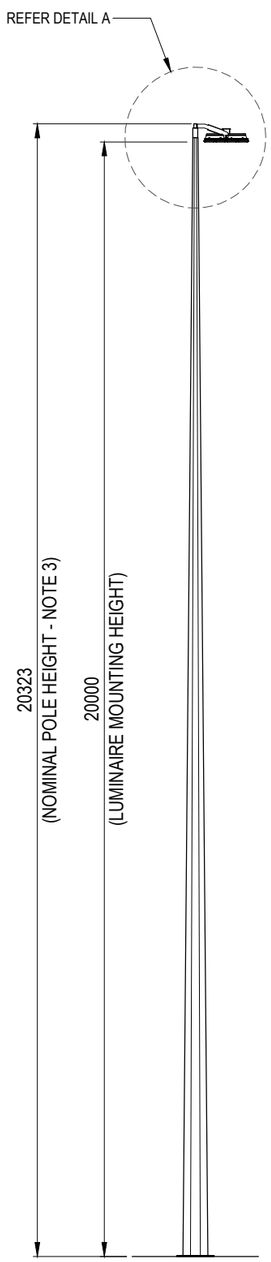
FRONT ELEVATION

SPUNLITE 20m OCTAGONAL GENERAL PURPOSE FLANGE BASED POLE AND EWO R4 LED FLOODLIGHT MOUNTED TO 0.6m CROSS ARM



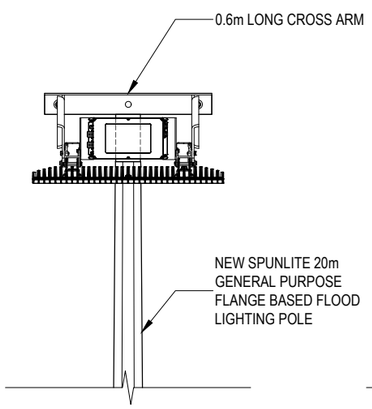
END ELEVATION

SPUNLITE 20m OCTAGONAL GENERAL PURPOSE FLANGE BASED POLE AND EWO R4 LED FLOODLIGHTS (2 OFF) MOUNTED TO EACH SIDE OF 0.6m CROSS ARM

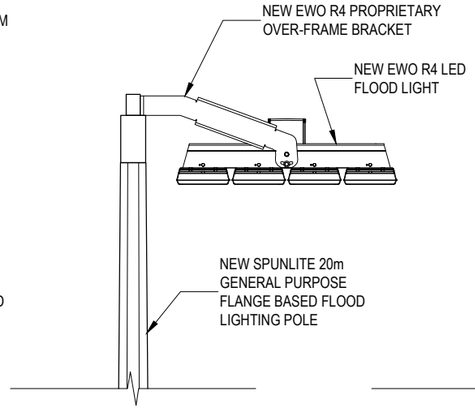


END ELEVATION

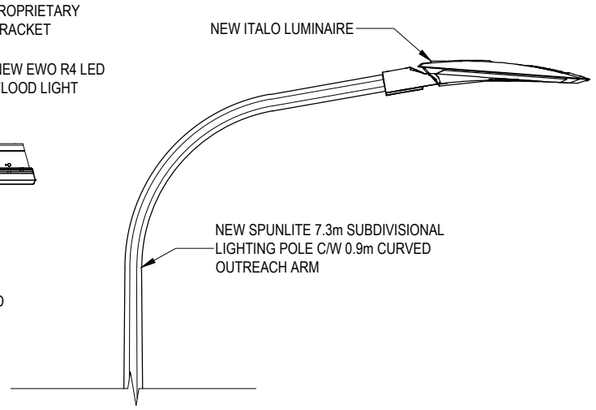
SPUNLITE 20m OCTAGONAL GENERAL PURPOSE FLANGE BASED POLE AND EWO R4 LED FLOODLIGHT MOUNTED TO 0.6m CROSS ARM



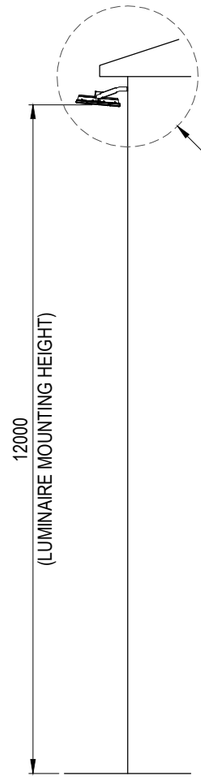
DETAIL A



DETAIL B

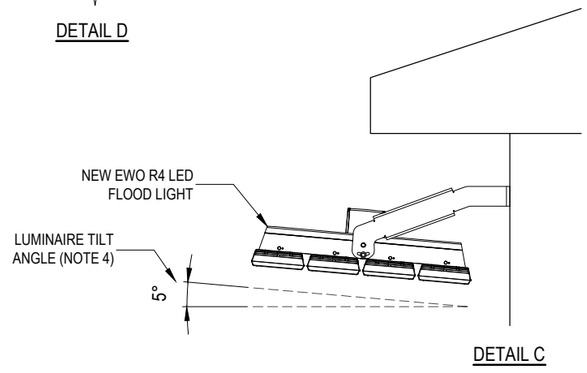


DETAIL D

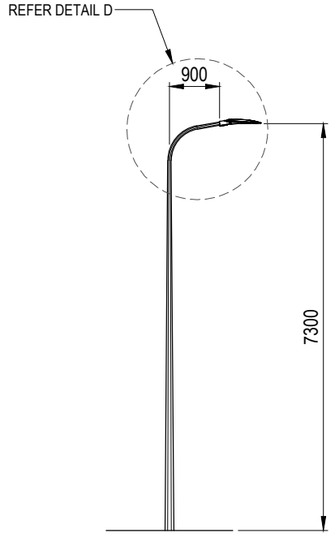


END ELEVATION

BUILDING MOUNTED EWO R4 LED FLOODLIGHT

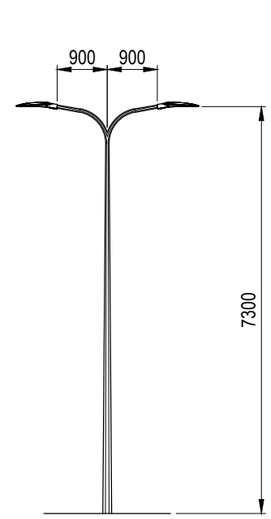


DETAIL C



END ELEVATION

SPUNLITE 7.3m SUBDIVISIONAL GROUND PLANTED POLE C/W 0.9m SINGLE CURVED ARM AND ITALO LED LUMINAIRE



END ELEVATION

SPUNLITE 7.3m SUBDIVISIONAL GROUND PLANTED POLE C/W 0.9m DOUBLE CURVED ARMS AND ITALO LED LUMINAIRES (2 OFF)

NOTES

1. POLE AND LUMINAIRE DETAILS ARE INDICATIVE ONLY.
2. FINAL POLE CONFIGURATIONS, LUMINAIRE DETAILS AND MOUNTING ARRANGEMENTS SHALL BE FINALISED DURING DETAILED DESIGN.
3. NOMINAL POLE HEIGHTS (REQUIRED TO ACHIEVE THE SPECIFIED LUMINAIRE MOUNTING HEIGHTS) AND FABRICATION DETAILS TO BE CONFIRMED BY POLE SUPPLIER.
4. ALL LUMINAIRE TILT ANGLES SHALL BE AS NOTED ON THE INFORMATION SHEET (FIG: 200).

NOTE: REFER TO FIG: 200 FOR LIGHTING LEGEND, NOTES AND EQUIPMENT SCHEDULE

REV: B

KiwiRail — Stantec

Job No: 310003007

KIWIRAIL HUB
SITE 3-G2 LIGHTING POLE
AND LUMINAIRE MOUNTING DETAILS

Drawn By: IAN CAMPBELL
Scale: NTS

FIG: 209

SPILL LIGHT CALCULATION RESULTS - NE PROPERTIES

AS/NZS4282:2019 Control of Obtrusive Lighting Effects - Calculation Summary - Spill Light

Label	CalcType	Units	Max	Description
Clevely Line - No 22A_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Clevely Line - No 22A_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Clevely Line - No 22A_III_Seg3	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Clevely Line - No 22A_III_Seg4	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Clevely Line - No 22A_III_Seg5	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Clevely Line - No 22A_III_Seg6	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Clevely Line - No 41A_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Clevely Line - No 41A_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Clevely Line - No 41A_III_Seg3	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Clevely Line - No 41A_III_Seg4	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Clevely Line - No 41A_III_Seg5	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Clevely Line - No 41A_III_Seg6	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Clevely Line - No 41B_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Clevely Line - No 41B_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Clevely Line - No 41B_III_Seg3	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Clevely Line - No 41B_III_Seg4	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Clevely Line - No 41B_III_Seg5	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Nathan Pl - No 1_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Nathan Pl - No 1_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Nathan Pl - No 1_III_Seg3	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Nathan Pl - No 2_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Nathan Pl - No 2_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Nathan Pl - No 2_III_Seg3	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Nathan Pl - No 3_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Nathan Pl - No 3_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Nathan Pl - No 3_III_Seg3	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Nathan Pl - No 3_III_Seg4	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Nathan Pl - No 3_III_Seg5	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Nathan Pl - No 3_III_Seg6	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Nathan Pl - No 3_III_Seg7	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Nathan Pl - No 4_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Nathan Pl - No 4_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Nathan Pl - No 4_III_Seg3	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Nathan Pl - No 4_III_Seg4	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Nathan Pl - No 5_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Nathan Pl - No 5_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Nathan Pl - No 5_III_Seg3	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Nathan Pl - No 5_III_Seg4	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Nathan Pl - No 6_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Nathan Pl - No 6_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Nathan Pl - No 6_III_Seg3	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Nathan Pl - No 6_III_Seg4	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Nathan Pl - No 6_III_Seg5	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Nathan Pl - No 6_III_Seg6	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Nathan Pl - No 6_III_Seg7	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Nathan Pl - No 6_III_Seg8	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Nathan Pl - No 7_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Nathan Pl - No 7_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Nathan Pl - No 7_III_Seg3	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Nathan Pl - No 7_III_Seg4	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Parrs Rd - No 27_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Parrs Rd - No 27_III_Seg2	Obtrusive - III	Lux	0.1	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Parrs Rd - No 27_III_Seg3	Obtrusive - III	Lux	0.1	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Parrs Rd - No 27_III_Seg4	Obtrusive - III	Lux	0.1	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Parrs Rd - No 27_III_Seg5	Obtrusive - III	Lux	0.1	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Parrs Rd - No 27_III_Seg6	Obtrusive - III	Lux	0.1	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Parrs Rd - No 27_III_Seg7	Obtrusive - III	Lux	0.1	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Parrs Rd - No 55D_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Parrs Rd - No 55D_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Parrs Rd - No 55D_III_Seg3	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Parrs Rd - No 55D_III_Seg4	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Parrs Rd - No 55D_III_Seg5	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Parrs Rd - No 55D_III_Seg6	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Parrs Rd - No 55D_III_Seg7	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Parrs Rd - No 58_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Parrs Rd - No 58_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Parrs Rd - No 58_III_Seg3	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Parrs Rd - No 58_III_Seg4	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Parrs Rd - No 58_III_Seg5	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Parrs Rd - No 59_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Parrs Rd - No 59_III_Seg10	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Parrs Rd - No 59_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Parrs Rd - No 59_III_Seg3	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Parrs Rd - No 59_III_Seg4	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Parrs Rd - No 59_III_Seg5	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Parrs Rd - No 59_III_Seg6	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Parrs Rd - No 59_III_Seg7	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Parrs Rd - No 59_III_Seg8	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Parrs Rd - No 59_III_Seg9	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 09_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 09_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 09_III_Seg3	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 09_III_Seg4	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 09_III_Seg5	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 09_III_Seg6	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 09_III_Seg7	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 11_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 11_III_Seg10	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 11_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 11_III_Seg3	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 11_III_Seg4	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 11_III_Seg5	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 11_III_Seg6	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 11_III_Seg7	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 11_III_Seg8	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 11_III_Seg9	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 15_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 15_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 15_III_Seg3	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 25_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 25_III_Seg2	Obtrusive - III	Lux	0.1	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 25_III_Seg3	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 43_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 43_III_Seg2	Obtrusive - III	Lux	0.1	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 43_III_Seg3	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 43_III_Seg4	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 43_III_Seg5	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 43_III_Seg6	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 43_III_Seg7	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Stoney Creek Rd - No 819_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Stoney Creek Rd - No 819_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Stoney Creek Rd - No 819_III_Seg3	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Stoney Creek Rd - No 819_III_Seg4	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Stoney Creek Rd - No 819_III_Seg5	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Stoney Creek Rd - No 819_III_Seg6	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Stoney Creek Rd - No 819_III_Seg7	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Stoney Creek Rd - No 819_III_Seg8	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Stoney Creek Rd - No 821_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Stoney Creek Rd - No 821_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Stoney Creek Rd - No 821_III_Seg3	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Stoney Creek Rd - No 821_III_Seg4	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)

SPILL LIGHT CALCULATION RESULTS - SE AND SW PROPERTIES

AS/NZS4282:2019 Control of Obtrusive Lighting Effects - Calculation Summary - Spill Light

Label	CalcType	Units	Max	Description
Clevely Line - No 163_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Clevely Line - No 163_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Clevely Line - No 163_III_Seg3	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Clevely Line - No 163_III_Seg4	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Clevely Line - No 163_III_Seg5	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Clevely Line - No 163_III_Seg6	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Clevely Line - No 163_III_Seg7	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Railway Rd - No 422_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Railway Rd - No 422_III_Seg2	Obtrusive - III	Lux	0.2	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Railway Rd - No 422_III_Seg3	Obtrusive - III	Lux	0.1	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Railway Rd - No 422_III_Seg4	Obtrusive - III	Lux	0.1	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Railway Rd - No 422_III_Seg5	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Railway Rd - No 422_III_Seg6	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Railway Rd - No 422_III_Seg7	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 761_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 761_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 761_III_Seg3	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 761_III_Seg4	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 761_III_Seg5	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 761_III_Seg6	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 761_III_Seg7	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 771_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 771_III_Seg10	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 771_III_Seg11	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 771_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 771_III_Seg3	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 771_III_Seg4	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 771_III_Seg5	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 771_III_Seg6	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 771_III_Seg7	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 771_III_Seg8	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 771_III_Seg9	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 787_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 787_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 787_III_Seg3	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 787_III_Seg4	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 787_III_Seg5	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 787_III_Seg6	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 787_III_Seg7	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 787_III_Seg8	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 803_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 803_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 803_III_Seg3	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 803_III_Seg4	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 803_III_Seg5	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 803_III_Seg6	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 814_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 814_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 814_III_Seg3	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 814_III_Seg4	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 824_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 824_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 824_III_Seg3	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 824_III_Seg4	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 824A_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 824A_III_Seg10	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 824A_III_Seg11	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 824A_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 824A_III_Seg3	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 824A_III_Seg4	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 824A_III_Seg5	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 824A_III_Seg6	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 824A_III_Seg7	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 824A_III_Seg8	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Roberts Line - No 824A_III_Seg9	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 73_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 73_III_Seg2	Obtrusive - III	Lux	0.1	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 73_III_Seg3	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 73_III_Seg4	Obtrusive - III	Lux	0.1	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 73_III_Seg5	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 91_III_Seg1	Obtrusive - III	Lux	0.1	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 91_III_Seg2	Obtrusive - III	Lux	0.1	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 91_III_Seg3	Obtrusive - III	Lux	0.1	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 91_III_Seg4	Obtrusive - III	Lux	0.1	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 91_III_Seg5	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 91_III_Seg6	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 91_III_Seg7	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 91_III_Seg8	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 95_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 95_III_Seg2	Obtrusive - III	Lux	0.1	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 95_III_Seg3	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 95_III_Seg4	Obtrusive - III	Lux	0.1	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Sangsters Rd - No 95_III_Seg5	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Tutaki Rd - No 428_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Tutaki Rd - No 428_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Tutaki Rd - No 428_III_Seg3	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)

THRESHOLD INCREMENT (TI)

AS/NZS 4282:2019 Control of Obtrusive Lighting Effects - Calculation Summary - Threshold Increment (TI)

Label	CalcType	Units	TI	Description
ObtrusiveLight_TI_West Bdy N	Obtrusive - TI	%	0	Maximum TI of 20% (Zone A2 - Adaption Luminance of 0.2 cd/m2)
ObtrusiveLight_TI_West Bdy S	Obtrusive - TI	%	0	Maximum TI of 20% (Zone A2 - Adaption Luminance of 0.2 cd/m2)

SKY GLOW - UPWARD WASTE LIGHT RATIO (UWLR)

UWLR Area Summary

Label	UWLR
LPDArea_1	0.000

SPILL LIGHT CALCULATION RESULTS - NW PROPERTIES

AS/NZS4282:2019 Control of Obtrusive Lighting Effects - Calculation Summary - Spill Light

Label	CalcType	Units	Max	Description
Maple St - No 01_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 01_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 01_III_Seg3	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 01_III_Seg4	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 01_III_Seg5	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 01_III_Seg6	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 01A_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 01A_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 01A_III_Seg3	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 01A_III_Seg4	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 01A_III_Seg5	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 01A_III_Seg6	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 01A_III_Seg7	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 01A_III_Seg8	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 03_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 03_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 03_III_Seg3	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 03_III_Seg4	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 03_III_Seg5	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 05 (2 Storey)_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 05 (2 Storey)_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 05 (2 Storey)_III_Seg3	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 05 (2 Storey)_III_Seg4	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 05 (2 Storey)_III_Seg5	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 05 (2 Storey)_III_Seg6	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 05 (2 Storey)_III_Seg7	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 07_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 07_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 07A_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 07A_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 09_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 09_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 09A (2 Storey)_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 09A (2 Storey)_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 09A (2 Storey)_III_Seg3	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 09A (2 Storey)_III_Seg4	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 09A (2 Storey)_III_Seg5	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 09A (2 Storey)_III_Seg6	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 11_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 11_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 11A_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 11A_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 13_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 13_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 15_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 15_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 17_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 17_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 19_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 19_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 19_III_Seg3	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 21_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 21_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 21_III_Seg3	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 21_III_Seg4	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 57_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 57_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 57_III_Seg3	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 57_III_Seg4	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Maple St - No 57_III_Seg5	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Te Ngaio Rd - No 241 (2 Storey)_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Te Ngaio Rd - No 241 (2 Storey)_III_Seg10	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Te Ngaio Rd - No 241 (2 Storey)_III_Seg11	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Te Ngaio Rd - No 241 (2 Storey)_III_Seg12	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Te Ngaio Rd - No 241 (2 Storey)_III_Seg13	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Te Ngaio Rd - No 241 (2 Storey)_III_Seg14	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Te Ngaio Rd - No 241 (2 Storey)_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Te Ngaio Rd - No 241 (2 Storey)_III_Seg3	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Te Ngaio Rd - No 241 (2 Storey)_III_Seg4	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Te Ngaio Rd - No 241 (2 Storey)_III_Seg5	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Te Ngaio Rd - No 241 (2 Storey)_III_Seg6	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Te Ngaio Rd - No 241 (2 Storey)_III_Seg7	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Te Ngaio Rd - No 241 (2 Storey)_III_Seg8	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Te Ngaio Rd - No 241 (2 Storey)_III_Seg9	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Te Ngaio Rd - No 242_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Te Ngaio Rd - No 242_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Te Ngaio Rd - No 242_III_Seg3	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Te Ngaio Rd - No 242_III_Seg4	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Te Ngaio Rd - No 242_III_Seg5	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Te Ngaio Rd - No 245_III_Seg1	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Te Ngaio Rd - No 245_III_Seg2	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Te Ngaio Rd - No 245_III_Seg3	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Te Ngaio Rd - No 245_III_Seg4	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)
Te Ngaio Rd - No 245_III_Seg5	Obtrusive - III	Lux	0.0	Maximum Vertical Illuminance of 1 Lux (Zone A2 curfew hours)

OBTRUSIVE LIGHTING NOTES

1. ACCORDING TO AS/NZS 4282:2019 (CONTROL OF THE OBTRUSIVE EFFECTS OF OUTDOOR LIGHTING) THE FREIGHT HUB IS WITHIN ENVIRONMENTAL ZONE A2 (SPARSELY INHABITED RURAL / SEMI-RURAL AREAS WITH LOW DISTRICT BRIGHTNESS) WHERE THE VERTICAL ILLUMINATION (ON THE FRONT FACES OF RESIDENTIAL BUILDINGS CONTAINING WINDOWS) AND OTHER LIGHT TECHNICAL PARAMETERS (LTPs) ARE NOT PERMITTED TO EXCEED SPECIFIED MAXIMUMS. THE POINT VERTICAL ILLUMINATION IS NOT PERMITTED TO EXCEED 1 LUX DURING CURFEW HOURS (BETWEEN 11pm AND 6am). DURING NON-CURFEW HOURS THIS LIMIT INCREASES TO 5 LUX. THE THRESHOLD LIMIT (TI) IS NOT PERMITTED TO BE GREATER THAN 20% (WITH ADAPTION LUMINANCE LEVEL OF 0.2 cd/m2). THE AMOUNT OF SKY GLOW (UWLR) IS NOT PERMITTED TO EXCEED 0.01.
2. ONLY THE CLOSEST RESIDENTIAL BUILDINGS SURROUNDING THE PROPOSED RAIL FREIGHT HUB SITE WERE CONSIDERED AND THE CALCULATION RESULTS INDICATE THAT THE AMOUNT OF SPILL LIGHT, THRESHOLD INCREMENT AND SKY GLOW DOES NOT EXCEED THE MAXIMUM LIMITS SPECIFIED FOR ENVIRONMENTAL ZONE A2. THE EXISTING TREES AND VEGETATION (BETWEEN THE PROPERTIES AND RAIL FREIGHT HUB) WERE NOT TAKEN INTO ACCOUNT THEREFORE THE ACTUAL SPILL LIGHT (WITHIN THE RESIDENTIAL PROPERTIES) SHOULD BE LOWER THAN THE CURRENT RESULTS INDICATE.

REV: B

KiwiRail
Backbone of integrated transport networks

Stantec

Job No: 310003007

KIWIRAIL HUB
SITE 3-G2 LIGHTING
SPILL LIGHT & LTP CALCULATION RESULTS

Drawn By: IAN CAMPBELL
Scale: AS SHOWN
FIG: 210

4/28/2021 2:03 pm

C:\pwworkdir\ap_projects01\d0117046\310003007-FIG-210-SITE 3-G2 Spill Light Calculation Results.dwg

GLARE CALCULATION RESULTS - NE PROPERTIES

AS/NZS4282:2019 Control of Obtrusive Lighting Effects - Calculation Summary - Glare

Label	CalcType	Units	Max	Description
Clevely Line - No 22A_Cd_Seg1	Obtrusive - Cd	N.A.	154	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Clevely Line - No 22A_Cd_Seg2	Obtrusive - Cd	N.A.	349	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Clevely Line - No 22A_Cd_Seg3	Obtrusive - Cd	N.A.	136	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Clevely Line - No 22A_Cd_Seg4	Obtrusive - Cd	N.A.	251	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Clevely Line - No 22A_Cd_Seg5	Obtrusive - Cd	N.A.	193	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Clevely Line - No 22A_Cd_Seg6	Obtrusive - Cd	N.A.	186	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Clevely Line - No 41A_Cd_Seg1	Obtrusive - Cd	N.A.	600	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Clevely Line - No 41A_Cd_Seg2	Obtrusive - Cd	N.A.	613	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Clevely Line - No 41A_Cd_Seg3	Obtrusive - Cd	N.A.	588	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Clevely Line - No 41A_Cd_Seg4	Obtrusive - Cd	N.A.	649	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Clevely Line - No 41A_Cd_Seg5	Obtrusive - Cd	N.A.	123	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Clevely Line - No 41A_Cd_Seg6	Obtrusive - Cd	N.A.	121	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Clevely Line - No 41B_Cd_Seg1	Obtrusive - Cd	N.A.	142	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Clevely Line - No 41B_Cd_Seg2	Obtrusive - Cd	N.A.	144	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Clevely Line - No 41B_Cd_Seg3	Obtrusive - Cd	N.A.	147	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Clevely Line - No 41B_Cd_Seg4	Obtrusive - Cd	N.A.	366	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Clevely Line - No 41B_Cd_Seg5	Obtrusive - Cd	N.A.	383	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Nathan Pl - No 1_Cd_Seg1	Obtrusive - Cd	N.A.	363	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Nathan Pl - No 1_Cd_Seg2	Obtrusive - Cd	N.A.	341	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Nathan Pl - No 1_Cd_Seg3	Obtrusive - Cd	N.A.	342	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Nathan Pl - No 2_Cd_Seg1	Obtrusive - Cd	N.A.	349	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Nathan Pl - No 2_Cd_Seg2	Obtrusive - Cd	N.A.	13	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Nathan Pl - No 2_Cd_Seg3	Obtrusive - Cd	N.A.	11	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Nathan Pl - No 3_Cd_Seg1	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Nathan Pl - No 3_Cd_Seg2	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Nathan Pl - No 3_Cd_Seg3	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Nathan Pl - No 3_Cd_Seg4	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Nathan Pl - No 3_Cd_Seg5	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Nathan Pl - No 3_Cd_Seg6	Obtrusive - Cd	N.A.	39	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Nathan Pl - No 3_Cd_Seg7	Obtrusive - Cd	N.A.	39	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Nathan Pl - No 4_Cd_Seg1	Obtrusive - Cd	N.A.	31	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Nathan Pl - No 4_Cd_Seg2	Obtrusive - Cd	N.A.	13	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Nathan Pl - No 4_Cd_Seg3	Obtrusive - Cd	N.A.	40	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Nathan Pl - No 4_Cd_Seg4	Obtrusive - Cd	N.A.	40	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Nathan Pl - No 5_Cd_Seg1	Obtrusive - Cd	N.A.	40	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Nathan Pl - No 5_Cd_Seg2	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Nathan Pl - No 5_Cd_Seg3	Obtrusive - Cd	N.A.	40	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Nathan Pl - No 5_Cd_Seg4	Obtrusive - Cd	N.A.	361	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Nathan Pl - No 6_Cd_Seg1	Obtrusive - Cd	N.A.	37	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Nathan Pl - No 6_Cd_Seg2	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Nathan Pl - No 6_Cd_Seg3	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Nathan Pl - No 6_Cd_Seg4	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Nathan Pl - No 6_Cd_Seg5	Obtrusive - Cd	N.A.	42	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Nathan Pl - No 6_Cd_Seg6	Obtrusive - Cd	N.A.	41	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Nathan Pl - No 6_Cd_Seg7	Obtrusive - Cd	N.A.	41	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Nathan Pl - No 6_Cd_Seg8	Obtrusive - Cd	N.A.	42	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Nathan Pl - No 7_Cd_Seg1	Obtrusive - Cd	N.A.	446	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Nathan Pl - No 7_Cd_Seg2	Obtrusive - Cd	N.A.	8	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Nathan Pl - No 7_Cd_Seg3	Obtrusive - Cd	N.A.	444	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Nathan Pl - No 7_Cd_Seg4	Obtrusive - Cd	N.A.	53	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Parrs Rd - No 27_Cd_Seg1	Obtrusive - Cd	N.A.	116	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Parrs Rd - No 27_Cd_Seg2	Obtrusive - Cd	N.A.	352	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Parrs Rd - No 27_Cd_Seg3	Obtrusive - Cd	N.A.	355	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Parrs Rd - No 27_Cd_Seg4	Obtrusive - Cd	N.A.	350	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Parrs Rd - No 27_Cd_Seg5	Obtrusive - Cd	N.A.	374	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Parrs Rd - No 27_Cd_Seg6	Obtrusive - Cd	N.A.	377	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Parrs Rd - No 27_Cd_Seg7	Obtrusive - Cd	N.A.	402	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Parrs Rd - No 55D_Cd_Seg1	Obtrusive - Cd	N.A.	85	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Parrs Rd - No 55D_Cd_Seg2	Obtrusive - Cd	N.A.	163	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Parrs Rd - No 55D_Cd_Seg3	Obtrusive - Cd	N.A.	86	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Parrs Rd - No 55D_Cd_Seg4	Obtrusive - Cd	N.A.	182	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Parrs Rd - No 55D_Cd_Seg5	Obtrusive - Cd	N.A.	192	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Parrs Rd - No 55D_Cd_Seg6	Obtrusive - Cd	N.A.	103	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Parrs Rd - No 55D_Cd_Seg7	Obtrusive - Cd	N.A.	102	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Parrs Rd - No 58_Cd_Seg1	Obtrusive - Cd	N.A.	113	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Parrs Rd - No 58_Cd_Seg2	Obtrusive - Cd	N.A.	257	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Parrs Rd - No 58_Cd_Seg3	Obtrusive - Cd	N.A.	262	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Parrs Rd - No 58_Cd_Seg4	Obtrusive - Cd	N.A.	7	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Parrs Rd - No 58_Cd_Seg5	Obtrusive - Cd	N.A.	107	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Parrs Rd - No 59_Cd_Seg1	Obtrusive - Cd	N.A.	103	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Parrs Rd - No 59_Cd_Seg10	Obtrusive - Cd	N.A.	123	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Parrs Rd - No 59_Cd_Seg2	Obtrusive - Cd	N.A.	87	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Parrs Rd - No 59_Cd_Seg3	Obtrusive - Cd	N.A.	141	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Parrs Rd - No 59_Cd_Seg4	Obtrusive - Cd	N.A.	95	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Parrs Rd - No 59_Cd_Seg5	Obtrusive - Cd	N.A.	188	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Parrs Rd - No 59_Cd_Seg6	Obtrusive - Cd	N.A.	134	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Parrs Rd - No 59_Cd_Seg7	Obtrusive - Cd	N.A.	130	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Parrs Rd - No 59_Cd_Seg8	Obtrusive - Cd	N.A.	129	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Parrs Rd - No 59_Cd_Seg9	Obtrusive - Cd	N.A.	155	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 09_Cd_Seg1	Obtrusive - Cd	N.A.	888	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 09_Cd_Seg2	Obtrusive - Cd	N.A.	906	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 09_Cd_Seg3	Obtrusive - Cd	N.A.	807	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 09_Cd_Seg4	Obtrusive - Cd	N.A.	808	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 09_Cd_Seg5	Obtrusive - Cd	N.A.	375	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 09_Cd_Seg6	Obtrusive - Cd	N.A.	336	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 09_Cd_Seg7	Obtrusive - Cd	N.A.	334	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 11_Cd_Seg1	Obtrusive - Cd	N.A.	83	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 11_Cd_Seg10	Obtrusive - Cd	N.A.	99	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 11_Cd_Seg2	Obtrusive - Cd	N.A.	7	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 11_Cd_Seg3	Obtrusive - Cd	N.A.	32	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 11_Cd_Seg4	Obtrusive - Cd	N.A.	6	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 11_Cd_Seg5	Obtrusive - Cd	N.A.	85	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 11_Cd_Seg6	Obtrusive - Cd	N.A.	95	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 11_Cd_Seg7	Obtrusive - Cd	N.A.	87	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 11_Cd_Seg8	Obtrusive - Cd	N.A.	90	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 11_Cd_Seg9	Obtrusive - Cd	N.A.	91	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 15_Cd_Seg1	Obtrusive - Cd	N.A.	131	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 15_Cd_Seg2	Obtrusive - Cd	N.A.	199	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 15_Cd_Seg3	Obtrusive - Cd	N.A.	183	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 25_Cd_Seg1	Obtrusive - Cd	N.A.	223	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 25_Cd_Seg2	Obtrusive - Cd	N.A.	284	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 25_Cd_Seg3	Obtrusive - Cd	N.A.	293	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 43_Cd_Seg1	Obtrusive - Cd	N.A.	503	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 43_Cd_Seg2	Obtrusive - Cd	N.A.	573	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 43_Cd_Seg3	Obtrusive - Cd	N.A.	295	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 43_Cd_Seg4	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 43_Cd_Seg5	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 43_Cd_Seg6	Obtrusive - Cd	N.A.	107	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 43_Cd_Seg7	Obtrusive - Cd	N.A.	231	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Stoney Creek Rd - No 819_Cd_Seg1	Obtrusive - Cd	N.A.	515	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Stoney Creek Rd - No 819_Cd_Seg2	Obtrusive - Cd	N.A.	520	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Stoney Creek Rd - No 819_Cd_Seg3	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Stoney Creek Rd - No 819_Cd_Seg4	Obtrusive - Cd	N.A.	510	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Stoney Creek Rd - No 819_Cd_Seg5	Obtrusive - Cd	N.A.	519	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Stoney Creek Rd - No 819_Cd_Seg6	Obtrusive - Cd	N.A.	521	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Stoney Creek Rd - No 819_Cd_Seg7	Obtrusive - Cd	N.A.	520	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Stoney Creek Rd - No 819_Cd_Seg8	Obtrusive - Cd	N.A.	530	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Stoney Creek Rd - No 821_Cd_Seg1	Obtrusive - Cd	N.A.	213	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Stoney Creek Rd - No 821_Cd_Seg2	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Stoney Creek Rd - No 821_Cd_Seg3	Obtrusive - Cd	N.A.	702	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Stoney Creek Rd - No 821_Cd_Seg4	Obtrusive - Cd	N.A.	707	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)

GLARE CALCULATION RESULTS - SE AND SW PROPERTIES

AS/NZS4282:2019 Control of Obtrusive Lighting Effects - Calculation Summary - Glare

Label	CalcType	Units	Max	Description
Clevely Line - No 163_Cd_Seg1	Obtrusive - Cd	N.A.	76	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Clevely Line - No 163_Cd_Seg2	Obtrusive - Cd	N.A.	76	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Clevely Line - No 163_Cd_Seg3	Obtrusive - Cd	N.A.	77	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Clevely Line - No 163_Cd_Seg4	Obtrusive - Cd	N.A.	78	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Clevely Line - No 163_Cd_Seg5	Obtrusive - Cd	N.A.	79	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Clevely Line - No 163_Cd_Seg6	Obtrusive - Cd	N.A.	79	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Clevely Line - No 163_Cd_Seg7	Obtrusive - Cd	N.A.	10	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Railway Rd - No 422_Cd_Seg1	Obtrusive - Cd	N.A.	312	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Railway Rd - No 422_Cd_Seg2	Obtrusive - Cd	N.A.	515	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Railway Rd - No 422_Cd_Seg3	Obtrusive - Cd	N.A.	514	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Railway Rd - No 422_Cd_Seg4	Obtrusive - Cd	N.A.	425	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Railway Rd - No 422_Cd_Seg5	Obtrusive - Cd	N.A.	439	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Railway Rd - No 422_Cd_Seg6	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Railway Rd - No 422_Cd_Seg7	Obtrusive - Cd	N.A.	383	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 761_Cd_Seg1	Obtrusive - Cd	N.A.	212	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 761_Cd_Seg2	Obtrusive - Cd	N.A.	217	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 761_Cd_Seg3	Obtrusive - Cd	N.A.	216	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 761_Cd_Seg4	Obtrusive - Cd	N.A.	222	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 761_Cd_Seg5	Obtrusive - Cd	N.A.	84	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 761_Cd_Seg6	Obtrusive - Cd	N.A.	214	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 761_Cd_Seg7	Obtrusive - Cd	N.A.	85	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 771_Cd_Seg1	Obtrusive - Cd	N.A.	52	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 771_Cd_Seg10	Obtrusive - Cd	N.A.	54	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 771_Cd_Seg11	Obtrusive - Cd	N.A.	22	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 771_Cd_Seg2	Obtrusive - Cd	N.A.	53	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 771_Cd_Seg3	Obtrusive - Cd	N.A.	68	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 771_Cd_Seg4	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 771_Cd_Seg5	Obtrusive - Cd	N.A.	73	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 771_Cd_Seg6	Obtrusive - Cd	N.A.	75	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 771_Cd_Seg7	Obtrusive - Cd	N.A.	24	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 771_Cd_Seg8	Obtrusive - Cd	N.A.	68	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 771_Cd_Seg9	Obtrusive - Cd	N.A.	23	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 787_Cd_Seg1	Obtrusive - Cd	N.A.	17	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 787_Cd_Seg2	Obtrusive - Cd	N.A.	29	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 787_Cd_Seg3	Obtrusive - Cd	N.A.	17	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 787_Cd_Seg4	Obtrusive - Cd	N.A.	13	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 787_Cd_Seg5	Obtrusive - Cd	N.A.	17	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 787_Cd_Seg6	Obtrusive - Cd	N.A.	28	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 787_Cd_Seg7	Obtrusive - Cd	N.A.	27	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 787_Cd_Seg8	Obtrusive - Cd	N.A.	26	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 803_Cd_Seg1	Obtrusive - Cd	N.A.	43	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 803_Cd_Seg2	Obtrusive - Cd	N.A.	17	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 803_Cd_Seg3	Obtrusive - Cd	N.A.	43	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 803_Cd_Seg4	Obtrusive - Cd	N.A.	43	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 803_Cd_Seg5	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 803_Cd_Seg6	Obtrusive - Cd	N.A.	40	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 814_Cd_Seg1	Obtrusive - Cd	N.A.	28	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 814_Cd_Seg2	Obtrusive - Cd	N.A.	6	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 814_Cd_Seg3	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 814_Cd_Seg4	Obtrusive - Cd	N.A.	6	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 824_Cd_Seg1	Obtrusive - Cd	N.A.	37	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 824_Cd_Seg2	Obtrusive - Cd	N.A.	36	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 824_Cd_Seg3	Obtrusive - Cd	N.A.	36	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 824_Cd_Seg4	Obtrusive - Cd	N.A.	6	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 824A_Cd_Seg1	Obtrusive - Cd	N.A.	49	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 824A_Cd_Seg10	Obtrusive - Cd	N.A.	48	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 824A_Cd_Seg11	Obtrusive - Cd	N.A.	4	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 824A_Cd_Seg2	Obtrusive - Cd	N.A.	49	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 824A_Cd_Seg3	Obtrusive - Cd	N.A.	48	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 824A_Cd_Seg4	Obtrusive - Cd	N.A.	48	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 824A_Cd_Seg5	Obtrusive - Cd	N.A.	48	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 824A_Cd_Seg6	Obtrusive - Cd	N.A.	48	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 824A_Cd_Seg7	Obtrusive - Cd	N.A.	4	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 824A_Cd_Seg8	Obtrusive - Cd	N.A.	29	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Roberts Line - No 824A_Cd_Seg9	Obtrusive - Cd	N.A.	4	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 73_Cd_Seg1	Obtrusive - Cd	N.A.	488	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 73_Cd_Seg2	Obtrusive - Cd	N.A.	490	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 73_Cd_Seg3	Obtrusive - Cd	N.A.	496	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 73_Cd_Seg4	Obtrusive - Cd	N.A.	504	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 73_Cd_Seg5	Obtrusive - Cd	N.A.	246	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 91_Cd_Seg1	Obtrusive - Cd	N.A.	399	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 91_Cd_Seg2	Obtrusive - Cd	N.A.	304	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 91_Cd_Seg3	Obtrusive - Cd	N.A.	401	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 91_Cd_Seg4	Obtrusive - Cd	N.A.	378	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 91_Cd_Seg5	Obtrusive - Cd	N.A.	133	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 91_Cd_Seg6	Obtrusive - Cd	N.A.	344	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 91_Cd_Seg7	Obtrusive - Cd	N.A.	130	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 91_Cd_Seg8	Obtrusive - Cd	N.A.	278	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 95_Cd_Seg1	Obtrusive - Cd	N.A.	372	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 95_Cd_Seg2	Obtrusive - Cd	N.A.	374	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 95_Cd_Seg3	Obtrusive - Cd	N.A.	377	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 95_Cd_Seg4	Obtrusive - Cd	N.A.	379	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Sangsters Rd - No 95_Cd_Seg5	Obtrusive - Cd	N.A.	367	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Tutaki Rd - No 428_Cd_Seg1	Obtrusive - Cd	N.A.	79	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Tutaki Rd - No 428_Cd_Seg2	Obtrusive - Cd	N.A.	79	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Tutaki Rd - No 428_Cd_Seg3	Obtrusive - Cd	N.A.	77	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)

GLARE CALCULATION RESULTS - NW PROPERTIES

AS/NZS4282:2019 Control of Obtrusive Lighting Effects - Calculation Summary - Glare

Label	CalcType	Units	Max	Description
Maple St - No 01_Cd_Seg1	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 01_Cd_Seg2	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 01_Cd_Seg3	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 01_Cd_Seg4	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 01_Cd_Seg5	Obtrusive - Cd	N.A.	30	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 01_Cd_Seg6	Obtrusive - Cd	N.A.	30	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 01A_Cd_Seg1	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 01A_Cd_Seg2	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 01A_Cd_Seg3	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 01A_Cd_Seg4	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 01A_Cd_Seg5	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 01A_Cd_Seg6	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 01A_Cd_Seg7	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 01A_Cd_Seg8	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 03_Cd_Seg1	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 03_Cd_Seg2	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 03_Cd_Seg3	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 03_Cd_Seg4	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 03_Cd_Seg5	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 05 (2 Storey)_Cd_Seg1	Obtrusive - Cd	N.A.	56	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 05 (2 Storey)_Cd_Seg2	Obtrusive - Cd	N.A.	56	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 05 (2 Storey)_Cd_Seg3	Obtrusive - Cd	N.A.	55	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 05 (2 Storey)_Cd_Seg4	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 05 (2 Storey)_Cd_Seg5	Obtrusive - Cd	N.A.	56	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 05 (2 Storey)_Cd_Seg6	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 05 (2 Storey)_Cd_Seg7	Obtrusive - Cd	N.A.	57	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 07_Cd_Seg1	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 07_Cd_Seg2	Obtrusive - Cd	N.A.	31	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 07A_Cd_Seg1	Obtrusive - Cd	N.A.	32	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 07A_Cd_Seg2	Obtrusive - Cd	N.A.	32	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 09_Cd_Seg1	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 09_Cd_Seg2	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 09A (2 Storey)_Cd_Seg1	Obtrusive - Cd	N.A.	55	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 09A (2 Storey)_Cd_Seg2	Obtrusive - Cd	N.A.	55	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 09A (2 Storey)_Cd_Seg3	Obtrusive - Cd	N.A.	55	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 09A (2 Storey)_Cd_Seg4	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 09A (2 Storey)_Cd_Seg5	Obtrusive - Cd	N.A.	56	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 09A (2 Storey)_Cd_Seg6	Obtrusive - Cd	N.A.	56	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 11_Cd_Seg1	Obtrusive - Cd	N.A.	30	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 11_Cd_Seg2	Obtrusive - Cd	N.A.	30	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 11A_Cd_Seg1	Obtrusive - Cd	N.A.	33	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 11A_Cd_Seg2	Obtrusive - Cd	N.A.	33	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 13_Cd_Seg1	Obtrusive - Cd	N.A.	31	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 13_Cd_Seg2	Obtrusive - Cd	N.A.	31	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 15_Cd_Seg1	Obtrusive - Cd	N.A.	31	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 15_Cd_Seg2	Obtrusive - Cd	N.A.	25	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 17_Cd_Seg1	Obtrusive - Cd	N.A.	17	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 17_Cd_Seg2	Obtrusive - Cd	N.A.	31	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 19_Cd_Seg1	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 19_Cd_Seg2	Obtrusive - Cd	N.A.	32	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 19_Cd_Seg3	Obtrusive - Cd	N.A.	32	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 21_Cd_Seg1	Obtrusive - Cd	N.A.	59	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 21_Cd_Seg2	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 21_Cd_Seg3	Obtrusive - Cd	N.A.	59	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 21_Cd_Seg4	Obtrusive - Cd	N.A.	463	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 57_Cd_Seg1	Obtrusive - Cd	N.A.	64	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 57_Cd_Seg2	Obtrusive - Cd	N.A.	147	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 57_Cd_Seg3	Obtrusive - Cd	N.A.	63	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 57_Cd_Seg4	Obtrusive - Cd	N.A.	137	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Maple St - No 57_Cd_Seg5	Obtrusive - Cd	N.A.	114	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Te Ngaio Rd - No 241 (2 Storey)_Cd_Seg1	Obtrusive - Cd	N.A.	70	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Te Ngaio Rd - No 241 (2 Storey)_Cd_Seg10	Obtrusive - Cd	N.A.	96	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Te Ngaio Rd - No 241 (2 Storey)_Cd_Seg11	Obtrusive - Cd	N.A.	32	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Te Ngaio Rd - No 241 (2 Storey)_Cd_Seg12	Obtrusive - Cd	N.A.	32	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Te Ngaio Rd - No 241 (2 Storey)_Cd_Seg13	Obtrusive - Cd	N.A.	32	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Te Ngaio Rd - No 241 (2 Storey)_Cd_Seg14	Obtrusive - Cd	N.A.	32	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Te Ngaio Rd - No 241 (2 Storey)_Cd_Seg2	Obtrusive - Cd	N.A.	69	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Te Ngaio Rd - No 241 (2 Storey)_Cd_Seg3	Obtrusive - Cd	N.A.	57	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Te Ngaio Rd - No 241 (2 Storey)_Cd_Seg4	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Te Ngaio Rd - No 241 (2 Storey)_Cd_Seg5	Obtrusive - Cd	N.A.	87	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Te Ngaio Rd - No 241 (2 Storey)_Cd_Seg6	Obtrusive - Cd	N.A.	94	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Te Ngaio Rd - No 241 (2 Storey)_Cd_Seg7	Obtrusive - Cd	N.A.	54	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Te Ngaio Rd - No 241 (2 Storey)_Cd_Seg8	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Te Ngaio Rd - No 241 (2 Storey)_Cd_Seg9	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Te Ngaio Rd - No 242_Cd_Seg1	Obtrusive - Cd	N.A.	60	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Te Ngaio Rd - No 242_Cd_Seg2	Obtrusive - Cd	N.A.	241	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Te Ngaio Rd - No 242_Cd_Seg3	Obtrusive - Cd	N.A.	246	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Te Ngaio Rd - No 242_Cd_Seg4	Obtrusive - Cd	N.A.	0	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Te Ngaio Rd - No 242_Cd_Seg5	Obtrusive - Cd	N.A.	234	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Te Ngaio Rd - No 245_Cd_Seg1	Obtrusive - Cd	N.A.	69	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Te Ngaio Rd - No 245_Cd_Seg2	Obtrusive - Cd	N.A.	73	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Te Ngaio Rd - No 245_Cd_Seg3	Obtrusive - Cd	N.A.	70	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Te Ngaio Rd - No 245_Cd_Seg4	Obtrusive - Cd	N.A.	88	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)
Te Ngaio Rd - No 245_Cd_Seg5	Obtrusive - Cd	N.A.	96	Maximum Luminous Intensity of 1,000 cd (Zone A2 curfew hours)

SPILL LIGHT NOTES

1. ACCORDING TO AS/NZS 4282:2019 (CONTROL OF THE OBTRUSIVE EFFECTS OF OUTDOOR LIGHTING) THE FREIGHT HUB IS WITHIN ZONE A2 (SPARSELY INHABITED RURAL / SEMI-RURAL AREAS WITH LOW DISTRICT BRIGHTNESS) WHERE THE GLARE (MAXIMUM LUMINOUS INTENSITY PER LUMINAIRE - cd) (ON THE FRONT FACES OF RESIDENTIAL BUILDINGS CONTAINING WINDOWS) IS NOT PERMITTED TO EXCEED 1,000 cd DURING CURFEW HOURS (BETWEEN 11pm AND 6am). DURING NON-CURFEW HOURS THIS LIMIT INCREASES TO 7,500 cd.
2. ONLY THE CLOSEST RESIDENTIAL BUILDINGS SURROUNDING THE PROPOSED RAIL FREIGHT HUB SITE WERE CONSIDERED AND THE CALCULATION RESULTS INDICATE THAT THE AMOUNT OF GLARE DOES NOT EXCEED THE MAXIMUM LIMIT (1,000 cd) SPECIFIED FOR ENVIRONMENTAL ZONE A2. THE EXISTING TREES AND VEGETATION (BETWEEN THE PROPERTIES AND RAIL FREIGHT HUB) WERE NOT TAKEN INTO ACCOUNT THEREFORE THE ACTUAL GLARE (WITHIN THE RESIDENTIAL PROPERTIES) SHOULD BE LOWER THAN THE CURRENT RESULTS INDICATE.

REV: B

KiwiRail
Backbone of integrated transport networks

Stantec

Job No: 310003007

KIWIRAIL HUB
SITE 3-G2 LIGHTING
GLARE CALCULATION RESULTS

Drawn By: IAN CAMPBELL
Scale: AS SHOWN
FIG: 211

4/28/2021 2:03 pm

C:\pwworkdir\ap_projects01\d0117046\310003007-FIG-211-SITE 3-G2 Glare Calculation Results.dwg

UNDER the Resource Management Act 1991 ("**RMA**")

AND

IN THE MATTER of a notice of requirement ("**NoR**") for a designation by KiwiRail Holdings Limited ("**KiwiRail**") for the Palmerston North Regional Freight Hub ("**Freight Hub**") under section 168 of the RMA

STATEMENT OF EVIDENCE OF ANDREW MOTT
ON BEHALF OF KIWIRAIL HOLDINGS LIMITED

GEOTECHNICAL

1. SUMMARY

1.1 A Preliminary Geotechnical Assessment ("**PGA**") has been undertaken for the Freight Hub. While there are some potential geotechnical risks for the proposed site for the Freight Hub ("**Site**"), based on the information in the PGA, I consider that these risks will be able to be managed by developing engineering solutions through the design process.

1.2 The most significant geotechnical risks identified at this stage include potentially soft, liquefiable ground in low lying areas with potential for settlement and the requirement for cut and fill earthworks. The extent to which these risks eventuate will inform engineering design.

1.3 Confirmation of ground conditions will be achieved through ground investigation and ground model development during the design process. This is common for a project of this type or nature. Whether ground improvement measures are required, and if so, what measures are most appropriate to incorporate into design will depend on the outcomes of ground investigations and ground model development.

2. INTRODUCTION

2.1 My full name is Andrew Peter Mott. I am a Principal Engineering Geologist at Stantec. I hold the qualifications of Bachelor of Science (Joint Honours) in Physical Geology and Geomorphology from the Liverpool University (1992)

and Master of Science in Environmental Geotechnology from the University of Newcastle upon Tyne (1994). I am a Fellow of the Geological Society of London and a Chartered Geologist (UK). I am also a member of the New Zealand Geotechnical Society.

Experience

2.2 I have approximately 26 years' experience in civil engineering consultancy including approximately 1 year seconded to the Transpower National Grid upgrade construction between Brown Hill in Auckland and Whakamaru north of Taupō. I have approximately 9 years' experience in the UK with the remainder mainly within the North Island of New Zealand.

2.3 Other infrastructure projects I have worked on include SH3 Manawatu Gorge slip investigations and assessments following the February 2004 rain event, SH1 Otaki to North of Levin Multi Criteria Analysis route optioneering, SH58 Safety Improvements between the Hutt Valley and Porirua, the Hawkes Bay windfarm and Hamilton City Council Pukete 2 and Pukete 3 Wastewater Treatment Plant upgrades.

2.4 Other recent projects I have worked on include Kāinga Ora housing redevelopments in Palmerston North and Hamilton City Council's Rotokauri Greenway Notice of Requirement. For the Greenway project I assessed the geotechnical effects of the requiring authorities proposed swale, ponds and flood storage system in low lying recent alluvial deposits.

Involvement in the Freight Hub

2.5 I have been engaged by KiwiRail to provide advice on the geotechnical related aspects of the Freight Hub development. I have been involved with the multi criteria analysis ("**MCA**") optioneering process inputting on geotechnical and natural hazard considerations and commenting on geotechnical considerations of the Freight Hub.

2.6 I prepared the PGA that was included with the Assessment of Environmental Effects for the Freight Hub ("**AEE**"). I also assisted with KiwiRail's response on 15 February 2021 to Palmerston North City Council's ("**PNCC**") further information request. This included matters relating to cumulative effects of lateral spreading, differential settlement, seismicity and flooding.

Code of conduct

2.7 I confirm that I have read the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2014 and that I agree to comply with

it. I confirm that I have considered all the material facts that I am aware of that might alter or detract from the opinions that I express, and that this evidence is within my area of expertise, except where I state that I am relying on the evidence of another person.

3. SCOPE OF EVIDENCE

3.1 This statement of evidence will:

(a) provide an overview of the methodology and key conclusions of the PGA;

(b) respond to the submissions received that relate to geotechnical matters; and

(c) address relevant matters raised in the Section 42A Report.

4. METHODS OF ASSESSMENT

4.1 The geotechnical assessment of the Site involved undertaking a desktop assessment of available information, outlining possible geotechnical constraints and measures to manage or mitigate those possible constraints. The assessment includes the following elements:

(a) review published geological mapping, the Active Faults Database and reports from Geological and Nuclear Sciences ("**GNS**");

(b) assessment of ground investigation records from the New Zealand Geotechnical Database;

(c) review historical aerial photography from Retrolens and Google Earth;

(d) assess PNCC and Horizons Regional Council ("**HRC**") natural hazard information;

(e) assessment of engineering geological and geomorphological features using Google Earth, Google Streetview, Site lidar contours and drive over of accessible roads adjacent to and through the Site.

4.2 Being a desktop assessment, no geotechnical walkover of the Site or any ground investigation has been undertaken as part of this assessment.

5. EXISTING ENVIRONMENT

5.1 The Site is largely undulating and predominantly located on an alluvial terrace above a lower lying alluvial plain. The terrace is likely to consist of sands, silts and clays and is between approximately 24,000 and 59,000 years old. Two streams flow across the Site from east to west cutting across the terrace in broad gullies at a lower alluvial plain level. The alluvial plain material consists of geologically younger soils than the terrace and are likely to include loose or soft sands, silts, clays, and possibly peat with possible high groundwater levels. Due to the extent of alluvial soils covering the region and published geological mapping, rock is not likely to be encountered within at least 20 m of the ground surface.

5.2 Fill is likely to be present on the Site of up to several metres of thickness where Railway Road and the North Island Main Trunk line cross the gullies, and may be present elsewhere due to historic agricultural activities. Elsewhere, farm rubbish pits may be present.

5.3 While no known active faults underlie the Site there are several active faults and fault structures within the region, as indicated on the GNS Active Fault Database and a recently completed GNS study for HRC. Significant active regional faults include the Northern Ohariu, Wellington and Ruahine Faults. Other faults are present including those with unknown details or low slip rates and / or recurrence intervals.

5.4 The NZ Geotechnical Database shows 28 Cone Penetration Tests ("**CPT**") across the Site and one borehole has been added to the database since the geotechnical assessment was undertaken.

6. POTENTIAL GEOTECHNICAL CONSIDERATIONS RELEVANT TO THE FREIGHT HUB

6.1 The following geotechnical factors have been considered relevant to the development of the Freight Hub:

(a) seismic hazards;

(b) liquefaction, lateral spread;

(c) soft ground and settlement;

(d) earthworks;

(e) slope instability; and

(f) road paving.

Seismic hazards

6.2 The Site is located in a highly seismic region with several active faults and regionally significant active faults within 20 km of the Freight Hub. Concealed active faults under the Site obscured by relatively recent alluvial deposits cannot be ruled out.

6.3 Since writing the PGA, additional fault information has become available including a recent GNS study commissioned by HRC. While the study shows additional active faults in the region and a fault related structure approximately 2 km from the Site it has not affected my conclusions or recommendations.

6.4 While the majority of the Site is in a zone that is expected to have low amplification of ground shaking, low lying ground is indicated on the Palmerston North District Plan to be of moderate to high liquefaction potential. The consequence is that higher shaking events may be encountered more frequently in the younger alluvial material.

Liquefaction

6.5 A liquefaction assessment report undertaken by GNS in 2011 divided Palmerston North into liquefaction zones based on soil type and age. Older, higher terrace soils were assessed as having negligible liquefaction damage potential while low lying recent alluvial soils were assessed as having moderate to high liquefaction damage potential.

6.6 Lateral spreading can occur where slopes have high groundwater levels and are adjacent to watercourses. While gullies will be infilled to create a platform for rail and associated infrastructure, lateral spreading could still occur at the perimeter of the Site adjacent to water courses, or where open water courses flow through the Site.

6.7 Lateral spreading and differential settlement will be managed through engineering design, as is common engineering practice. Seismic design assumes normal water and groundwater levels since the probability of the Site experiencing both flooding and a significant seismic event at the same time is extremely low.

Soft Ground and Settlement

6.8 Soft ground is likely to be present on the Site, particularly on low lying ground and may cause settlement or differential settlement when loaded for example by earthworks fill, structures or heavy live loads (such as locomotives).

Earthworks

6.9 As set out in Mr Skelton's evidence, extensive earthworks will be required to form a level surface for the Freight Hub.[1]

6.10 Granular soils (sands and gravels) are generally more suitable to use as engineering fill while cohesive soils (silts and clays) tend to be more moisture sensitive and may require treatment to make them suitable for use. Published GNS geological mapping and limited existing ground investigation from the New Zealand Geotechnical Database indicates soils to be a mixture of granular and cohesive materials. The materials appear to be highly layered which may make reuse challenging, particularly if the materials vary significantly horizontally.

Slope stability

6.11 Slope stability is not anticipated to be an issue for the Freight Hub. Gullies crossing the Site will be infilled as part of development and most of the slopes are likely to consist of engineered cuts and fills which will be designed with a sufficient Factor of Safety to take account of slope instability and the potential for seismically induced lateral spreading. Some natural slopes may remain, particularly around the western part of the Site including the stormwater detention ponds. These areas will be engineered to ensure appropriate stability.

Road paving

6.12 Weak road subgrades may be encountered where new roads cross recent low-lying alluvial materials, requiring more extensive pavement design than on higher terrace areas.

7. CONCLUSIONS OF PRELIMINARY GEOTECHNICAL ASSESSMENT

7.1 From the assessment undertaken, I prepared a preliminary geotechnical risk appraisal, and qualitative risks were assigned to the geotechnical factors

[1] Evidence of Michael Skelton, dated 9 July 2021, at section 6.

outlined in section 6 above. The outcomes of the preliminary geotechnical risk appraisal are outlined at Table 7-1 of the PGA and summarised below.

7.2 The most significant geotechnical risks to the Freight Hub are anticipated to be from the low-lying alluvial soils with potential poor engineering properties, in particular:

(a) the availability and suitability of material for earthworks; and

(b) the potential soft and liquefiable ground, particularly associated with low lying / gully deposits.

7.3 I do not consider that the extent to which these risks eventuate will impact the feasibility of the Freight Hub being constructed on the Site, but will influence the engineering design of the Freight Hub to ensure that these risks are appropriately managed during construction.

7.4 Confirmation of ground conditions through detailed ground investigation and ground model development will occur during the detailed design process. These investigations are likely to consist of boreholes, CPT's test pits, hand augers and laboratory testing. This is a common approach for a project of this scale or type.

7.5 Whether ground improvement measures are required, and if so, what measures are most appropriate to incorporate into design, will depend on the outcomes of ground investigations and ground model development. Examples of typical ground improvement measures include pre-loading of fill for settlement, digging and replacement of unsuitable fill, and stone columns.

8. RESPONSE TO SUBMISSIONS

8.1 HRC’s submission comments on natural hazards including, active faulting and liquefaction.

8.2 HRC commissioned GNS to undertake a report which mapped active faults within the Horowhenua District and suggested fault avoidance zones. I have since reviewed a copy of this report dated May 2019. The faults discussed in this report match those obtained from other sources I have commented on in my PGA report together with new faults and fault related structures. However, none of these faults or active folds are within 2 km of the site and therefore the GNS report does not alter the conclusions in my PGA or this statement of evidence.

8.3 HRC also outlined that GNS and PNCC have completed liquefaction susceptibility mapping for the area. My PGA has considered this data and reflects the latest susceptibility mapping for the area. As outlined at section 6 of my evidence, I agree that these matters will be required to be addressed as part of the detailed engineering design for the Freight Hub and can be appropriately managed as part of Freight Hub construction.

9. RESPONSE TO SECTION 42A REPORT

9.1 I have reviewed the sections of the Section 42A Report relevant to my evidence, particularly Section 9.16.[2]

9.2 The Council Officers' comment on the potential and risks for damage caused by a seismic event due to the Freight Hub being located in an active seismic area, and presence of liquefaction prone land. I agree with the Council Officers that the primary seismic risk is to infrastructure and assets within the Freight Hub. As outlined in sections 6 and 7 of my evidence, these matters are capable of being managed through standard engineering design measures, and will be addressed by KiwiRail as part of the design process, and will meet Building Act obligations.[3]

9.3 The Council Officers consider there is insufficient detailed geotechnical information regarding Freight Hub construction to form a conclusion as to the severity of these risks and whether they can be avoided, remedied or mitigated.[4] In my opinion, geotechnical risks for the Site can be suitably managed. As outlined in my evidence above, engineering solutions will be chosen to manage geotechnical risks. Which solutions are suitable and implemented will be determined during the design process following ground investigation.

9.4 I consider that the level of investigations undertaken to date are appropriate for the nature and stage of this project.

Andrew Mott

9 July 2021

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2 Section 42A Report, dated 18 June 2021, at paragraphs [860] to [866].

3 Section 42A Report, dated 18 June 2021, at paragraph [866].

4 Section 42A Report, dated 18 June 2021, at paragraph [866].

UNDER the Resource Management Act 1991 ("**RMA**")

AND

IN THE MATTER of a notice of requirement ("**NoR**") for a designation by KiwiRail Holdings Limited ("**KiwiRail**") for the Palmerston North Regional Freight Hub ("**Freight Hub**") under section 168 of the RMA

STATEMENT OF EVIDENCE OF MARK GEORGESON ON BEHALF OF KIWIRAIL HOLDINGS LIMITED

TRANSPORT

1. SUMMARY

1.1 I was responsible for preparing the Integrated Transport Assessment, dated 23 October 2020 ("**ITA**") that was included as Technical Report C to the Assessment of Environmental Effects ("**AEE**") for the Freight Hub.

1.2 This evidence addresses the likely transport effects of the Freight Hub which include effects on network traffic, travel times, level crossing, road safety, public transport users, walking and cycling routes and on parking. Overall, I consider that with the mitigation proposed by KiwiRail, the traffic effects of the Freight Hub will be acceptable to the receiving environment.

1.3 The positive effects of the Freight Hub include those relating to level crossing closures, the opportunities created to improve the public transport facilities at the North East Industrial Zone ("**NEIZ**") and the walking and cycling network in the vicinity of the Freight Hub.

1.4 There are a number of transport network upgrades relevant to the Freight Hub which are planned and funded and will be in place before the Freight Hub is operational. KiwiRail has also proposed upgrades to the surrounding transport network. In my opinion, with these transport upgrades in place, the transport network will be readily able to accommodate the traffic volumes generated by the Freight Hub and the adverse effects on the transport network will be minor.

I consider that the effects on travel time will also be minor, and that there will be no adverse safety or parking effects.

1.5 My evidence will also respond to relevant transportation issues raised in submissions and confirms that those various transportation concerns will be either avoided, or mitigated, or will be no more than minor. I will also respond to various transportation matters raised in the Section 42A Report, as well as by Ms Fraser and Mr van Bentum in their technical evidence.

2. INTRODUCTION

2.1 My full name is Mark Grant Georgeson. I am a transport engineer and am currently the Transport Operations Leader for Stantec New Zealand. Prior to that, I worked as a transportation engineer with Traffic Design Group.

2.2 I am a Chartered Professional Engineer and hold a Bachelor of Civil Engineering degree from the University of Auckland. I am:

(a) a Member of Engineering New Zealand and its specialist Transportation Group;

(b) an International Professional Engineer;

(c) a Member of the Institute of Transportation Engineers USA;

(d) a Member of the Institute of Public Works Engineering Australasia;

(e) a Member of the New Zealand Parking Association; and

(f) an Associate Member of the New Zealand Planning Institute.

Experience

2.3 I have 29 years' experience as a transportation engineering specialist, practicing throughout New Zealand.

2.4 I have been involved in a number of strategic projects within Palmerston North and many site-specific developments, from which I have acquired a broad working knowledge of the area. Key strategic transport studies I have been involved with in the last ten years include:

(a) the Palmerston North-Manawatu Strategic Transport Study;

(b) Palmerston North City Council Plan Change for Fringe and Business zoning;

(c) Palmerston North Airport Limited Plan Change for industrial zoning expansion towards Richardsons Line; and

(d) Palmerston North City Council Plan Change 15E: North East Industrial Zone Extension, Intersections Assessment Report.

2.5 I have appeared as an expert witness before councils and the Environment Court on multiple projects of various scales.

Involvement in the Regional Freight Hub

2.6 I was engaged by KiwiRail in 2019 to lead the transportation investigations for the Freight Hub.

2.7 I was responsible for the ITA that was included as Technical Report C to the AEE for the NoR.

2.8 I also assisted with KiwiRail's responses to Palmerston North City Council's ("**PNCC**") further information requests in relation to transport matters. Since the lodgement of the NoR, I was responsible for responding to transport matters raised in PNCC's first section 92 Request, dated December 2020 and did so by way of a report dated 12 February 2021 ("**First Section 92 Response**").

2.9 I attended a number of KiwiRail's in-community engagement events (which are described in Ms Poulsen's evidence)[1] and have continued to engage with PNCC's transport advisor, Ms Fraser, with respect to transportation effects of the Freight Hub, including providing further clarification of the transport model in a Technical Memo dated 30 April 2021, **Appendix A**.

2.10 I am familiar with the proposed site for the Freight Hub ("**Site**") and surrounding transport environment, having undertaken numerous site visits during the resource consenting phase of the Freight Hub. I most recently visited the Site on 5 May 2021.

Code of conduct

2.11 I confirm that I have read the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2014 and that I agree to comply with

[1] Evidence of Olivia Poulsen, dated 9 July 2021, at paragraphs 6.18 to 6.25.

it. I confirm that I have considered all the material facts that I am aware of that might alter or detract from the opinions that I express, and that this evidence is within my area of expertise, except where I state that I am relying on the evidence of another person.

3. SCOPE OF EVIDENCE

3.1 In my evidence I:

(a) provide an overview of the key transportation elements of the Freight Hub that relate to my area of expertise, including describing the transport-related changes that have been made since the NoR was lodged (Section 4);

(b) summarise the existing transport environment for the Freight Hub (Section 5);

(c) provide an overview of the predicted trip generation for the Freight Hub (Section 6);

(d) summarise the assessment of effects of the Freight Hub on the transport network (Section 7);

(e) outline the recommended mitigation (Section 8);

(f) respond to the submissions received that relate to the traffic effects of the Freight Hub (Section 9);

(g) respond to matters raised in the Section 42A Report that relate to my area of expertise (Section 10); and

(h) comment on the proposed conditions (Section 11).

3.2 I have drawn together a summary and key conclusion, included at the beginning of my evidence.

4. OVERVIEW OF THE FREIGHT HUB

4.1 The Freight Hub is proposed to be located at the north-eastern extent of Palmerston North, shown in blue in Figure 1 below. The Site is bounded generally by Railway Road to the east and north and Roberts Line to the south. The North Island Main Trunk ("**NIMT**") is located on the eastern edge of the Site, with Railway Road lying between the NIMT and the Site. The Palmerston

North Gisborne Line ("**PNGL**") is located south of the proposed Freight Hub as shown on Figure 1.

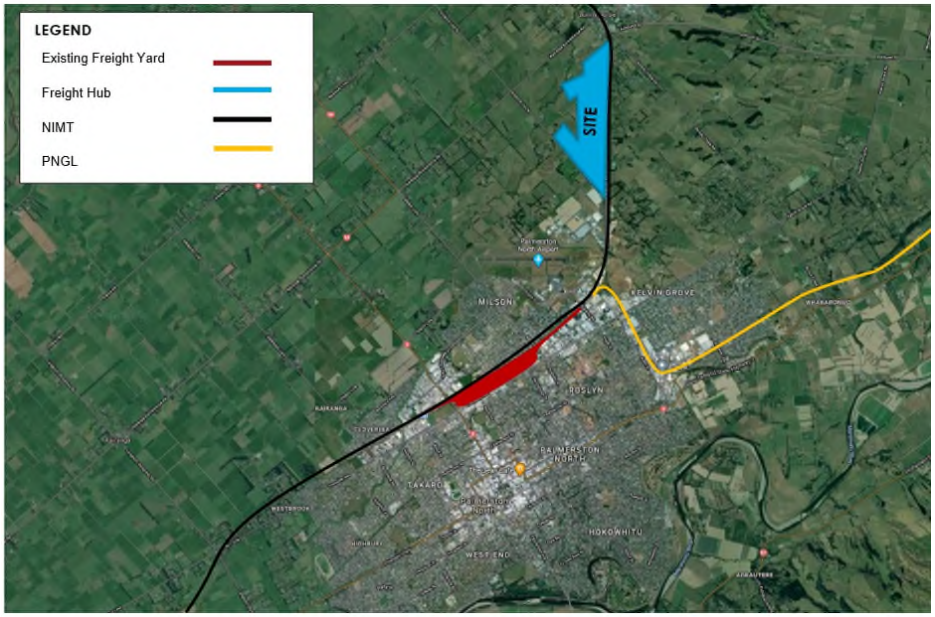

Figure 1: Location of KiwiRail's Existing Freight Yard compared to the Freight Hub

4.2 The Freight Hub will be established over 177.7 hectares, approximately four times the size of KiwiRail's existing freight yard at Tremaine Avenue ("**Existing Freight Yard**").

4.3 The Freight Hub will accommodate similar activities to the Existing Freight Yard including marshalling yards, container terminal, maintenance and network service facilities, and wagon storage. The traffic generating activities of the Freight Hub can be grouped into four general categories:

(a) depots;

(b) freight Forwarders;

(c) container Terminal; and

(d) logs handling facilities.

4.4 A distinguishing feature of the Freight Hub compared to the Existing Freight Yard is the internal roading network for the Site. As proposed, all parts of the Site will be connected internally without the need for vehicles to travel outside the Site to access other parts of the Freight Hub. This contrasts with the Existing Freight Yard which requires use of the external public roading network to access from one gate to another.

4.5 The key transportation-related aspects of the establishment of the Freight Hub are as follows:

(a) closure of Railway Road from Roberts Line to approximately 50m south of Maple Street;

(b) construction of a 2.6km new Perimeter Road extending between Maple Street and Roberts Line. This Perimeter Road is required to replace Railway Road and will provide access to the Freight Hub;

(c) two accesses to the Freight Hub from the Perimeter Road, on the northern and western boundaries of the Site;

(d) a new intersection of Roberts Line to the new Perimeter Road;

(e) Richardsons Line east of the Roberts Line / Richardsons Line intersection closed and converted to a Freight Hub access;

(f) a posted speed limit of 80km/h for the new Perimeter Road. A posted speed limit reduction to 60km/h is envisaged for Roberts Line between Railway Road and the new Perimeter Road, as now intended by PNCC's Speed Limits Bylaw that came into effect on 1 April 2021;

(g) closure of Te Ngaio Road (approximately 250m from the Clevely Line / Te Ngaio Road intersection);

(h) closure of the Richardsons Line level crossing along Railway Road; and

(i) Sangsters Road improvements to Roberts Line.

4.6 The ITA listed the closure of the Clevely Line and Roberts Line level crossings as a feature of the Freight Hub Project. However, as confirmed in the Section 42A Technical Evidence of Ms Fraser, PNCC has written to KiwiRail seeking approval to close these two level crossings independent of the Freight Hub,[2] such that the physical changes and associated impacts will be in place well in advance of the operation of the Freight Hub. Since the current bus services follow a route that includes Clevely Line, the established services and bus stops will also change in response to these PNCC-initiated level crossing closures.

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[2] Section 42A Technical Evidence Traffic and Transportation, dated 18 June 2018, of Harriet Fraser, dated 18 June 2021, at [39](e)].

4.7 Figure 2is a schematic plan showing the proposed changes ((a) to (i) listed above) to the road network surrounding the Site once the Freight Hub is operational, in addition to the baseline upgrades I describe later at paragraph 5.28 of my evidence.

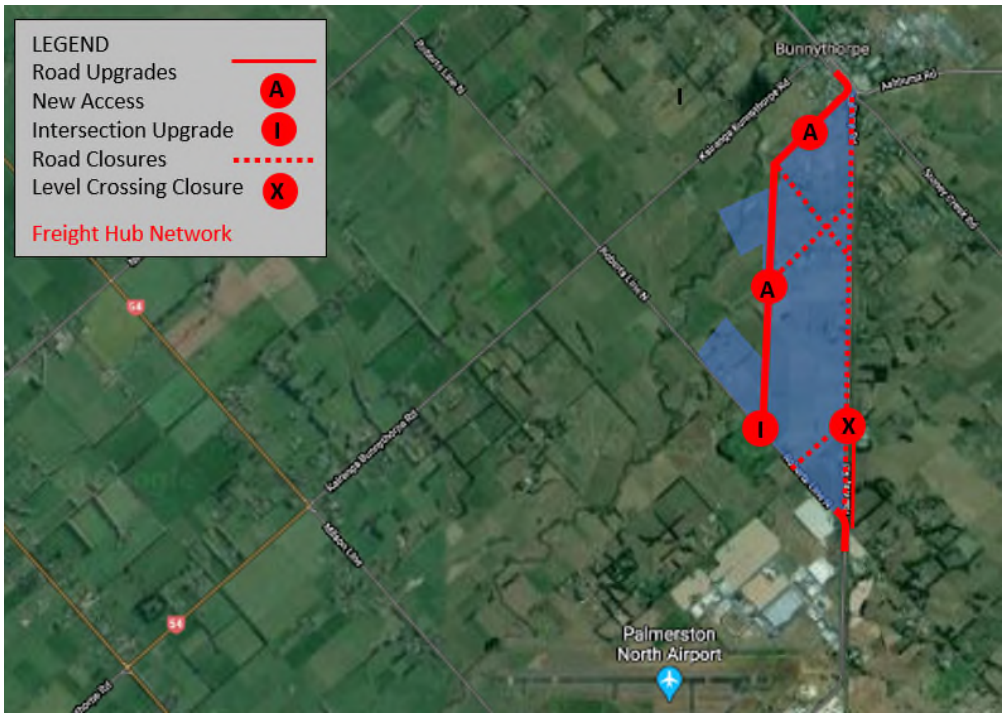

Figure 2: Freight Hub induced network changes

Proposed Staging

4.8 Based on KiwiRail's proposed timing of the Freight Hub, I anticipate that the Freight Hub will begin generating operational traffic in approximately 2031. I refer to this as the 'initial stage', which will cater for the existing operation traffic plus a component of additional traffic demand.

4.9 I understand that the Freight Hub will be fully operational by approximately 2051. I refer to this as the 'full build out' stage.

4.10 Table 9-1 in the ITA presents a breakdown of the anticipated development staging of the Freight Hub by activity.

5. OVERVIEW OF EXISTING TRANSPORT ENVIRONMENT

Existing Freight Yard

5.1 The Existing Freight Yard occupies approximately 40 hectares of land and is served by four vehicle accesses onto Tremaine Avenue. These are located at the intersections of Tremaine Avenue / Toll Access, Tremaine Avenue / North

Street, Tremaine Avenue / KiwiRail Access and Tremaine Avenue/Matthews Avenue.

Existing Road Environment

5.2 The road network surrounding the Freight Hub comprises multiple road types and hierarchies, which have been identified using the Waka Kotahi NZ Transport Agency ("**Waka Kotahi**") One Network Road Classification ("**ONRC**").

5.3 Railway Road is classified as an arterial road,[3] comprising one lane in each direction. This road provides access to three level crossings over the NIMT, comprising two KiwiRail owned and operated level crossings (Roberts Line and Clevely Line), which PNCC has requested be closed,[4] and one privately owned and operated level crossing (Richardsons Line).

5.4 Kairanga Bunnythorpe ("**KB**") Road is a two-lane, two-way road and is classified as an arterial road in its length between Campbell Road and Roberts Line and as a primary collector road[5] Between Roberts Line and Milson Line. It has a level crossing at its eastern end at Bunnythorpe. There are two weight restricted bridges along its length, which restrict the movement of heavy vehicles over 4,500kg, between Te Ngaio Road and Campbell Road.

5.5 Campbell Road is an arterial that connects between Feilding and Bunnythorpe township. There is a level crossing at the extension of Campbell Road northwards at Waughs Road. It serves a key commuter route and also supports a portion of the Te Araroa New Zealand Trail ("**Te Araroa Trail**").

5.6 Ashhurst Road is classified as an arterial connecting between Ashhurst and Bunnythorpe. This road terminates at the intersection with Stoney Creek Road and Campbell Road.

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3 These roads make a significant contribution to social and economic wellbeing, link regionally significant places, industries, ports or airports and may be the only route available to some places within the region (i.e. they may perform a significant lifeline function).https://www.nzta.govt.nz/assets/Road-Efficiency-Group/docs/functional-classification.pdf

4 Section 42A Technical Evidence of Harriet Fraser, dated 18 June 2021, at [39](e)].

5 These are locally important roads that provide a primary distributor/collector function, linking significant local economic areas or areas of population. https://www.nzta.govt.nz/assets/Road-Efficiency-Group/docs/functional-classification.pdf

5.7 Tremaine Avenue is classified as an arterial. From the south, the road continues as an extension of No 1 Line through to Midhurst Street in the Kelvin Grove area.

5.8 Tremaine Avenue provides access to the Existing Freight Yard at four locations. This portion of the road is urban, with one lane in each direction and a flush median for most of its length.

5.9 Roberts Line is classified as a secondary collector road,[6] running from Newbury Line in the west to Kelvin Grove Road. There is a level crossing across the NIMT at the Railway Road intersection that PNCC is proposing to close. To the west of Railway Road, Roberts Line provides access into parts of the North East Industrial Zone ("**NEIZ**").

5.10 Richardsons Line is classified as an access road and runs along the boundary of the NEIZ and the airport from Milson Line to Railway Road. The privately owned and operated level crossing on the eastern side of Railway Road provides access to two residential properties. Currently, there are no access points into the NEIZ from Richardsons Line.

5.11 Clevely Line also has the function of an access road. The road extends between Stoney Creek Road and Roberts Line, with a level crossing at Railway Road.

5.12 Te Ngaio Road is an access road. The road runs from Newbury Line to a T-Intersection at Railway Road. There is a bridge along this road that lies in a flood plain.

5.13 Sangsters Road is an access road which runs on the opposite (eastern) side of Railway Road. It is formed between Clevely Line and Tutaki Road, with an unformed section (paper road) south of Tutaki Road. The route also forms a part of the Te Araroa Trail.

5.14 Table 5-1 in the ITA provides a summary of the characteristics of these and other surrounding roads including hierarchy, speed and typical daily volumes.[7]

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6 These are roads that provide a secondary distributor / collector function, linking local areas of population and economic sites and may be the only route available to some places within this local area.

7 ITA, dated 23 October 2020, at page 18.

Existing Public Transport Network

5.15 I have reviewed the bus-services which operate near or through the vicinity of the proposed Freight Hub. There is a single bus route which runs between Feilding and Palmerston North. The route also includes a school bus service.

5.16 From the south, the bus route follows Railway Road, crosses the Clevely Line level crossing towards Bunnythorpe, before travelling along Campbell Road towards Feilding. Currently, the only bus stops (one in each direction) within the vicinity of the Freight Hub are along Campbell Road, near Dutton Street. There are 14 scheduled buses on a typical weekday. There are currently no bus stops within or near the NEIZ.

5.17 There is an existing passenger train station at the Existing Freight Yard. The passenger train station will remain at the current site at the end of Mathews Avenue.

Existing Walking and Cycling Facilities

5.18 I have assessed the active mode network in the immediate vicinity (Railway Road, Roberts Line, Richardsons Line, Clevely Line and Te Ngaio Road) of the Freight Hub. There are currently no formal walking facilities or cycling routes on this network near the Site.

5.19 From the north, the Te Araroa Trail follows Campbell Road, switching to Waughs Road at the level crossing, accessing Stoney Creek Road via Bunnythorpe, then traverses Sangsters Road before joining the shared path along Railway Road south of the Roberts Line intersection.

5.20 I also note that PNCC is reviewing the active mode connections in the vicinity of the Freight Hub Site as part of the Palmerston North to Feilding Active Mode Connectivity Project,[8] which intends to provide additional on and off-road walking and cycling routes between Palmerston North and Feilding. Project planning is ongoing.

5.21 The Freight Hub will also provide opportunities for improvements to cycling and walking, including along the Te Araroa Trail and new Perimeter Road.

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[8] Active Mode Connectivity Palmerston North to Feilding Single Stage Business Case Report, dated 15 August 2019.

Road Safety

5.22 In preparing the ITA for the Freight Hub, I carried out a search of Waka Kotahi's Crash Analysis System ("**CAS**") for all reported crashes (80 in total) within the vicinity of the Site for the full five-year period from 2015 to 2019. The CAS search area is shown in Figure 3 below**.**

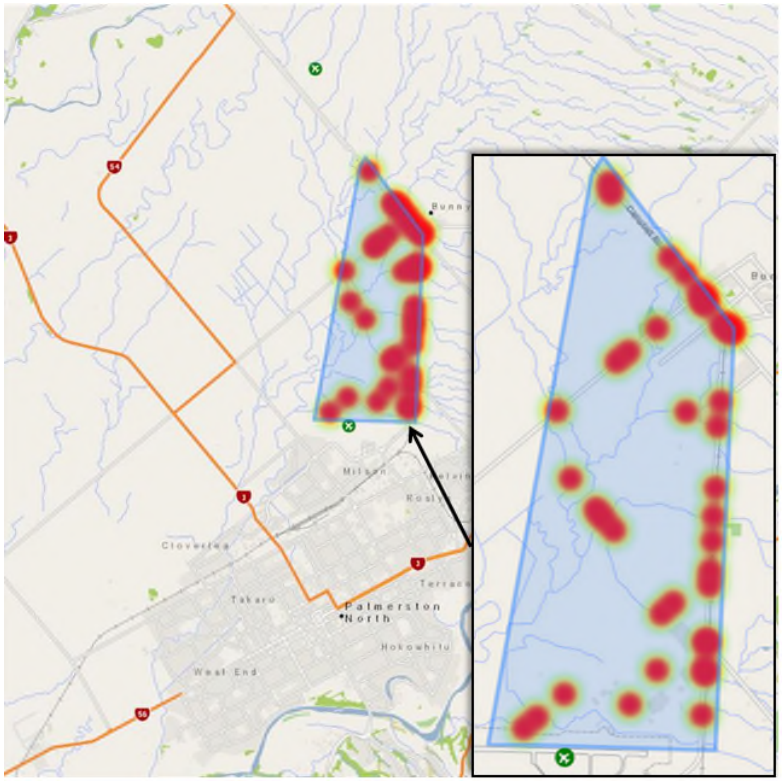

Figure 3: CAS Search Area

5.23 From this search, a total of 24 injury crashes were identified of which 2 resulted in fatalities, 7 resulted in serious injuries and 15 resulted in minor injuries. Of the serious and fatal crashes, five occurred on Railway Road, two on KB Road and one each on Campbell Road and Stoney Creek Road.

5.24 Twelve percent of all crashes involved heavy vehicles (10 crashes in total). Seven occurred at intersections that carry a high percentage of heavy vehicles, listed below:

(a) Campbell Road / KB Road;

(b) Railway Road / Cleverly Line; and

(c) Railway Road / Roberts Line.

5.25 More recently, I carried out a further search of the CAS to assess whether any crashes had been recorded since the analysis period detailed in my ITA, and

note that in 2020 there were two fatal injury crashes, one at Railway Road / Roberts Line intersection involving a truck and the other at the Clevely Line level crossing involving a school bus. These crashes have set in motion PNCC's plans to close the Roberts Line and Clevely Line level crossings, independent of the Freight Hub proposal.

5.26 I also utilised the Waka Kotahi Mega Maps tool to determine the Collective Risk and Infrastructure Risk Rating ("**IRR**") for roads in the vicinity of the proposed Site. Mega Maps is an industry accepted risk assessment tool which provides a standardised view of road risk. Collective Risk is a measure of the total number of fatal and serious injury crashes per kilometre (essentially the crash density) over a section of road. The IRR assessment presents the risk of road segments independent of the crash history, representing the underlying risk inherent to the road based on engineering features and traffic volumes. From this assessment, I found that the majority of the roads surrounding the proposed Site have a low to medium Collective Risk, due to the low traffic volumes in the area and low number of fatal and serious injury crashes that have occurred. Railway Road and KB Road have a medium-high risk profile.

5.27 In terms of IRR, there is a medium high to high rating for roads in the immediate vicinity of the proposed Site due to their respective infrastructure deficiencies, including Railway Road, KB Road, Ashhurst Road, Richardsons Line, Clevely Line, Te Ngaio Road, and Campbell Road. Their deficiencies include narrowness, lack of shoulders and unprotected roadside hazards.

Future Road Network

5.28 As set out in section 7.1.1 of the ITA,[9] the transportation assessment for the Freight Hub assessed the baseline transportation environment on the basis that the following funded infrastructure improvements will be in place before the Freight Hub is operational, as a "Do Minimum scenario":

(a) KB Road - Two Roundabouts with SH54 and SH3;

(b) KB Road - Road widening between SH3 and SH54;

(c) KB Road bridge strengthening and renewal (Jacks Creek and Mangaone Stream);

(d) Campbell Road - Bridge Renewal;

9 ITA, dated 23 October 2020, at page 39.

(e) Richardsons Line upgrade: Road widening between Milson Line and Roberts Line. The Roberts Line to Railway Road section will be closed and displaced by the Freight Hub;

(f) Richardsons Line / Roberts Line intersection upgrade (roundabout);

(g) Alderson Drive to Richardsons Line: New link to NEIZ off Richardsons Line and an access into NEIZ;

(h) Setters Line to Richardsons Line: New access into NEIZ; and

(i) Roberts Line road widening between KB Road and Richardsons Line.

5.29 These Do Minimum scenario improvements are shown schematically in Figure 4 below.

Figure 4: Do Minimum Road Network

5.30 In preparing the ITA, I considered it appropriate that the abovementioned Do Minimum transport network upgrades should form part of the existing environment for the purposes of assessing the transportation effects of the Freight Hub. This is because, in my opinion, there is sufficient certainty that these infrastructure upgrades will be in place before the Freight Hub is

operational and as such form part of the reasonably foreseeable future environment. The Do Minimum upgrades are planned with committed funding as included in the PNCC 10-year plan, the Regional Land Transport Plan and the Waka Kotahi National Land Transport Programme.[10]

5.31 I understand that the Palmerston North Integrated Transport Initiative ("**PNITI**") has recently received final endorsement from the Waka Kotahi Board. An updated PNITI programme is shown in the draft Transport Asset Management Plan dated April 2021.[11] It includes the following strategic improvements to the transport network in the area surrounding the Site:

(a) A western bypass of Bunnythorpe – Connecting KB Road to Waughs Road;

(b) A southern bypass of Bunnythorpe – Connecting Ashhurst Road to KB Road;

(c) A full ring road - A regional ring road, with a downstream bridge connection across the Manawatu River;

(d) Reclassifying Ashhurst Road from Arterial to Inter-Regional and associated road upgrades; and

(e) Reclassifying KB Road from Arterial to Inter-Regional and associated road upgrades.

5.32 I have not considered these changes as part of the existing (future) environment for the Freight Hub, given that there is no certainty around their funding or implementation commitments. Notwithstanding, I am aware that these projects continue to be reviewed by Waka Kotahi and PNCC and are expected to form part of the future roading network of the city.

5.33 In Section 7.1 of the ITA I consider that opportunities for the coordination of future upgrades can be addressed through a Road Network Integration Plan ("**RNIP**"), which is a proposed condition for the NoR. The objective of the RNIP is to ensure that the roading network for the Freight Hub is appropriately

10 https://www.pncc.govt.nz/media/3131028/10-year-plan-2018-28.pdf
https://www.horizons.govt.nz/HRC/media/Media/Bus-Route-Timetable/Final-RLTP-2015-25.pdf?ext=.pdf
https://www.nzta.govt.nz/planning-and-investment/national-land-transport-programme/2018-21-nltp

11 https://www.pncc.govt.nz/media/3133853/transport-asset-management-plan-april-2021.pdf

managed and integrated with the wider transport network. Therefore, the RNIP will provide the basis for a coordinated approach to the required transport network improvements with PNCC and Waka Kotahi, an approach which I consider is entirely reasonable given the multiple parties and timeframes involved.

Future North East Industrial Zone Demand

5.34 The NEIZ is located adjacent to the proposed Freight Hub. The NEIZ comprises approximately 240 hectares, with equal parts allocated to the NEIZ and the NEIZ Extension ("**Extension**"). Around 36 hectares of the total NEIZ area is developed to date. I understand that the NEIZ and the Extension is expected to be fully developed prior to the full buildout of the Freight Hub (2051).

5.35 On behalf of PNCC I was responsible for preparing the Intersections Assessment Report for Plan Change 15 to the District Plan,[12] for PNCC, which examined the intersection effects of the proposed NEIZ Extension. Drawing from that Report, the NEIZ is expected to generate approximately 13,500 vehicles per day ("**vpd**") and the Extension is expected to generate an equivalent 13,500vpd. The developed area of the NEIZ generates 4,100vpd, with the remaining designated NEIZ land therefore expected to generate a total of 22,900vpd once fully developed. These volumes are relevant in terms of the displacement assessment I make from paragraph 6.8 to 6.10.

5.36 For the purposes of my transport assessment, I have assumed that the NEIZ will be fully developed by 2031 and that one-third of the Extension will be developed by 2031. Once fully developed, it is expected that the final form of the NEIZ will have access to Roberts Line, Richardsons Line, and El Prado Drive.

6. PREDICTED TRIP GENERATION

Trip Generation at the Existing Freight Yard

6.1 Traffic counts undertaken at each of the four gate accesses at the Existing Freight Yard have informed a baseline traffic position for the Freight Hub.

6.2 I have determined the following from September 2019 count data for the Existing Freight Yard:

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12 Palmerston North City Council, Plan Change 15E: North East Industrial Zone Extension, Intersections Assessment Report, TDG, October 2014.

(a) the busiest periods occurred between 6:00 – 8:00am and 16:00 – 18:00pm;

(b) the site has a 7-day average daily traffic of 3,650vpd;

(c) the depot activity generated a daily volume of 750vpd;

(d) the freight forwarders activity generated a daily traffic volume of 2,450vpd;

(e) the container terminal generated a daily traffic volume of 300vpd;

(f) activity associated with logs generated a daily traffic volume of 150vpd; and

(g) the data showed a light / heavy vehicle split of 80% / 20% for the Existing Freight Yard.

6.3 In order to benchmark these September 2019 counts, I also reviewed the rail freight commodities through Palmerston North for 2018 provided by KiwiRail. From this, I determined the seasonal variation using the commodity tonnage and found that September 2019 represented 86% of the total throughout when compared to an average month. Using this I estimated that the Existing Freight Yard generates approximately 4,200vpd in an average month.

6.4 Further, after discussions with the KiwiRail operations team I considered that the observed heavy vehicle proportion at the Existing Freight Yard was lower than what is typical for the Existing Freight Yard, likely due to the season during which the count was undertaken. Therefore, I have adopted a light / heavy vehicle split of 60% / 40% which I, along with KiwiRail's operations team, consider better represents typical operations.

Trip Generation Rates

6.5 Using the scaled traffic volumes and the traffic generating areas of the Existing Freight Yard, I calculated the trip generation rate per 100m^2 for each land use. Table 1 below summarises the calculated trip generation rates for the Existing Freight Yard.

Table 1: Calculated trip generation rates at the Existing Freight Yard

Land use	Trip Generation Rates (per 100m^2)	
	PM Peak Hour	Daily
Depots	0.11	1.25
Freight Forwarders	0.34	5.50
Container Terminal	0.13	2.50
Logs	0.08	1.00

Traffic Generation of Freight Hub

6.6 I calculated the potential traffic generation at the Site based on areas for each land use for the initial stage and for the full build out, on the following principles:

(a) I utilised commodity forecast for 2050 from the National Freight Demand Study[13] to calculate the potential traffic generating area for depots and logs at the Freight Hub. Based on the projected growth I determined that the traffic generating area associated with depots increased by 60%, and logs increased by 30%, compared with the Existing Freight Yard;

(b) One of the intentions of the Freight Hub is to maximise the freight forwarders operation. I therefore assumed that the full area allocated to freight forwarders as shown in Table 9.1 in section 9.2 of the ITA[14] will be traffic generating; and

(c) The area allocated to the container terminal as set out in Table 9.1 of my ITA is more than 13 times larger than the area allocated at the Existing Freight Yard as it includes a significant area allocated for container storage which will not generate any traffic. I therefore assumed that approximately 50% of the area would be traffic generating.

6.7 Table 2 below summarises the anticipated daily trip generation for each land use for the initial stage and the full buildout of the proposed Freight Hub.

13 https://www.transport.govt.nz/assets/Uploads/Report/NFDS3-Final-Report-Oct2019-Rev1.pdf

14 ITA, dated 23 October 2020, at page 58.

Table 2: Estimated Daily Traffic Demand for the Freight Hub

Land use	Traffic Generating Area (m^2)		Daily Traffic Demand (vpd)	
	Initial Stage	Full build-out	Initial Stage	Full build-out
Depots	67,000	105,000	850	1,300
Freight	50,000	150,000	2,800	8,500
Container Terminal	80,000	80,000	2,000	2,000
Logs	15,000	20,000	150	200
Total	**212,000**	**355,000**	**5,800**	**12,000**

NEIZ Displacement

6.8 The Freight Hub is proposed to be developed on a portion of land currently allocated to the NEIZ Extension. This is shown in Figure 5 below.

Figure 5: NEIZ and Freight Hub Traffic Generating Area

6.9 I have calculated that 37.5% of the NEIZ Extension area will be occupied by the Freight Hub and have assumed that 37.5% of the traffic generated by the full buildout of the NEIZ extension will be displaced by the Freight Hub.

6.10 Considering the above, I conclude that the overall net increase to the network due to the full build out of Freight Hub will be approximately 6,900vpd, as set out at Section 7.2.1 of the ITA.[15]

Freight Traffic Distribution

6.11 I have used Waka Kotahi's Traffic Monitoring System ("**TMS**") to determine the distribution of Freight Hub traffic to the four primary freight routes in and out of Palmerston North, listed below:

(a) SH3;

(b) SH56;

(c) Waughs Road / Campbell Road; and

(d) Ashhurst Road.

6.12 Figure 6 below shows the anticipated heavy vehicle split to and from the proposed Freight Hub.

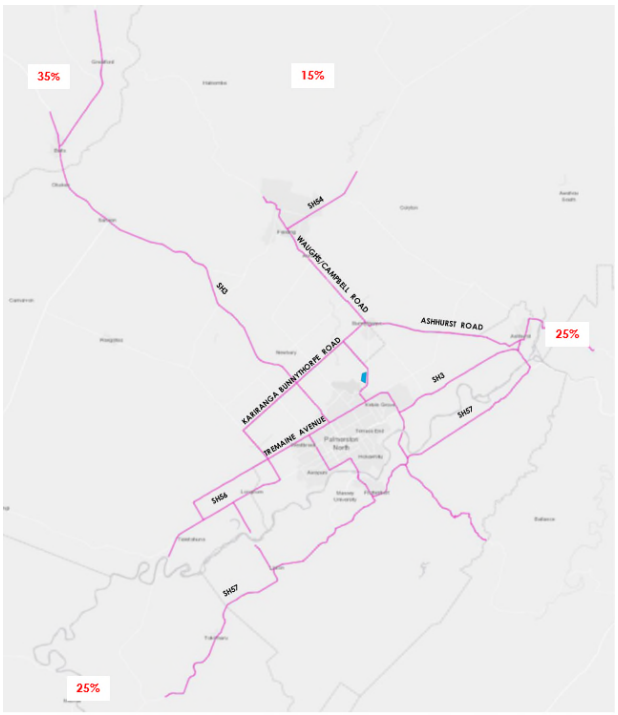

Figure 6: Heavy Vehicle Strategic Routes to Palmerston North

15 ITA, dated 23 October 2020, at page 42.

7. ASSESSMENT OF EFFECTS ON THE TRANSPORT NETWORK

Assessment methodology

7.1 The seven categories listed below were evaluated for the Freight Hub. I consider these categories to be the primary transport groupings that provide appropriate coverage of the issues for the purposes of this assessment:

(a) Network Traffic Effects;

(b) Effects on Travel Times;

(c) Level Crossing Effects;

(d) Road Safety Effects;

(e) Effects on Public Transport Users;

(f) Effects on Walking and Cycling routes; and

(g) Parking Effects.

7.2 Each category was rated according to a six-point scale ranging from significantly positive impact to significantly negative impact. Table 4-2 in the ITA outlines the measures used to analyse each category and the thresholds assumed for minor, moderate and significant impact.[16]

7.3 I turn to address each category from paragraph 7.1. Before doing so, I note that one of the methodology assumptions shared with PNCC in advance of undertaking the transportation assessment related to the use of the Palmerston North Area Traffic Model ("**PNATM**") as the primary assessment tool for the Project. The PNATM was provided to Stantec by PNCC. The model was validated by Beca and peer reviewed by a third party which concluded that "*Overall, the base-year model is well specified and can be regarded as being fit for purpose for subsequent application to forecasting and specific assessments*'.[17]

7.4 It is my view that the PNATM provides an appropriate level of detail for informing the NoR assessments, as adopted for this purpose. In the Stantec Technical Memo dated April 2021 ("**Memo**")which was provided to Ms Fraser

16 ITA, dated 23 October 2020, at page 15.

17 Palmerston North Area traffic Model, Peer Review Report (including Beca responses to issues raised), Tim Kelly Transportation Planning Ltd, 2015.

to further clarify modelling assumptions and outputs,[18] I stated PNCC's acceptance of the PNATM as an appropriate project assessment tool for the Freight Hub.[19] The Memo also included details of further analysis provided that reconfirmed that the PNATM is 'fit for purpose'. I have attached a copy of the Memo as **Appendix A**.

Network Traffic Effects

7.5 I arranged for the following five scenarios to be assessed using the PNATM:

(a) a 2021 Existing Scenario (Existing Freight Yard);

(b) a 2031 Without Freight Hub Scenario;

(c) a 2031 With Freight Hub Scenario;

(d) a 2041/51 Without Freight Hub Scenario; and

(e) a 2041/51 With Freight Hub Scenario.

7.6 The traffic model scenarios are summarised in Table 3 and Table 4 below.

Table 3: Traffic Model – 'without Freight Hub' Scenarios

Scenarios			
Scenario		**Additional Land use**	**Do Minimum Road Improvements**
'without Freight Hub	Existing	1. Existing NEIZ– 4,100vpd	None
	Initial Stage	1. Existing NEIZ– 13,500vpd 2. NEIZ Extension– 4,500vpd	Detailed in Section 7.1 of the ITA
	Full build-out	1. Existing NEIZ– 13,500vpd 2. NEIZ Extension– 13,500vpd	Detailed in Section 7.1 of the ITA

18 Section 3.3 of the S42A Technical Evidence: Traffic and Transportation references material considered as part of the technical evidence which includes the Stantec Technical Memo dated 30 April 2021.

19 *'The Cube model is appropriate but should be updated to reflect the change in land use both from the development and the existing railway land'* : Memo - Feedback on draft Assessment Scope and Assumption documents for Transport and Flooding and Stormwater, issued by Anita Copplestone dated 26 May 2020.

Table 4: Traffic Model – 'with Freight Hub' Scenarios

Scenarios				
Scenario		**Additional Land use**	**Do Minimum Road Improvements**	**Freight Hub Road Improvements**
'with Freight Hub'	Initial stage	1. Existing NEIZ– 13,500vpd 2. NEIZ Extension– 4,500vpd 3. Traffic at the Existing Freight Yard remains – 4,700vpd 4. Initial Stage Freight Hub - 5,800vpd	Detailed in Section 7.1 of the ITA	Detailed in Section 9.3 of the ITA
	Full build-out	1. Existing NEIZ– 13,500vpd 2. NEIZ Extension (less 37.5%) – 8,400vpd 3. Traffic at the Existing Freight Yard remains – 4,700vpd 4. Full build-out Freight Hub - 12,000vpd	Detailed in Section 7.1 of the ITA	Detailed in Section 9.6 of the ITA

7.7 The PNATM, as initially provided by PNCC, permitted all vehicle movements along Flygers Line and Richardsons Line.

7.8 However, PNCC considered that route choice along these two roads for heavy vehicles did not reflect the intended use of the road network. I agree with this assessment, noting the narrow width and surface condition of these roads are such that trucks tend to use alternative routes.

7.9 Therefore, as sought by PNCC, and set out in KiwiRail's first Section 92 Response dated February 2021, the following changes were made to all five scenarios in the PNATM model:

(a) Flygers Line between Gillespies Line and Milson Line was converted to an access only route; and

(b) the western end of Richardsons Line was made accessible to light but not heavy vehicles.

7.10 Based on the outputs of the PNATM, Figure 7 below presents the difference in total traffic volumes at a daily level in 2041/51 with the Freight Hub compared to the 2041/51 scenario without the Freight Hub.

Figure 7: Daily Traffic Volume Shift

7.11 The largest traffic shift once the Freight Hub is operational will be from the existing Railway Road to the new Perimeter Road, expected to be in the order of 10,000vpd. The new Perimeter Road will be designed to a level able to accommodate the anticipated future traffic volumes generated by the Freight Hub. I also acknowledge that there will be an increase in traffic along local routes surrounding the Freight Hub including along Stoney Creek Road, Ashhurst Road and the southern portion of Railway Road.

7.12 For Stoney Creek Road, the traffic modelling indicates that there will likely be an increase in traffic of around 1,200vpd associated with the full buildout of the Freight Hub. I consider that this is well within the traffic carrying capacity of Stoney Creek Road and note that most of the traffic shifting onto Stoney Creek Road will result from the closure of the Roberts Line level crossing, as now proposed by PNCC independent of the Freight Hub proposal.

7.13 Figure 8 below presents the difference in heavy vehicle volumes at a daily levels in 2041/51 with the Freight Hub, compared to the 2041/51 scenario without the Freight Hub.

Figure 8: Heavy Vehicle Volume Shift

7.14 Traffic modelling indicates an increase in heavy vehicles along SH3, KB Road, Ashhurst Road, Campbell Road, Richardsons Line, and the southern extent of Railway Road. For these routes, I do not consider that any infrastructure upgrades are required beyond what has already been identified by roading authorities (as mentioned in paragraph 5.28 above), what will be provided by KiwiRail (as mentioned in paragraph 4.5 above) and those discussed later in paragraphs 8.2 and 8.3 identified as locations of future deficiencies.

7.15 As shown in Section 10.1 of the ITA, modelling of future traffic conditions when the Freight Hub is operational confirms that:

(a) with the exception of Waughs Road between SH54 to Feilding, the roads in the vicinity of the Freight Hub will operate between LOS A[20] to LOS D in the PM peak (worst peak) which indicates generally good traffic operations with moderate delays;

(b) Waughs Road between SH54 and Feilding will continue to operate at LOS E regardless of whether the Freight Hub is developed;

(c) the new Perimeter Road, when assessed as an arterial road with an operating speed of 80km/h, will operate at a similar performance compared to Railway Road in the 'Without Freight Hub' scenarios;

20 Table 8-1 and 8-2 in the ITA define the Intersection and Link LOS Thresholds used as part of the modelling assessment.

(d) the SH54 / Waughs Road, Tremaine Avenue/Milson Line, SH3 / Flygers Line, and Campbell Road/KB Road intersections in their existing format will perform poorly with or without the Freight Hub (LOS F).

7.16 In my opinion, aspects of the road network will need to be upgraded irrespective of the Freight Hub and I consider that the RNIP will provide the right mechanism for a coordinated approach with Waka Kotahi and PNCC to address identified future deficiencies.

7.17 Using traffic volume data extracted from the PNATM I arranged for SIDRA intersection models to be developed for the following intersections in the vicinity of the Freight Hub Site that were identified as critical in the PNATM for the 2041/2051 scenarios:

(a) SH54 - Waughs Road;

(b) Tremaine Avenue - Milson Line;

(c) SH3 - Flygers Line; and

(d) Campbell Road - KB Road.

7.18 Section 10.1 of the ITA details the proposed upgrades for these intersections. With the identified upgrades the SIDRA analysis indicates that the intersections will perform at an overall LOS C with and without the Freight Hub, as shown in Table 5 below.

7.19 A co-ordinated traffic signal for the Campbell Road / KB Road, Railway Road / KB Road, and KB Road level crossing was analysed as a potential solution at this node. I should note that an infrastructure upgrade at the Campbell Road / KB Road intersection could be superseded by the implementation of the western and southern bypasses, depending on timing, and again pointing to the relevance of the proposed RNIP condition to provide a coordinated approach to infrastructure improvements.

Table 5: Full Build out Sidra Results including proposed mitigation

Site	**'without** Freight Hub**' LOS (2041)**	**'with Freight Hub' LOS (Full Buildout)**
SH54 – Waughs Road (roundabout)	C	C
SH3 – Flygers Line (roundabout)	C	C
Tremaine Avenue - Milson Line (increased lanes)	C	C
Campbell Road / KB Road (signal)	C	C

7.20 I conclude therefore that the transport network, with the baseline infrastructure upgrades mentioned in paragraph 5.28 above, the proposed upgrades to be undertaken by KiwiRail (detailed in paragraph 4.5) and the proposed mitigation in 8.2 and 8.3, is readily able to accommodate the traffic volumes generated by the Freight Hub. In my opinion the adverse effects of the Freight Hub on network traffic will be minor.

Travel time effects

7.21 On average, between key origin and destinations, increases in travel times due to increased traffic on the network generated by the Freight Hub will be less than two minutes. The two properties on Richardsons Line (422 and 422A Railway Road) will have a travel time impact of six minutes when travelling to the Bunnythorpe township. It is my opinion that the infrastructure costs required to shorten this travel time by, for example, constructing a new road link to Tutaki Road is not a sustainable response given the majority of related property traffic movements are to and from the south.

7.22 In other instances, changes to travel times are inevitable in response to the PNCC-initiated closures of the Roberts Line and Clevely Line level crossings.

7.23 Travel time impacts due to increased train lengths were analysed based on a train speed ranging between 30-80km/h. The results show that the longer trains (1,500m) could cause an increase in travel times ranging up to one minute (for the first vehicle at the level crossing).

7.24 I consider these travel times to be acceptable for the area. In my opinion the travel time effects of the Freight Hub will be minor.

Level crossing effects

7.25 The Australian Level Crossing Assessment Model ("**ALCAM**") was used to assess the impacts of the Freight Hub at level crossings in the area adjacent to the Freight Hub. The ALCAM is an industry accepted risk assessment tool that considers unique crossing infrastructure, user exposure (train and vehicle / pedestrian volumes) and the consequence of an incident to determine a comparative crossing risk score as well as identify some of the key risks at the crossing.

7.26 Based on the ALCAM scores, the existing Clevely Line, Richardsons Line and Roberts Line level crossings are high risk crossings. I again note that PNCC has plans to close Clevely Line and Roberts Line at the level crossings, independent of the Freight Hub proposal. The Richardsons Line level crossing will close in response to the Freight Hub Project. The high ALCAM risk will be removed once these crossings are closed.

7.27 Based on the ALCAM score, my analysis of the Change in Use (change in train length and traffic volumes) at the Kairanga Bunnythorpe level crossing shows it will remain as a Criterion 1[21] which means the crossings has a "Low" (LCSS≤19) or "Medium-Low" (LCSS 20≤x<30) risk score.

7.28 The level crossing closures will cause a redistribution of traffic throughout the network and will result in reduced traffic on the Palmerston North Gisborne Line ("**PNGL**") level crossings at Roberts Line and James Line.

7.29 Based on the above, I consider that the effects associated with the level crossing closures are overall positive, noting this includes the changes to be advanced by PNCC in respect to the Roberts Line and Clevely Line level crossings.

Safety risk

7.30 I undertook the analysis for the safety risk category using the Waka Kotahi Mega Maps Tools. The results are presented in Section 10.4 of the ITA and show that the safety risk will reduce on the following roads once the Freight Hub is operational:

(a) Railway Road;

21 Refer to section 2.2 of the Level Crossing Risk Assessment Guidance (October 2018).

(b) Perimeter Road (compared to existing Railway Road between KB Road and Roberts Line);

(c) Richardsons Line; and

(d) Roberts Line.

7.31 The traffic generated by the Freight Hub will not result in the risk band (Collective and IRR) thresholds being exceeded for the following roads:

(a) SH54;

(b) Railway Road (between Roberts Line and Airport Drive);

(c) Campbell Road; and

(d) Waughs Road.

7.32 Based on the above, I consider that the Freight Hub will have an overall neutral effect on road safety.

Public transport effects

7.33 The bus route connecting Bunnythorpe and Feilding to Palmerston North will be disrupted due to the closure of the Clevely Line level crossing, as planned by PNCC independent of the Freight Hub proposal. Once the Freight Hub is established, an alternative route, along the new Perimeter Road, will present the logical alternative to Railway Road, being 200m longer than the existing route. This will result in an increase in travel time of less than 15 seconds. This redirected route will trigger the relocation of the Bunnythorpe stops near Dutton Street. As such, and including PNCC's plans to close the Clevely Line level crossing, the Freight Hub will not materially impact this public transport route.

7.34 In my opinion the Freight Hub will provide an opportunity to improve public transport offerings for the NEIZ and Freight Hub and will therefore have an overall positive effect.

Effects on walking and cycling

7.35 The Freight Hub will provide the opportunity for the existing Te Araroa Trail to be improved within the Designation Extent, as well as an opportunity for additional recreational areas around the Freight Hub. The Freight Hub is not expected to disrupt any existing or planned walking and cycling routes.

7.36 The design of the new Perimeter Road will include provision for walking and cycling. Therefore, I consider that overall, the Freight Hub will contribute positively to the walking and cycling network in the vicinity of the Site.

Parking effects

7.37 All parking requirements for the Freight Hub will be accommodated on Site. Therefore, there will be no adverse parking effects from the Freight Hub.

8. RECOMMENDED MITIGATION

8.1 In addition to the infrastructure upgrades I listed above at paragraph 4.5, KiwiRail has proposed to undertake the following mitigation measures, which are reflected in the conditions attached to Ms Bell's evidence at Appendix 1:

(a) a Level Crossing Safety Impact Assessment ("**LCSIA**") to determine the safety risks and need for safety improvements at selected level crossings;

(b) a RNIP that has an objective to ensure the roading network for the Freight Hub is appropriately managed and safely and efficiently integrated with the wider transport network. It includes recognising the stopping of roads, level crossing closures, changes to property accesses, the form of pedestrian, cycling and public transport improvements, and the identification of infrastructure works to integrate with other funded works;

(c) a Construction Traffic Management Plan ("**CTMP**"). It is recommended the CTMP be prepared once details around the Freight Hub construction become clearer. The objective of the CTMP is to minimise adverse effects on property access, traffic safety and efficiency as a result of enabling construction works activities through the construction of all Freight Hub stages; and

(d) an Operational Traffic Management Plan ("**OTMP**"). It is recommended an OTMP be prepared to manage the traffic generated by the operational activities of the Freight Hub over time and outline the methods that will be undertaken to manage any identified adverse transport effects.

8.2 In addition to the "Do Minimum" requirements outlined above at paragraph 5.28, the following transportation infrastructure upgrades were identified through analysis for the "without Hub" scenario, as upgrades to address existing and future deficiencies. As such, it is anticipated they will be delivered by PNCC and Waka Kotahi. These are:

(a) upgrade of SH54/Waughs Road intersection from a priority control to a roundabout;

(b) upgrade of SH3/Flygers Line intersection from a priority control to a roundabout; and

(c) upgrade of Tremaine Avenue/Milson Line intersection to include additional through lanes on each approach.

8.3 The analysis also showed that the following intersections and midblock will require upgrades. KiwiRail is conscious that the traffic generated by the Freight Hub will compound conditions in these locations and will work with the roading authority to facilitate improvements:

(a) intersection upgrade at the Bunnythorpe node incorporating the intersection of Campbell Road/KB Road, the intersection of Railway Road/KB Road, and the level crossing as addressed above at paragraph 7.19; and

(b) safety improvements along Roberts Line (Railway Road to Richardsons Line).

8.4 Section 11 below discusses the transportation related conditions, which relate to Level Crossings, Road Network Integration Plan and Construction. As I discussed above at paragraph 5.33, the RNIP is extremely important in ensuring the road network supporting the community and the Freight Hub is developed in a fair and holistic manner. This Plan will provide the basis for a coordinated approach to the required improvements with PNCC and Waka Kotahi.

9. RESPONSE TO SUBMISSIONS

9.1 A number of submitters have raised concerns which relate to such matters as dust and noise from traffic. These are more appropriately addressed by other specialists.

9.2 Transport matters related to construction, design and operations, and rail versus road mode share have also been addressed by other specialists but are also mentioned at a high level in my further evidence to follow.

9.3 A number of the submissions received on the NoR raise matters relating to traffic effects and transportation matters associated with the Freight Hub. I have read and reviewed each submission in so far as they relate to transport matters and consider that they can be grouped into the following topic areas to which this section of my evidence will respond:

(a) Integration with future transport network upgrades

(b) effects of additional traffic generated by the Freight Hub, including the ability for the road network to accommodate the traffic generated by the Freight Hub;

(c) property access, including increase in road travel times;

(d) safety; and

(e) active mode safety.

Integration with future transport network upgrades

9.4 Integration has been highlighted as a primary concern for many residents in the area, with particular focus on the integration with Waka Kotahi's strategic roading plans I referred to earlier at paragraph 5.31. Waka Kotahi has released an Interim Business Case ("**IBC**") for the ring road and bypasses at Bunnythorpe, setting out a staged approach for the development of the future roading network.

9.5 Although the IBC shows an outline of potential future road network for the area, details around intersection / interchange form, road configuration and design parameters have not yet been developed and therefore could not be considered at the time of preparing the ITA or preparing this evidence. These upgrades are not KiwiRail's responsibility and without this detail I do not consider that it is appropriate to make assumptions for the purpose of modelling the effects of these upgrades. I do note however that the information released in the IBC aligns with that included at Figure 12.3 from the ITA, which I repeat below in Figure 9. This image demonstrates that the proposed road network of the Freight Hub will not foreclose future development of the strategic roading network.

9.6 To ensure that the NoR and any future upgrades are appropriately integrated, KiwiRail has proposed a RNIP condition which has been included to ensure the development of the road network in an integrated manner.

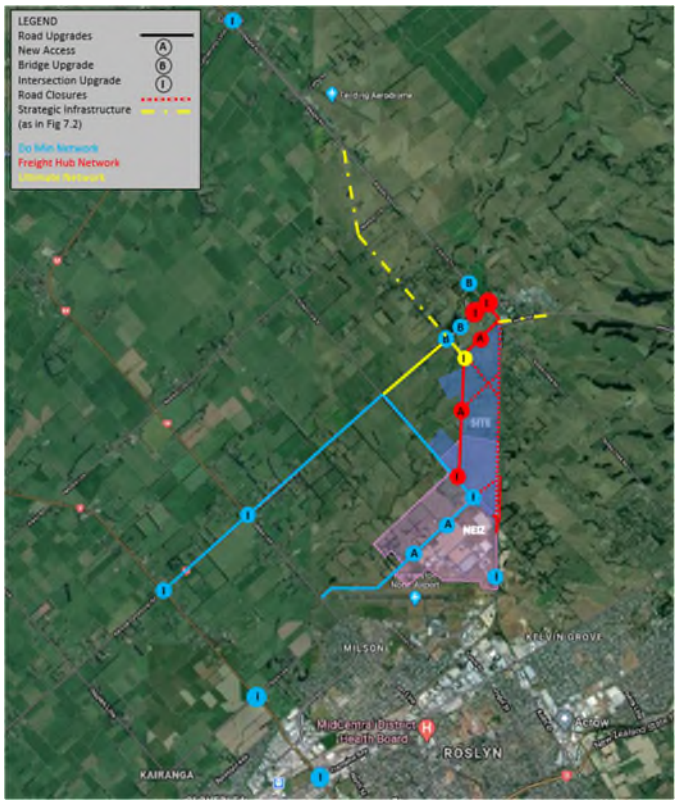

Figure 9: Ultimate Road Network – Do Minimum plus Freight Hub Triggered plus Strategic Infrastructure Improvements

Effects of additional traffic generated by the Freight Hub

9.7 Some submitters have expressed concerns that the additional traffic generated by the Freight Hub will have significant effects on the surrounding road network environment. These concerns include:

(a) the ability for the surrounding road network to accommodate the additional traffic from the Freight Hub;

(b) the impacts on the road network between the NEIZ and the Freight Hub;

(c) effects on commuters between Feilding and Palmerston North; and

(d) effects on Bunnythorpe School.

Effects on the roading network generally

9.8 As I set out in the Assessment of Effects section of my evidence (Section 7), the full build out of the Freight Hub is expected to generate approximately 12,000vpd resulting in a net increase on the surrounding road network of 6,900vpd. By implementing the mitigations set out throughout my evidence it is clear that the traffic generated by the Freight Hub can be accommodated on the road network safely.

9.9 The 2041/51 PNATM shows that Railway Road is expected to carry approximately 8,900vpd in the future without the Freight Hub. The full build-out scenario with the Freight Hub shows that the new Perimeter Road is expected to carry approximately 9,600vpd. The volume difference is small. Additionally, in my opinion the location of the Perimeter Road and the Freight Hub will not bisect the Bunnythorpe area any more than Railway Road and the NIMT do at present.

9.10 I have previously concluded at paragraph 7.20 that the transport network, with the baseline infrastructure upgrades mentioned in paragraph 5.28, in conjunction with the proposed upgrades to be undertaken by KiwiRail (outlined in paragraph 4.5) and those further upgrades identified in paragraphs 8.2 and 8.3, will be able to accommodate the proposed Freight Hub traffic generation in 2051. However, several submitters[22] have raised concerns about the effects of the additional traffic on the surrounding rural roads and have suggested that rural roads such as Clevely Line, Parrs Road, Tutaki Road, and Sangsters Road, in their current condition, are not adequate to accommodate the traffic generated by the Freight Hub and particularly heavy vehicles.

9.11 While the Freight Hub is expected to generate approximately 12,000vpd, the roads identified above by submitters have no direct connection to the Freight Hub or Railway Road. I believe that the rural roads mentioned will continue to be utilised primarily by the immediate traffic and that there will be only a minor increase, if any, in traffic on surrounding local rural roads of a scale that is acceptable on those roads in their current condition. There would certainly be no heavy vehicles associated with the Freight Hub on these roads.

9.12 I acknowledge that there will likely be an increase in traffic along Stoney Creek Road as a result of the Freight Hub. The modelling results as set out in Figure 7 of my evidence, indicate that traffic volumes along Stoney Creek Road will be in the order of 2,700vpd (total in both directions) in 2051 with the full buildout

22 Submissions by Rochelle & Rex McGill, Jeff Williams Sonia and Neal Watson.

of the Freight Hub. For heavy vehicles, the results of Figure 8 show that there will be an increase from 8 to 10%. In my view Stoney Creek Road in its current condition has adequate capacity and form to accommodate these changes, noting most will arise in response to PNCC's proposal to close the Roberts Line level crossing independent of the Freight Hub proposal.

9.13 Based on the above, and as set out in Section 7 of my evidence, I consider that the surrounding transport network (with the upgrades proposed) will be able to accommodate the additional traffic generated from the Freight Hub once operational.

Connection between NEIZ and Freight Hub

9.14 Submitters Nicola Schreus and Thomas Good noted that there is no rail connection between the NEIZ and the Freight Hub and raise concerns that heavy vehicle traffic travelling between the NEIZ and Freight Hub will be mixed with general traffic travelling between Feilding and Palmerston North. As demonstrated in Section 10.1 of the ITA, the Perimeter Road including the roundabout upgrade at the Roberts Line/Richardsons Line intersection will have sufficient capacity to accommodate the traffic generated between these sites without requiring a private siding or other road solutions.

9.15 I acknowledge that heavy vehicles will be required to travel a short distance to access the NEIZ from the Freight Hub. Traffic modelling (refer to ITA Section 10.1) indicates that approximately 730 heavy vpd in 2051 will travel between the Freight Hub and the NEIZ, of which 320 heavy vpd will use Richardsons Line for access and 410 heavy vpd will use the El Prado Drive access.

9.16 Further, as outlined in the First Section 92 Response, the NEIZ and the NEIZ Extension will have multiple accesses along Richardsons Line and the existing access at Railway Road/El Prado Drive, such that movements will not be concentrated at any one location. Based on the modelling undertaken, no capacity or performance issues have been identified in terms of travel efficiencies between and near the NEIZ and Freight Hub not otherwise addressed by the suite of infrastructure improvements.

9.17 Based on the above, it is my opinion that the additional heavy vehicles generated from the Freight Hub will be able to be accommodated on the road network between the NEIZ and the Freight Hub, inclusive of the Richardsons Line upgrade being progressed independently by PNCC.

Effects on commuters between Feilding and Palmerston North

9.18 Submitters Andreas Johannes Hofman and Peter Hurly have raised concerns about the effect of the Freight Hub on commuters travelling between Palmerston North and Feilding and have queried whether any infrastructure upgrades will be provided.

9.19 The two main travel routes between Feilding and Palmerston North are along SH54 and along Campbell Road (and via the new Perimeter Road in the future). It is my opinion that the closure of Railway Road will have minimal effect on commuters as the new Perimeter Road will provide for an alternative connection, offering a substantially improved design and safer travel compared with the existing road. I also do not consider that there will be adverse effects on commuters' travel time for the same reason. PNCC's transport expert, Ms Fraser, has also agreed that the additional route length of the new Perimeter Road compared with Railway Road will make very little difference to overall travel times.[23]

Effects on Bunnythorpe School

9.20 The Minister of Education has raised concerns relating to increased traffic passing Bunnythorpe School affecting the safety of those travelling to and from the school during construction and operation. Baring Street (directly adjacent to the School) has no direct link to a preferred traffic route to and from the Freight Hub. In addition, the PNATM shows that the difference in volumes in the "without Hub" and "with Hub" scenarios is very minor at 10 vpd for the Bunnythorpe township combined (for both 2031 and 2041/2051) illustrating that almost no traffic travelling to the Freight Hub will do so via Bunnythorpe township.

9.21 In addition, the potential signalisation of the Bunnythorpe node (Campbell Road/KB Road, KB Road/Railway Road and the KB Road level crossing) will improve safety for crossing pedestrians and cyclists. In my opinion this will also improve the safety for pedestrians travelling to and from Bunnythorpe School from Bunnythorpe West.

9.22 Overall, I consider that the Freight Hub can be established as proposed in a manner such that the transportation effects, particularly related to safe travel to and from Bunnythorpe School, will be less than minor. I do not consider that any additional upgrades or mitigation (other than those already proposed by

[23] Section 42A Technical Evidence: Traffic and Transportation dated 18 June 2021 at [151].

KiwiRail) are required to address the concerns raised by the Minister of Education.

Property access

9.23 Several submitters have raised concerns with respect to property access and safety of the transport network as a result of the infrastructure changes surrounding the Freight Hub.[24] The primary focus of the submissions is the impact of the new Perimeter Road on the surrounding road network and the associated infrastructure changes affecting access to property.

9.24 The design and construction of infrastructure to be implemented as part of Freight Hub will be undertaken to minimise impacts to property accesses. In that regard, KiwiRail has proposed a condition requiring a Construction Traffic Management Plan ("**CTMP**") to manage and mitigate adverse effects of construction works on property access, traffic safety and efficiency. In my opinion, the preparation of a CTMP will be sufficient to appropriately manage any adverse effects regarding safety and property access.

9.25 In regard to Maple Street, the proposed new Perimeter Road has been designed to link into the existing Railway Road on the northern boundary of the Freight Hub Site and will not impact Maple Street directly. The only material change on Maple Street will be the safety benefits at the Maple Street/Railway Road intersection since the proposed new Perimeter Road design will improve the current crest curve south of the intersection and will function with a lower operating speed. It is my opinion that the changes will improve safety at this intersection.

9.26 As included in the RNIP condition, all surrounding property accesses directly impacted by the Freight Hub infrastructure changes will be evaluated during the design and construction of the Freight Hub and associated works. Impacted property accesses will be designed in accordance with appropriate standards.

9.27 The operations at the Foodstuffs accessways on Roberts Line are not expected to be disrupted by the new Perimeter Road. I acknowledge that there will be an increase in traffic passing the Foodstuffs' site. However, it is my opinion that the reduced speed and changed infrastructure environment will continue to allow for the safe and efficient movement of vehicles into and out of the Foodstuffs' site. I am aware that KiwiRail has been in discussions with

[24] Submissions were received by Warren Bradley, Glen & B Karen Woodfield, Rochelle & Rex McGill and Tutaki 2019 Ltd.

Foodstuffs regarding their concerns, and that a design solution is being developed to be shared with Foodstuffs. These discussions are ongoing.

9.28 The two properties (422 and 422A Railway Road) that gain access via the Richardsons Line level crossing will in the future gain access via a portion of Sangsters Road which will be formed to intersect with Roberts Line. The formation of this portion of Sangsters Road will be undertaken by KiwiRail, as detailed in the Draft and Indicative Masterplan Cross Sections[25] and as provided for in the RNIP and CTMP conditions. I consider that this is an appropriate response to ensure that appropriate alternative access is provided to cater for all traffic movement requirements.

9.29 No new or through traffic will occur on Sangsters Road, Clevely Line or Tutaki Road as a result of the Freight Hub. Sangsters Road will not connect between Clevely Line and Roberts Line. Alternative routes via Sangsters Road and Roberts Line have been provided for properties and businesses affected by the closure of the Richardsons Line level crossing.[26]

9.30 In relation to the comment made about the Roberts Line level crossing remaining open, due to the safety risk at this level crossing PNCC has requested that this level crossing be closed, independent of the Freight Hub proposal.

9.31 Based on the above, it is my opinion that the adverse traffic effects from the Freight Hub will have a minor effect on the accessibility of the surrounding area.

Closure of Railway Road and Level Crossings

9.32 A number of residents and businesses are concerned with the impact of road network changes on daily operations of the surrounding community. The primary network change will be the closure of Railway Road.

9.33 The new Perimeter Road is required as a replacement of Railway Road and will provide access to the Freight Hub from the north and west. Its alignment will provide the shortest alternative to the existing alignment of Railway Road. The new Perimeter Road will be constructed before the closure of Railway Road (which is now expressly provided for in the Proposed Conditions) and therefore will not negatively impact on the daily operations of the surrounding

25 https://storymaps.arcgis.com/stories/e97ac83c3d3049759f754e0e2b64b7e1

26 Example: Traffic travelling onto Railway Road via the Richardsons Line level crossing will now travel via Roberts Line towards Tremaine Avenue.

community as an earlier closure of Railway Road otherwise would. In addition, the alignment will cause minimal disruptions to the existing road network, as the new Perimeter Road will connect to existing roads at its north and south ends, to Railway Road and Roberts Line respectively.

9.34 The redistribution of traffic resulting from the Freight Hub and associated infrastructure changes will be mostly localised, focusing on the primary road network surrounding the Freight Hub Site. Railway Road will have the biggest traffic volume shift onto the new Perimeter Road. SH3, KB Road, Ashhurst Road, Railway Road (south of Roberts Line) Roberts Line, and Richardsons Line will also have an increase in traffic volumes. As demonstrated earlier at paragraphs 7.10 to 7.14, these roads have sufficient capacity to accommodate the changed traffic volumes without lowering existing levels of service.

9.35 The Freight Hub is not expected to contribute to traffic increases along Clevely Line, Sangsters Road (north), Parrs Road and Tutaki Road as these roads are not connected to any of the primary traffic routes. A negligible traffic increase is expected along Sangsters Road between Roberts Line and the Richardsons Line level crossing as a result of the 422 and 422A Railway Road. In addition, the Clevely Line level crossing closure will result in less traffic using it.

9.36 I acknowledge that the level crossing closures will impact some road users by increasing travel times on select routes. However, as noted in the transport evidence in the Section 42A report, PNCC has written to KiwiRail for approval to close the Roberts Line and Clevely Line level crossings.[27] Therefore, the impacts to travel times on existing users from such closings are not directly a result of the Freight Hub Project.

9.37 Danelle O'Keeffe and Duane Butts have raised concerns around the suitability of the road network to accommodate heavy vehicle traffic as a result of the level crossing closures. The expected heavy vehicle routes to and from the Freight Hub will utilise roads currently used by heavy vehicles. As analysed by the PNATM (and set out at paragraph 7.14 to my evidence) these roads will have sufficient capacity to accommodate the level of heavy vehicle traffic generated by the Freight Hub.[28]

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27 Section 42A Technical Evidence: Traffic and Transportation, dated 18 June 2021, at [34(e)].

28 This includes consideration of all mitigations outlined in the ITA.

Safety

9.38 The safety impact of traffic volume increases on the road network is a concern for a few submitters.

9.39 As I have outlined in paragraphs 7.29, 7.30 and 7.31 above, the road safety risk on the surrounding road network is expected to improve or remain unchanged. Although traffic volumes on the road network will increase as a result of the Project, these increases will be supported by the infrastructure upgrades in the area. These upgrades include the speed reduction on the 2.6 km new Perimeter Road (from 100km/h on Railway Road to 80km/h on the Perimeter Road), various intersection upgrades in the vicinity of the Freight Hub and better vulnerable user facilities on the Perimeter Road. In my opinion the upgrades are sufficient to address safety concerns that have been raised by submitters.

9.40 In addition, it is my view that the Clevely Line level crossing closure, as now being advanced by PNCC independent of the Freight Hub proposal, will result in increased safety along Sangsters Road. The level crossing closure will convert the current Clevely Line/Sangsters Road intersection into a continuous road and will result in this road being utilised by local residents only. The reduction of through traffic utilising the Clevely Line level crossing will allow Sangsters Road to be safer for cyclists and pedestrians.

9.41 Sangsters Road will not be a route utilised by heavy vehicles as Sangsters Road will have no direct link into the Freight Hub or the NEIZ with no connections onto Railway Road or the new Perimeter Road. There are no plans to join the two (northern and southern) portions of Sangsters Road, so there will be no through-traffic use of the road.

9.42 On the matter of safety raised in regard to the SH54/Waughs Road intersection I acknowledge that the intersection currently performs at an unacceptable level of service from a traffic carrying and performance perspective. However, it is not classified as a high-risk location and a CAS search has shown that over the past five years no injury crashes have occurred at this intersection. Notwithstanding that current position, as part of my analysis, detailed in ITA Section 10.1, and included at paragraph 8.2, I have recommended that this intersection be upgraded to a roundabout to improve efficiency and safety.

9.43 The Collective risk for roads within the Bunnythorpe township, including Baring Street is low. Although Baring Street will not have an increase in traffic volumes, as highlighted in paragraph 7.30, I undertook a safety risk analysis using Mega Maps and an exceedingly conservative traffic increase of 100%.

The Mega Maps tool showed that the Collective risk for the area will remain low. Therefore, it is my opinion that the transport network surrounding Bunnythorpe School will not experience a reduction in safety as a result of the Freight Hub.

9.44 Lastly, Stoney Creek Road is expected to experience an increase in traffic volumes. I acknowledge that a portion of this increase will be a result of the Freight Hub, however, as discussed earlier in paragraph 7.12, the increase in traffic along Stoney Creek Road will mostly be a result of traffic rerouting due to the Roberts Line level crossing closure planned by PNCC.

Active mode safety

9.45 Several submitters have raised concerns about impacts to cycle routes and the safety of cyclists in the area with the expected increase in heavy vehicle volumes.[29]

9.46 Regarding the impact to on-road cyclists using Railway Road having to now use other routes, I note that there are currently no pedestrian or cyclist facilities provided on Railway Road or the other rural roads surrounding the proposed Freight Hub Site. For the most part, these roads have limited shoulders, and no footpaths or cycling facilities. In addition, the speeds on these roads are 100km/hr and would usually be considered unsafe for cyclists or pedestrians with no infrastructure to provide refuge from passing vehicles. KiwiRail's First Section 92 Response dated February 2021 shows a footpath along the new Perimeter Road and a potential offline recreational path. In my opinion, these proposed improvements in addition to the lower speed environment will result in a safer and more pleasant experience for vulnerable road users.

9.47 In relation to cycling between Palmerston North and Bunnythorpe, the Te Araroa Trail will continue to be the primary route. This route is planned for substantial investment and improvement by PNCC. As set out in Section 10.6 of the ITA the only material impact to the current Te Araroa Trail will be at the crossover at the Campbell Road/KB Road intersection where recommended upgrades (potentially to traffic signals) will improve crossing safety for vulnerable users. Since this trail follows away from the main roads, an increase in heavy vehicles will be physically separated from users. The proposed RNIP captures the timing and integration of path improvements, including the formation, timing and integration of the Te Araroa Trail along Sangsters Road.

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29 Submissions were received by Jim Jefferies, Kevin and Yvonne Stafford, Tomas Burleigh Behrens and Matthew McKenzie.

10. RESPONSE TO SECTION 42A REPORT

10.1 I have reviewed the following sections of the Section 42A Report relevant to my evidence:

(a) Section 42A Technical Evidence: Traffic and Transportation by Harriet Fraser;

(b) Section 42A Report: Palmerston North City Council Infrastructure Assets by Robert van Bentum; and

(c) Section 42A Technical Evidence: Planning by Anita Copplestone and Phillip Percy (including the Effects recommendations and summary table).

10.2 The technical evidence by Ms Fraser and Mr van Bentum outlines the following issues:

(a) sensitivity testing including the PNITI works and the bypasses;

(b) impacts of the Freight Hub on level crossing safety around Bunnythorpe;

(c) impact on NEIZ accesses as a result of the Freight Hub;

(d) impacts of the Freight Hub on active modes;

(e) construction effects;

(f) the RNIP;

(g) the transport effects and PNTAM model; and

(h) the proposed dedicated freight corridor between the Freight Hub and the NEIZ.

Sensitivity testing

10.3 In terms of testing the proposed PNITI interventions presented in the Council's Traffic and Transportation evidence, I first note that some of the short to medium term interventions have been included in the "Do Minimum".[30]

[30] Upgrades include: Kairanga Bunnythorpe Road/SH54, Kairanga Bunnythorpe Road/SH3, Kairanga Bunnythorpe Road - Road widening between SH3 and Roberts Line

10.4 The western and southern bypasses, however, have not been tested due to the lack of detail surrounding these bypasses as discussed in paragraph 5.31. In order for these bypasses to be tested these details would need to be released publicly (which has not occurred). This is echoed by section 238 of the Section 42A Report.[31] I again confirm that the infrastructure changes as a result of the Freight Hub will not foreclose the ability for the Strategic (PNITI) roading improvements to be delivered in the future, and that a fully integrated roading solution will be the subject of the proposed RNIP.

Level crossing safety around Bunnythorpe

10.5 Ms Fraser has raised concerns with the treatment type to improve safety at the Bunnythorpe level crossing.[32] As set out in section 10.1 of the ITA, a coordinated traffic signal at the Bunnythorpe node has been tested. This potential solution will increase the safety of crossing pedestrians and cyclists and will allow an initial solution at this intersection before the bypasses of Bunnythorpe are built and can otherwise be addressed through the proposed RNIP.

10.6 To further ensure safety at the Bunnythorpe level crossing the proposed conditions require that a Level Crossing Safety Impact Assessment must be undertaken at this level crossing.

10.7 As sought by Ms Fraser, ALCAM safety assessments have been completed for the two road level crossings (Waughs Road at Newbury Line and Campbell Road at the Feilding golf course) and the two pedestrian level crossings (Aorangi Marae and Taonui School) to the north of Bunnythorpe. As presented below, the results demonstrate that the train and road changes arising from the Freight Hub will not influence a change in the ALCAM risk. In addition, a further condition is proposed (as set out at Appendix 1 to Ms Bell's evidence) for LCSIA to be undertaken at these level crossings in the future if necessary:

(a) Waughs Road close to Newbury Line - The ALCAM risk band will remain High;

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31 Section 42A Report, dated 18 June 2021, at Section 238: *We agree with submitters and Ms Fraser that close coordination of these projects is needed. We appreciate the timing of delivery of the Freight Hub will significantly influence the PNITI programme. With respect to the potential cumulative effects raised by submitters, we recognise the relationship between the projects and the importance of successful and efficient integration between them. However, it is not possible at this stage to assess the cumulative effects of this project with the regional ring road, as that project is not sufficiently advanced in project planning and its effects (cumulative or on their own) cannot be known*.

32 Also referred to as the KB Road level crossing.

(b) Waughs Road and Campbell Road - The ALCAM risk band will remain High;

(c) Taonui School - The ALCAM risk band will remain Medium-High; and

(d) Aorangi Marae - The ALCAM risk band will remain Medium-High.

Impact on accesses

10.8 The Section 42A Report requested details around impact of accesses on Railway Road and Roberts Line.

10.9 As noted at paragraph 9.28 the access to Roberts Line for 422 and 422A Railway Road will be formed on the unformed portion of Sangsters Road leading to Roberts Line at the southern end as set out in the RNIP conditions.

10.10 KiwiRail and Foodstuffs have been engaged in discussions to work through minimising the impact to Foodstuffs. The Roberts Line frontage past the Foodstuffs property (between Railway Road and Richardsons Line) will be subject to a reduced 60kph speed limit as enabled by PNCC's Speed Limit Bylaw, independent of the Freight Hub. This engagement with Foodstuffs is continuing.

Active modes

10.11 This brief section relates to the impact the Freight Hub will have on PNCC's plans to formalise the shared path between Feilding and Palmerston North

10.12 Responding to Mr van Bentum's comments in regard to the shared path, the construction of the Freight Hub and associated infrastructure will not foreclose the ability of the path to be developed along Sangsters Road.[33] This is set out in the CTMP conditions.

10.13 The recreational tracks around the detention ponds being developed as part of the Freight Hub Project will connect into the pedestrian and cycle paths proposed along the Perimeter Road.

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33 Section 42A Technical Evidence Palmerston North City Council infrastructure assets, dated 18 June 2021, at section 6.

Construction effects

10.14 This section relates to the impacts of construction of the road network as raised by Ms Fraser. Construction matters are addressed more fully in the evidence of Mr Skelton.

10.15 Ms Fraser has requested confirmation:

(a) that there will be no construction or operational access to the Freight Hub via 9 and 9A Maple Street; and

(b) as to whether there will be any temporary or permanent closures of the Maple Street connection to Railway Road.

10.16 There will be no access to the Freight Hub via 9 and 9A Maple Street. As per paragraph 9.25 above, Maple Street will also not be impacted by the Perimeter Road and will not be used for construction access purposes. Construction of the Railway Road - Perimeter Road tie in will involve a geometry that improves the sight lines for Maple Street looking south, resulting in increased safety at this intersection. The proposed 80kph speed limit of the Perimeter Road will also facilitate safer operations compared with the 100kph approach of Railway Road currently.

10.17 Ms Fraser has also sought confirmation of the access points to the Site for construction purposes. The access points to the Site during construction will be outlined in the Construction Traffic Management Plan as provided for in the Proposed Conditions set out at Appendix 1 to Ms Bell's evidence.

Road Network Integration Plan

10.18 In relation to the confirmation of the parties to be consulted with as part of the RNIP, these are set out in the RNIP conditions and involve Palmerston North City Council, Horizons Regional Council, Manawatu District Council and Waka Kotahi NZ Transport Agency. In addition, this condition outlines the process of endorsement.

Transport effects and the PNTAM

10.19 Ms Fraser has raised concerns that the transport effects of the Freight Hub on central Bunnythorpe have been underestimated.[34] The 2020 actual traffic[35] on

34 Section 42A Technical Evidence: Traffic and Transportation, Point 8.

35 Sourced from Palmerston North City Council for 2019 and 2020.

surrounding key roads had a "good match"[36] to 2021 forecast volumes, indicating that the model is tracking well when compared to actual. In addition, as outlined in the Stantec Technical Memo dated April 2021 provided to Ms Fraser, use of the PNATM was accepted by PNCC in May 2020, as an appropriate project assessment tool for the Freight Hub.[37]

10.20 I acknowledge that the performance of the road network has been estimated using existing traffic data and best available future information. Due to the advanced nature of the assessment, there is a need to undertake traffic monitoring which is now provided for in the Proposed Conditions.

10.21 Ms Fraser has raised comments in relation to the road capacities used in the PNATM. It is my view they are appropriate for testing the impact of the Freight Hub on the network, noting the model has been properly validated and independently reviewed and confirmed as fit for purpose. A specific query has been raised about the Sidra analysis undertaken for the Tremaine Avenue/Milson Line intersection which I reported at Table 5. It has been reassessed using a signal cycle time of two minutes (120seconds). The results show that it remains with an acceptable level of performance at LOS D.

Dedicated Freight Corridor

10.22 Regarding the request for a dedicated connection between the NEIZ and the Freight Hub, traffic modelling shows that this is not required from a road capacity perspective in response to the traffic demands of the full Freight Hub and NEIZ developments as the upgraded roading network will have sufficient capacity to accommodate all forecast traffic.

10.23 Therefore, from a traffic perspective, I do not consider that a dedicated freight corridor is necessary. That said, should it become a consideration in the future, then appropriate assessment of options can be progressed at the time.

Point 108 of the Section 42A Technical Evidence: Traffic and Transportation "*As well as the initial ITA and further information response, Stantec provided me with additional clarification regarding the use of the traffic model. This was provided in a memo dated 30 April 2021. In particular, the memo describes a check of how the 2021 model performs compared with 2020 and 2021 count data collected by Council. Tables 1 and 2 in the memo show a good match between the modelled and observed traffic flows except on the links with the lowest observed flows. I agree that the absolute volume differences are low and the shortfall is likely to have negligible impact on the assessment findings. I note that with all the modelled flows being lower than the observed flows, the indication is that the model is slightly underestimating trips in this part of the network. Again, I consider that the scale of the difference is unlikely to impact on the assessment findings.*"

37 The Cube model is appropriate but should be updated to reflect the change in land use both from the development and the existing railway land.

11. RESPONSE TO RECOMMENDED CONDITIONS

11.1 I have carefully considered the recommendations in the Section 42A Report in terms of the changes sought to the transport conditions and, in response, a range of amendments have been included in the Proposed Conditions detailed in Appendix 1 to Ms Bell's evidence. By way of summary:

(a) Level Crossing Safety Impact Assessment – I agree with the Council Officers that two additional level crossings should be included to validate the ALCAM assessments outlined in paragraph 10.17.

(b) Road Network Integration Plan – I agree that it is appropriate for the RNIP to be reviewed and updated as it is intended to be a living document. I consider that it is appropriate for the timing and frequency of reviews to be outlined in the RNIP. Noting that PNCC will be involved in its preparation (as well as other key stakeholders), I do not consider it appropriate for one party to have a certifying role. I also agree that it is appropriate for the upgrades required to be delivered by KiwiRail to be expressly outlined in the RNIP (as now included in the Proposed Conditions).

(c) Roading connections and updates – a new condition is proposed to require the construction of the Perimeter Road prior to the closure of Railway Road. I agree that this is an appropriate requirement, but it needs to be qualified by the fact that alternative access (such as may be delivered by the future western and southern bypasses of Bunnythorpe) may be provided, such that the road (or part of it) may not need to be constructed.

(d) Construction Traffic Management Plan – a number of amendments have been made to incorporate the additional detail and level of specificity that the Council Officers are seeking. In particular, I agree that it is appropriate for there to be a requirement to undertake monitoring of construction traffic and the CTMP should set out the process to identify the locations and frequency of that monitoring.

(e) Operational Traffic Management Plan – as with the Construction Traffic Management Plan a number of amendments have been made to incorporate the additional detail and level of specificity that the Council Officers are seeking. I agree that a review trigger based on vehicle movements is appropriate and consider that this is most appropriately included in the Operational Traffic Management Plan rather than the RNIP, given that the objective of the Operational

Traffic Management Plan is to manage the traffic generated by the Freight Hub whereas the RNIP is more concerned with integration with the wider network.

11.2 The following recommendation have not been included:

(a) There is a recommendation relating to modelling and assessment of identified roads and intersections involving Railway Road (south), central Bunnythorpe, SH54/Waughs Road and Stoney Creek Road.[38] Each of these locations has been modelled as part of the assessments brought forward in the ITA, with proposed mitigations as reported and as set out at paragraphs 7.20 and 9.12 of my evidence. In addition, the principles of this recommendation have been incorporated through the OTMP that provides for ongoing performance and safety monitoring for locations to be determined, including through feedback with PNCC and Waka Kotahi. It is expected that the locations identified by PNCC in the recommendation will form part of the overall monitoring and as such I do not consider it necessary for assessment of these locations to be separately conditioned.

(b) There is a recommendation relating to the integration of the Freight Hub with the NEIZ.[39] The future traffic modelling undertaken and reported in the ITA and summarised in my evidence shows that the road network infrastructure will have adequate capacity to accommodate traffic movements between the sites. Again, I anticipate that the OTMP will capture monitoring of the related movements, such that a separate condition is unnecessary in my view.

Mark Georgeson
9 July 2021

38 Point 12 – Section 42A Planning Evidence: Effects and Recommendations Summary Table: KiwiRail Freight Hub Notice of Requirement.

39 Point 22 – Section 42A Planning Evidence: Effects and Recommendations Summary Table: KiwiRail Freight Hub Notice of Requirement.

APPENDIX A

Stantec

Memo

To:	Harriet Fraser Traffic Engineering and Transportation Planning	From:	Stantec
		Date:	April 30, 2021

This Technical Memo relates to transportation matters in respect of KiwiRail Holdings Limited's (KiwiRail) Notice of Requirement (NoR) for the Regional Rail Freight Hub (RFH). It is intended to address residual clarifications of the traffic model adopted for the RFH project.

As you are aware, Stantec adopted and used the Palmerston North Area Traffic Model (PNATM or Model) as the primary assessment tool to inform the transport assessment for the RFH (refer section 8 of the Integrated Transport Assessment dated 23 October 2020 (ITA). Prior to submitting the NoR for the RFH and supporting ITA, Stantec communicated to Palmerston North City Council (PNCC) its intention to adopt the PNATM as the primary assessment tool for transport matters. Based on correspondence in May 2020 it was understood that PNCC agreed the PNATM was an appropriate project assessment tool for the RFH.

This memo explains:

1. the changes that have been made to the PNATM used for the RFH, beyond the programmed roading improvements already documented in Section 7 of the TA.
2. checks that were undertaken to ensure Model accuracy.
3. how heavy vehicle movements are modelled under the PNATM for the RHF.
4. how local intersections near the RFH have been modelled under the PNATM; and
5. how link capacities on key roads surrounding the RFH have been modelled under the PNATM.

Overall, it is considered that the PNATM used as the primary tool for assessing localised effects of the RFH is both reliable and fit for purpose for the reasons outlined below.

1. MODEL CHANGES

The PNATM was developed by Beca in 2014 using 2013 Census land use data for the base year. Forecast models were developed for 2021, 2031 and 2041.

In 2019, Stantec investigated the performance of the Model on behalf of Waka Kotahi NZ Transport Agency to evaluate how well the Model was predicting traffic flows and travel times. The evaluation was undertaken by comparing observed 2018 traffic counts against the modelled outputs for 2013 and 2021 scenarios. It was found that the scenario with the 2021 land use on the 2013 network was tracking well towards the 2021 forecast volumes.

At the same time, the Model road network was updated to reflect recent or under construction network upgrades.

1A. CHANGES TO THE OVERALL MODEL

For the purpose of the RFH investigations, the following changes were made regardless of the 'with' and 'without' hub scenarios.

Tremaine Avenue Rail Freight Site

During the site selection phase of the Regional Freight Hub project, Stantec undertook traffic surveys (September 2019) at four of the main accesses from the existing KiwiRail Hub on Tremaine Avenue. The traffic surveys revealed that the 2021 forecast model was underrepresenting the traffic generated by the existing KiwiRail site (around 4,000 vehicles per day (vpd). As such, the forecasted demand from Zone 42, which represents the existing KiwiRail site in the Model, for 2021, 2031 and 2041, was factored up by 3.5 for each year to represent the existing level of demand more accurately.

Heavy vehicle proportions were also adjusted to match surveyed proportions (further detail on this is provided at 1B below).

North East Industrial Zone (NEIZ)

The traffic demands represented in the PNATM did not accurately reflect the existing conditions. As such, the PNATM used for assessing the effects of the RFH was updated to reflect current and future conditions to improve accuracy and reliability of modelled demand.

The NEIZ is represented by Zone 114 and the NEIZ Extension is represented by Zone 168 in the Model. The original Model allocated all traffic from the NEIZ onto the El Prado Drive / Railway Road intersection and traffic from the NEIZ Extension onto the northern and southern sections of Setters Line. The traffic study undertaken for the NEIZ in 2014[1] estimated that the NEIZ and NEIZ Extension would each generate approximately 13,500 vehicles per day (vpd), resulting in a total traffic demand of 27,000vpd when fully developed.

The original model showed traffic flows from Zone 114 to be around 14,000vpd in 2021. These modelled demands did not accurately reflect the existing conditions and is well ahead of what is currently developed. More recent count data from PNCC indicates that the traffic volumes along El Prado Drive are currently around 4,000vpd. As such, the PNATM used to assess transport effects of the RFH has been updated to more accurately reflect the existing and future conditions with respect to demand from the NEIZ and NEIZ Extension. Demand in Zone 114 has been reduced to match observed volumes. No NEIZ Extension is assumed in 2021 so no traffic generation has been included in the Model.

In 2031, it is assumed that the NEIZ will be fully developed and that a third of the NEIZ Extension will be completed. The NEIZ Extension is expected to be fully completed by 2051. The demands in Zones 114 and 168 have been adjusted in the PNATM used to assess transport effects of the RFH to match the aforementioned assumptions taken from the NEIZ Intersection Assessments Report thereby improving the reliability of the Model for the RFH.

Additional connections[2] have been added to the PNATM used to assess transport effects of the RFH based on the NEIZ Intersection Assessments Report. **Figure 1 and 2** illustrate the modelled access assumptions in 2021 and 2031/2041 for the NEIZ and NEIZ Extension.

[1] Intersections Assessment Report for Plan Change 15E: North East Industrial Zone Extension prepared in October 2014

[2] New connection to Richardsons Line at Setters Line in 2021. In 2031 additional connections to Richardsons Line from the NEIZ and NEIZ Extension

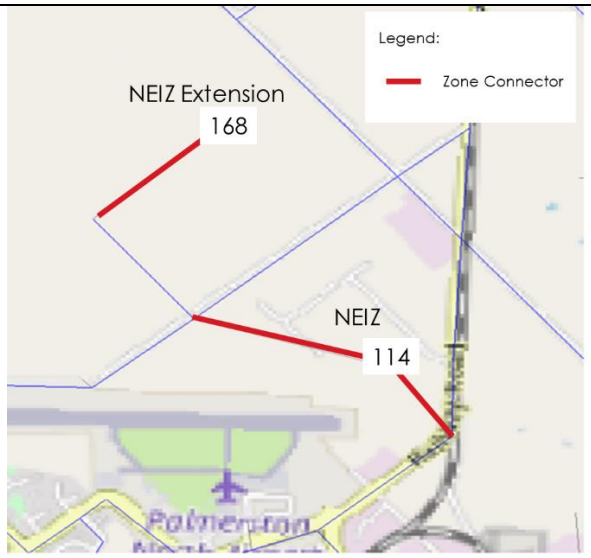

Figure 1: 2021 NEIZ Access

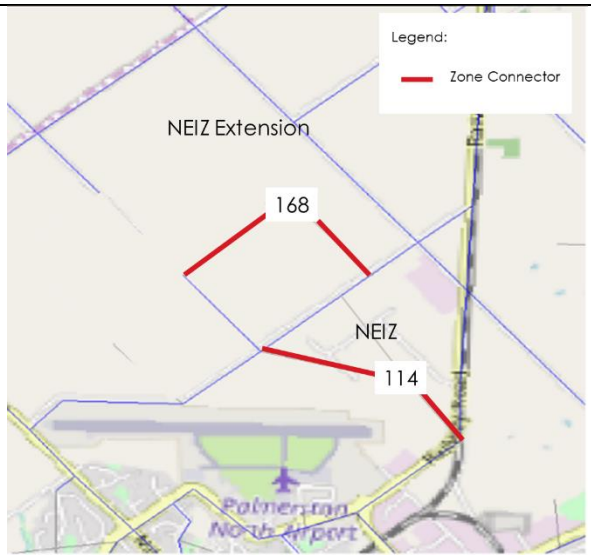

Figure 2: 2031/2041 NEIZ Access

Infrastructure Upgrades

The following infrastructure improvements have been added to the 2031 and 2041 base year models based on infrastructure works that have been allocated funding in the PNCC 10-year plan[3] and Regional Land Transport Plan 2015 - 2025[4], and the Waka Kotahi National Land Transport Program:[5]

- Kairanga Bunnythorpe Road - Two Roundabouts with SH54 and SH3
- Kairanga Bunnythorpe Road - Road widening between SH3 and Roberts Line
- Kairanga Bunnythorpe Road bridge strengthening and renewal (Jacks Creek and Mangaone Stream)
- Campbell Road Bridge Renewal
- Richardsons Line - Road widening between Milson Line and Roberts Line
- Richardsons Line/Roberts Line intersection upgrade (roundabout)
- New link to NEIZ extension off Richardsons Line and an access into existing NEIZ

The above road upgrades form the do-minimum road network. These upgrades are assumed to be completed before operation of the RFH commences.

Network Changes

The following changes were included in the 2021, 2031 and 2041 base year models as requested by PNCC as part of the Request for Further Information, to reflect the form and function of the road network more accurately:

- Convert Flygers Line to each side of SH3 as access only
- Ban heavy vehicles on the western end of Richardson Line between Setters Line and Milsons Line

1B. CHANGES TO THE 'WITH HUB' MODEL SCENARIOS ONLY

KR Hub Traffic Distribution

The only change to the traffic matrices in the PNATM used to assess transport effects of the RFH has been to the existing Zones 218, 222, 223 and 224 in the areas proposed for the future RFH in the 'With Hub' scenarios. No changes to the traffic matrices have been made to any of the future 'Without Hub' scenarios.

[3] https://www.pncc.govt.nz/media/3131028/10-year-plan-2018-28.pdf

[4] https://www.horizons.govt.nz/HRC/media/Media/Bus-Route-Timetable/Final-RLTP-2015-25.pdf?ext=.pdf

[5] https://www.nzta.govt.nz/planning-and-investment/national-land-transport-programme/2018-21-nltp/regional-summaries/manawatu-whanganui-region/manawatu-whanganui-2018-summary/

The PNATM has a fixed number of external light and heavy vehicle movements (based on trend growth applied to observed volumes) and so did not respond as expected for the new inter-regional heavy vehicle movements that the RFH will generate. To correct this, heavy vehicle trips to and from the RFH were manually adjusted, as the magnitude of change of activity at the new site is significantly greater and the model does not automatically increase the proportion of external traffic. The proportion of trips to all the external zones (Zones 172-185) were increased (from 15% to 25%) with a corresponding reduction in internal traffic to maintain the same number of trips in/out of the RFH. The proportion of heavy vehicles to/from the RFH travelling north, south, west and east was also altered to reflect a more realistic external distribution, as shown in Figure 6-4 of the ITA.

No changes were made to the distribution of heavy vehicle trips associated with any other sites in the modelled area, apart from the RFH, and no changes were made to the model for light vehicle trip distribution.

Tremaine Avenue Rail Freight Site

It is assumed that after the Existing Freight Hub is relocated, the existing site on Tremaine Avenue will be redeveloped to a mix of commercial, retail and industrial activity. There are many development opportunities for the existing site, however an assumption around trip generation was made to ensure traffic volumes along Tremaine Avenue were not underrepresented in the model when testing future scenarios.

For the purpose of the PNATM for the RFH, it is assumed that the site will generate the same level of traffic as the Existing Freight Hub (i.e., 4,000vpd), with employment equally divided between commercial, retail and industrial activity. The heavy vehicle proportions were adjusted downwards from 20% to 14% to reflect this changed mix of land use.

2. MODEL CHECKS

To review the accuracy of the PNATM used to assess transport effects of the RHF, model checks were undertaken to compare forecast demand against observed traffic counts. PNCC provided traffic count data for a number of points on the network surrounding the RFH site. The most recent 2020 and 2021 counts have been used to compare observed demand on key roads in the surrounding road network to the 2021 forecast model. The location of these counts is shown in **Figure 3**.

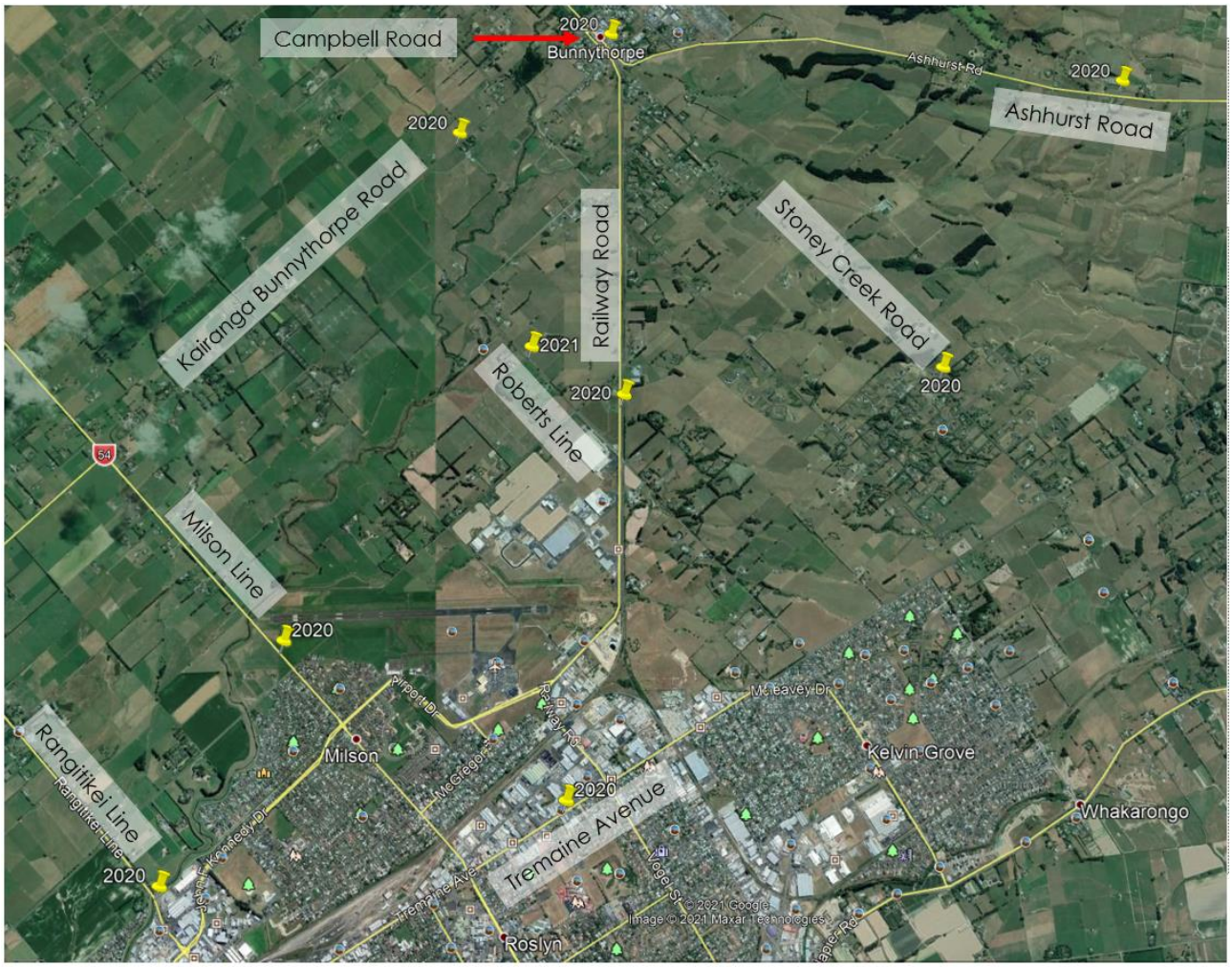

Figure 3: Traffic count locations and year

As demonstrated further below, comparison between these counts and the 2021 forecast volumes from the PNATM used to assess transport effects of the RFH show a close match. The volume comparison shows that the modelled counts are mostly within 15% of the observed traffic counts.

The GEH statistic (Geoffrey E. Havers) is a form of Chi-squared statistic that is used to compare observed and modelled counts. This is an internationally used statistic to assess the performance of models in estimating traffic flows. A GEH value will increase as the difference between modelled and observed increases. A GEH less than 5 indicates that the modelled flows compare well against the observed flows and a GEH of more than 10 suggests the modelled flows compares poorly against observed flows. The GEH compared well for almost all links scoring a GEH less than 5.

The traffic comparisons included in **Tables 1** and **2** below for the AM and PM peak hours respectively verify that the network modelled around the RFH does simulate traffic volumes that can be considered 'fit for purpose'. Therefore, the PNATM can be deemed an appropriate test tool to provide reliable outputs for the purpose of the NoR RFH assessment, as assumed from the outset of the study.

Table 1: Forecast vs traffic count volumes - AM Peak

AM PEAK				
Traffic Count Location	**Observed**	**Modelled**	**Counts vs Model**	**GEH**
Railway Road	740	660	0.88	3
Ashhurst Road	230	190	0.80	3
Stoney Creek Road	200	190	0.96	1
Campbell Road	930	840	0.90	3
Kairanga Bunnythorpe Road	140	80	0.57	6
Roberts Line	80	80	0.95	1
Milson Line	600	510	0.85	4
Tremaine Avenue	1310	1270	0.97	1

Table 2: Forecast vs traffic count volumes - PM Peak

PM PEAK				
Traffic Count Location	**Observed**	**Modelled**	**Counts vs Model**	**GEH**
Railway Road	910	800	0.87	4
Ashhurst Road	230	230	0.97	1
Stoney Creek Road	250	150	0.59	7
Campbell Road	1080	1030	0.95	2
Kairanga Bunnythorpe Road	180	100	0.56	7
Roberts Line	120	90	0.75	3
Milson Line	720	640	0.89	3
Tremaine Avenue	1300	1270	0.97	1

As shown, all results except Kairanga Bunnythorpe Road and Stoney Creek Road have GEH values less than 5. For Kairanga Bunnythorpe Road and Stoney Creek Road, the modelled volumes are lower than the observed, however the absolute volume differences are low and are assessed to have a negligible impact on the findings and conclusions drawn.

3. MODELLING OF HEAVY VEHICLES

No changes have been made to the PNATM parameters associated with heavy vehicles, as validated during the original model built by Beca.

The Beca heavy vehicle matrices were developed based on Electronic Road User Charges and 2013 traffic counts. Heavy vehicles are modelled as vehicles and not passenger car units (multiple car equivalents), in a manner typical for strategic models in New Zealand.

The route choice for heavy vehicles is based on the time it takes to reach a destination plus a distance weighted parameter depending on the type of road (e.g. collector vs a rural road).

The PNATM has then been used to obtain the traffic flows which were then used to inform the more discrete SIDRA modelling reported in the ITA. SIDRA has allowance for different light and heavy vehicle model parameters including slower acceleration and larger minimum gap requirements.

4. MODELLING OF LOCAL INTERSECTIONS

All local intersections surrounding the RFH have been included and explicitly modelled in the PNATM used to assess transport effects of the RFH. Equations considering the number of lanes available, saturation flows per lane, opposing flows, gap acceptance times, entry widths at roundabouts, and green times at traffic signals, are used in the PNATM to inform intersection performance, and intersection capacities calculated on this basis.

flows. **Figure 4** shows the intersections that have been included in the model and the intersection control assumptions.

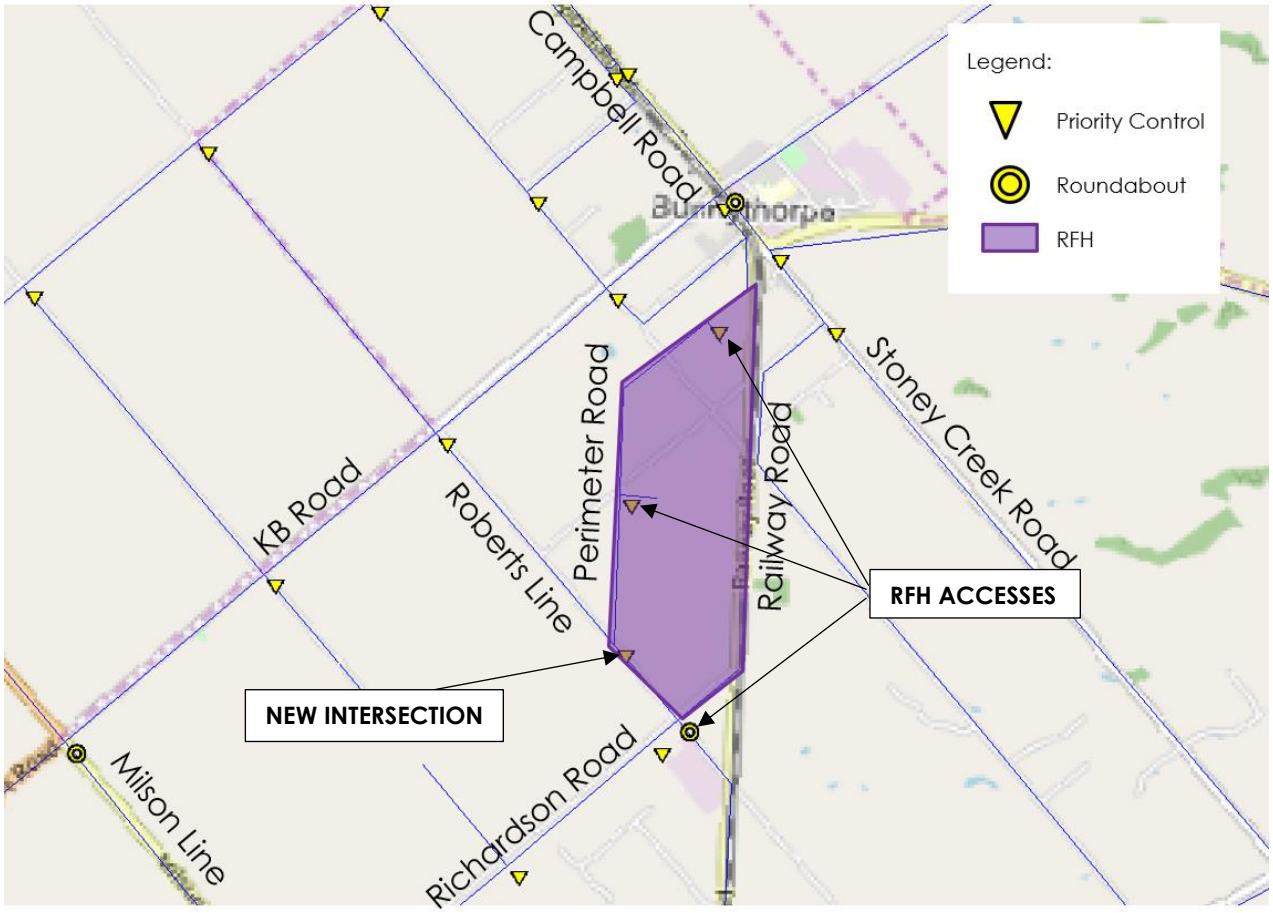

Figure 4: Modelled Network – 2041

The RFH is expected to have three accesses, with two onto the perimeter road and one at the new Roberts Line / Richardsons Line intersection. The two accesses onto the perimeter road have been modelled as a priority T intersection, with a separate left and right turn bay into the RFH. The third access forms the fourth arm of the Roberts Line / Richardsons Line roundabout.

5. LINK CAPACITIES

Modelled link capacities for the road network around the proposed RFH site have been reviewed. From Table 3.1 of the Beca Model Development and Validation Report, Link Types 4 to 11 are relevant, as repeated in **Figure 5** below.

Figure 6 then shows how the surrounding road network has been modelled with the appropriate link capacities as Rural standards.

Table 3-1 Generic Link Type Parameter

No	Type	Typical lane capacity, vph	Typical free speed, kph	Typical Friction Factor, J_A
4	Shopping/Commercial street	600	45	1.8
5	Residential	900	47	1.8
6	Collector	1000	50	1.5
7	Arterial	1250	52	1
8	Rural low standard	1450	54	0.8
9	Rural high standard	1200	85	1.5
10	Rural high HCV flows	1500	100	1.2
11	Expressway	1100	95	1.6

Figure 5: Modelled Link Type[6]

[6] Palmerston North Area Traffic Model – Model Development and Validation Report, Beca, 15 August 2014

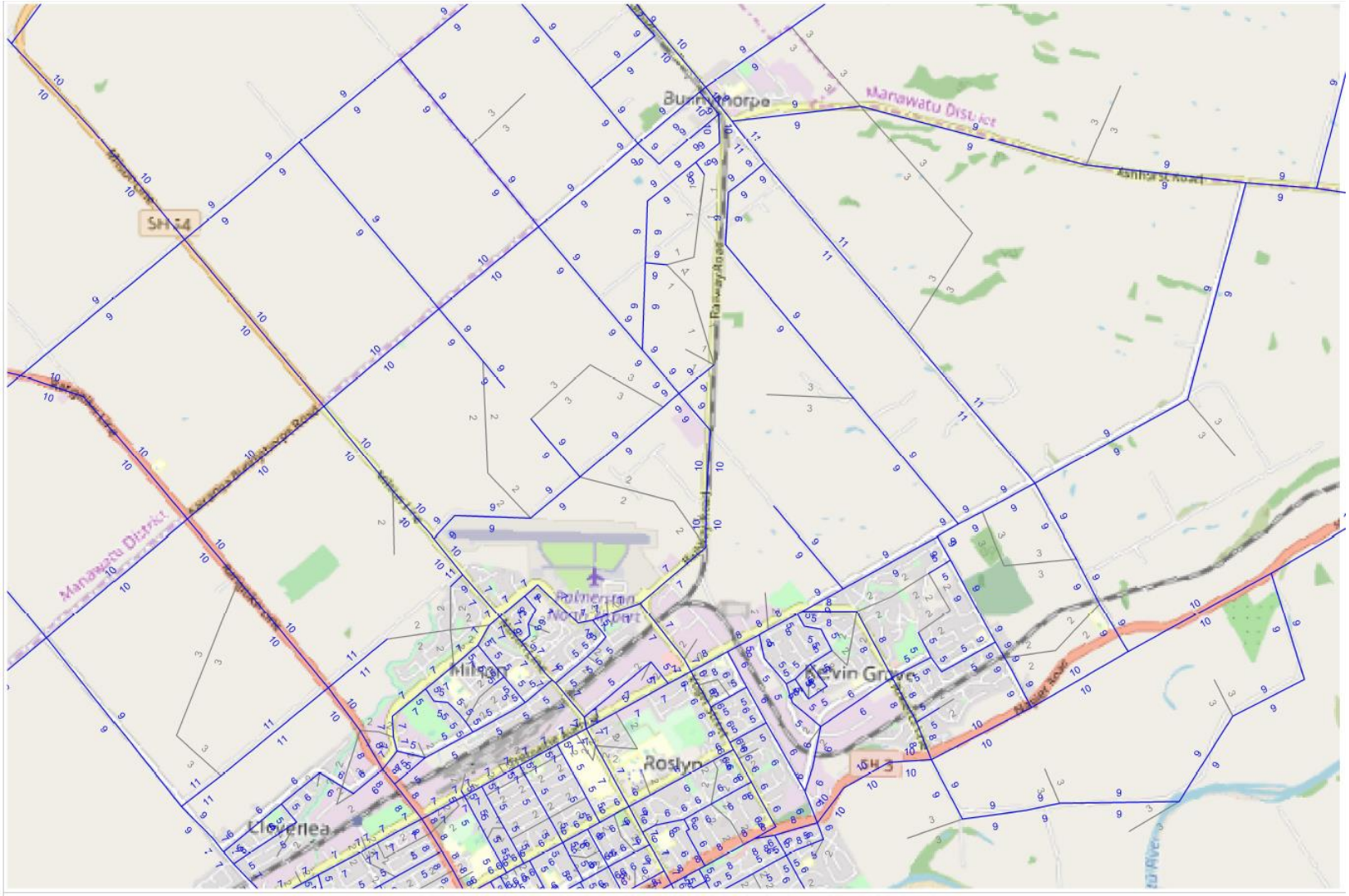

Figure 6: Mapped Link Type

6. CONCLUSION

Based on the information presented in the memo it is clear that the Model suitably represents the existing conditions and is an appropriate tool for assessing future scenarios, demonstrating that the results from the Model can be relied on to inform future decision making.

UNDER the Resource Management Act 1991 ("**RMA**")

AND

IN THE MATTER of a notice of requirement ("**NoR**") for a designation by KiwiRail Holdings Limited ("**KiwiRail**") for the Palmerston North Regional Freight Hub ("**Freight Hub**") under section 168 of the RMA

STATEMENT OF EVIDENCE OF STEPHEN CHILES
ON BEHALF OF KIWIRAIL HOLDINGS LIMITED

ACOUSTICS

1. SUMMARY

1.1 I am an acoustics specialist with specific experience in large infrastructure projects and have been engaged by KiwiRail to assist with the development of the Freight Hub. I was responsible for the Acoustics Assessment of operational and construction noise and vibration effects for the Freight Hub that was included with the Assessment of Environmental Effects ("**AEE**") as Technical Assessment Report D.

1.2 For each aspect of the acoustics assessment, I have established guideline criteria based on New Zealand Standards where available and otherwise with reference to international standards.

1.3 For the indicative site layout of the Freight Hub, I have considered likely noise and vibration emissions that may occur. For operational noise (on-site) I have used a computer model based on source data measured at other existing sites with similar activities to those proposed as part of the Freight Hub. For operational road-traffic noise, I have made a specific calculation for the new perimeter road, and for operational vibration and construction noise and vibration I have used indicative levels from previous projects.

1.4 I have examined the existing environment through observations and sound level measurements at representative locations around the Freight Hub.

1.5 I have compared predicted noise levels with guideline criteria and considered potential effects in the context of the existing environment. Without mitigation I have found that operational noise (on-site) could cause disturbance to residents over a wide area. I have found that residents may hear and feel operational noise (road-traffic), operational vibration and construction noise and vibration, but at levels within guideline criteria that should not cause undue disturbance.

1.6 I have identified controls that could be implemented to reduce emissions. For operational noise (on-site) I have found that a range of controls are required to mitigate adverse effects, including substantial noise barriers and treatment of some houses, in addition to future modelling and permanent monitoring. I have recommended that these matters be addressed through an Operational Noise and Vibration Management Plan as specified in the proposed conditions attached to Ms Bell's evidence as Appendix 1 ("**Proposed Conditions**"). For other aspects of the assessment, I have found that standard controls should be adequate to manage the potential effects. For construction noise and vibration these standard controls include use of a Construction Noise and Vibration Management Plan as specified in the Proposed Conditions.

1.7 I have recommended practical systems to implement all necessary noise and vibration controls as summarised above. With these controls, I consider the residual noise and vibration should be at reasonable levels and effects should be acceptable in this environment.

1.8 I have read the submissions relating to noise and vibration and have commented on matters raised by way of themes. I have read the technical evidence of Nigel Lloyd, who is the Section 42A noise report author. Mr Lloyd and I generally agree on fundamental matters of operational and construction noise and vibration criteria and the anticipated effects likely to arise from the Freight Hub. I have commented on areas where Mr Lloyd and I have differing opinions and on amendments to the designation conditions proposed by Mr Lloyd.

2. INTRODUCTION

2.1 My full name is Dr Stephen Gordon Chiles. I am an acoustics engineer self-employed by my company Chiles Limited. I hold the qualifications of Doctor of Philosophy in Acoustics from the University of Bath, and Bachelor of Engineering in Electroacoustics from the University of Salford. I am a Chartered Professional Engineer and a Fellow of the UK Institute of Acoustics.

Experience

2.2 I have been employed in acoustics (noise and vibration) since 1996. I have previously held positions as a research officer at the University of Bath, a principal environmental specialist for Waka Kotahi NZ Transport Agency ("**Waka Kotahi**"), and have worked as a consultant for the international firms Arup, WSP, and URS, and for the specialist firms Marshall Day Acoustics and Fleming & Barron.

2.3 I have undertaken acoustics assessments for and assisted with the designs for numerous infrastructure, industrial, commercial, recreational and residential developments, including major road projects and reconductoring of high voltage transmission lines. I was responsible for the acoustics assessment for Te Ahu a Turanga, Manawatū Tararua Highway and am currently involved in the Ōtaki to north of Levin project for Waka Kotahi.

2.4 I have extensive experience advising on and assessing noise and vibration effects from the railway network. I have frequently been engaged by KiwiRail over the last decade to advise on various noise and vibration issues associated with the railway network, including in relation to the Paekākāriki and Wairoa rail yards, the Temuka container transfer site, the monitoring and operation of the track and rolling stock, and controls for new sensitive land uses establishing near railways. I have also been involved in railway noise and vibration issues in association with other infrastructure projects that involved re-establishing or relocating railway lines, including the previously proposed Holcim Weston cement plant, and the Peka Peka to North Ōtaki and Baypark to Bayfair Link road projects.

2.5 I was an Independent Commissioner for plan changes for Queenstown and Wanaka Airports and a plan variation for Port Nelson, which addressed noise effects around large transportation infrastructure sites.

2.6 I am an independent professional advisor to Waka Kotahi for noise and vibration. I am frequently engaged to review or advise on matters relating to the development, operation and maintenance of the state highway network. I was the editor of guides on road-traffic noise assessment, noise barriers, road surface noise, building treatment, land-use planning for sensitive activities near highways, and construction and maintenance noise and vibration.

2.7 I am currently subcontracted by Southern Monitoring Services as the principal advisor for the Environmental Noise Analysis and Advice Service, advising the Ministry of Health and Public Health Services on environmental noise.

2.8 I am a convenor of the New Zealand reference group for 'ISO' acoustics standards, an observer of the 'IEC' committee for acoustics instrumentation standards and a member of joint Australian and New Zealand committees for acoustics standards. I was chair of the 2012 New Zealand acoustics standards review group, chair for the 2010 New Zealand wind farm noise standard revision and member for the 2008 New Zealand general environmental noise standards revision.

Involvement in the Freight Hub

2.9 I was engaged by KiwiRail in July 2019 to advise on and assess operational and construction noise and vibration associated with the Freight Hub. For this work I have:

(a) undertaken acoustics evaluations for each stage of the multi criteria analysis ("**MCA**") used by KiwiRail to identify the preferred site for the Freight Hub (AEE Volume 2, Appendix F5);

(b) advised KiwiRail in developing the indicative site layout for the Freight Hub;

(c) attended community meetings at Bunnythorpe School, and online, in July and September 2020;

(d) prepared the Acoustics Assessment that was included with the AEE for the Freight Hub (AEE Volume 3, Technical assessment report D);

(e) provided input to KiwiRail's section 92 response dated 15 February 2021 (Attachment 7) ("**First Section 92 Response**"); and

(f) provided input to KiwiRail's section 92 response dated 28 May 2021 regarding noise and vibration matters (Attachment 6) ("**Third Section 92 Response**").

2.10 I have been assisted in this work by Michael Smith of Altissimo Consulting. Mr Smith has reviewed my assessment, deputised for me during parts of the MCA process, and conducted the acoustics computer modelling and measurements.

Code of conduct

2.11 I confirm that I have read the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2014 and that I agree to comply with it. I confirm that I have considered all the material facts that I am aware of that might alter or detract from the opinions that I express, and that this evidence

is within my area of expertise, except where I state that I am relying on the evidence of another person.

3. SCOPE OF EVIDENCE

3.1 This statement of evidence will:

(a) provide an overview of the methodology and key conclusions of the Acoustics Assessment;

(b) respond to the submissions received that relate to noise and vibration matters; and

(c) address relevant matters raised in the Council's Section 42A Report ("**Section 42A Report**").

4. METHODS OF ASSESSMENT

4.1 As set out above, my involvement with the Freight Hub has included input to the site selection and development of the indicative design, as well as assessment of the noise and vibration effects of the Freight Hub as it is now set out in the NoR. My work has been iterative in that I have been evaluating potential effects since being engaged at the start of the MCA process in mid-2019, and I have been working with the project team to adjust and develop the indicative design to reduce and mitigate those effects where practicable. This process has contributed to specific elements of the indicative design that are beneficial for noise and vibration as set out in Section 1 of the Acoustics Assessment (also in the response to request 30 of the First Section 92 Response). The Acoustics Assessment and my evidence consider the effects of the Freight Hub, including this configuration of key elements on the site in the indicative design.

4.2 My Acoustics Assessment addresses construction and operational noise and vibration effects associated with the Freight Hub. Criteria, potential effects and appropriate assessment methodologies vary for different aspects so I have separately considered:

(a) operational noise (on-site);

(b) operational noise (road-traffic);

(c) operational vibration; and

(d) construction noise and vibration.

4.3 As set out in Section 1 of the Acoustics Assessment,[1] I have not considered noise and vibration from trains on the North Island Main Trunk ("**NIMT**") that operate in an existing designation authorising that activity, and I have not considered alteration of the national locomotive and wagon fleet to be a practicable option for noise mitigation for this specific site.

Operational noise (on-site)

4.4 In the Acoustics Assessment and my evidence, I use the term "on-site" to refer to activity within the Freight Hub, which excludes the new perimeter road and ancillary areas for stormwater retention, noise barriers and landscaping outside the Freight Hub. The Proposed Conditions will set noise criteria for on-site activity in place of underlying District Plan zone rules. While the zone rules can remain a relevant benchmark for establishing criteria, in this case the District Plan exempts most train activity from the noise limits.

4.5 There is no standardised method in New Zealand for assessing operational noise from an activity of this nature (being an intermodal freight and distribution hub). I have therefore considered noise effects with reference to a range of analogous standards,[2] and through broader consideration of changes in sound levels and potential sound characteristics. I have adopted progressive noise criteria, with three steps.[3] The first step is to achieve Category A external daytime, evening and night-time noise limits at existing houses. If that is not practicable, the second step (Category B) is treatment of existing houses to be implemented by KiwiRail if required to maintain reasonable internal noise environments. The final step is Category C upper external noise limits not to be exceeded at existing houses. The relevant categories and criteria are set out below in Figure 1.

1 Technical Report D, dated 23 October 2020, at page 7.

2 Technical Report D, dated 23 October 2020, at page 17, Table 4: airports (NZS 6805), ports (NZS 6809).

3 Technical Report D, dated 23 October 2020, at page 18, Table 5.

	Noise criteria	Comments
Category A	Day: <55 dB $L_{Aeq(1h)}$ Evening: <50 dB $L_{Aeq(1h)}$ Night: <45 dB $L_{Aeq(1h)}$ Night: <75 dB L_{AFmax}	Similar to existing noise allowed from the NEIZ. A change from existing Rural Zoned activity (R9.11.1), but noise would remain compatible with residential activity in both rural and residential zones.
Category B	Day: 55-65 dB $L_{Aeq(1h)}$ Evening: 50-60 dB $L_{Aeq(1h)}$ Night: 45-55 dB $L_{Aeq(1h)}$ Night: 75-85 dB L_{AFmax}	Houses may need to be acoustically treated and mechanically ventilated as necessary to meet a level of 35 dB $L_{Aeq(1h)}$ in bedrooms and 40 dB $L_{Aeq(1h)}$ in other habitable spaces.
Category C	Day: >65 dB $L_{Aeq(1h)}$ Evening: >60 dB $L_{Aeq(1h)}$ Night: >55 dB $L_{Aeq(1h)}$ Night: >85 dB L_{AFmax}	Freight Hub noise is likely to be incompatible with residential activity.

Figure 1: Operational Noise Criteria

4.6 Under my direction, my subconsultant Mr Smith has obtained indicative sound level data for the main Freight Hub activities on the selected site, primarily by taking measurements at other existing rail facilities, as set out in Section 5 of the Acoustics Assessment.[4] The main Freight Hub activities measured were:

(a) rail movements;

(b) container and log handling;

(c) refrigerated containers;

(d) workshop activity;

(e) truck movements; and

(f) ventilation plant.

4.7 Mr Smith has then prepared a computer model of the Freight Hub and surrounding area to predict noise contours generated by indicative activity.[5] This relates to a busy one-hour period of activity at the Freight Hub ("**Site**") and has been repeated with and without indicative noise barriers around the Site. Details of this modelling are set out in Section 5 of the Acoustics

4 Technical Report D, dated 23 October 2020, at pages 23 to 27.

5 Technical Report D, dated 23 October 2020, at page 28, Table 11. The sources considered were a number of locomotive and wagon movements, cut-offs and break squeals, top loaders, forklifts, reefers, road trucks, log loaders, various emissions from workshops, and ventilation fans.

Assessment.[6] I have also considered maximum sound levels of short duration events based on the separation distance from activities.

4.8 In response to the Third Section 92 Request 11, I arranged for Mr Smith to conduct an additional sound level survey at the Rail yard at Tremaine Avenue ("**Existing Freight Yard**") to specifically capture the sound of coupling during shunting activities. A summary of these additional measurements is attached as **Appendix A**. The individual sound level maxima from coupling are essentially the same as levels previously assessed from other aspects of the Freight Hub and the results do not alter the indicative noise contours, or my assessment findings.

4.9 Using the predicted sound levels for operational (on-site) activity I have considered potential effects at houses in the area with reference to the Category A, B and C criteria I have discussed at paragraph 4.5 above, and the existing environment which I describe below.

Operational noise (road-traffic)

4.10 I have evaluated operational road-traffic noise from the new perimeter road with reference to criteria in the applicable New Zealand Standard (NZS 6806). The District Plan references NZS 6806 for road-traffic noise, and the new perimeter road falls within the scope of that standard. NZS 6806 sets absolute rather than relative noise criteria to protect people living near roads from sleep disturbance and to provide a reasonable level of residential amenity.[7] I have predicted road-traffic noise at the nearest house to the new perimeter road using a Waka Kotahi online calculator and compared the level with the criteria in NZS 6806.

4.11 For roads in the wider area, I have examined future traffic forecasts with and without the Freight Hub to identify roads where the Freight Hub could cause a significant increase in general traffic or trucks in particular. In Section 5 of the Acoustics Assessment, I have identified three sections of road based on 2031 traffic forecasts.[8] In the First Section 92 Response, I repeated this exercise using a traffic forecast for 2041 with the full development of the Freight Hub.[9] For this 2041 scenario, I identified a fourth section of road (part of Railway Road) that may also have a significant increase in trucks as set out in the First

6 Technical Report D, dated 23 October 2020, at pages 23 to 29.

7 Technical Report D, dated 23 October 2020, at page 20, Table 6.

8 Technical Report D, dated 23 October 2020, at page 30, Table 13: 2031 forecast; parts of Stoney Creek Road, Roberts Line, and Kairanga Bunnythorpe Road.

9 First section 92 response, Attachment 9.

Section 92 Response. For each of the roads with significant increases in traffic due to the Freight Hub I have considered the resulting traffic volumes in terms of the nature and classifications of the specific roads.

Operational vibration

4.12 I have evaluated operational rail vibration with reference to an overseas criterion (Norwegian Standard NS 8176 Class C: 0.3 mm/s $v_{w,95}$) that is commonly used in New Zealand for both road-traffic and rail vibration, as set out in Section 4 of the Acoustics Assessment.[10] I made a screening assessment to check whether any existing residential dwellings would be close enough to a new section of rail track in the Freight Hub to be at risk of exceeding this guideline criterion, based on indicative data from a previous project.

Construction noise and vibration

4.13 I have adopted criteria from the applicable New Zealand Standard (NZS 6803) to evaluate construction noise,[11] and criteria published by Waka Kotahi (based on international standards) for construction vibration.[12] For both construction noise and vibration, I identified locations where there is risk of exceeding criteria based on typical distances for similar types of activity on previous projects, as set out in Section 5 of the Acoustics Assessment.[13] I then considered the practicality of management measures for construction activity in those specific locations.

5. EXISTING ENVIRONMENT

5.1 Details of my assessment of the existing environment are set out in Section 3 and Appendix A of the Acoustics Assessment. My focus is on the noise environment at existing dwellings around the Site. I have considered existing noise in the area based on measurements made over a week at four representative locations, coupled with short duration 'spot' measurements and observations at those four locations together with an additional three locations.

5.2 The survey locations along with an indication of District Plan zoning are shown on the following Figure 2, taken from the Acoustics Assessment.[14] The

10 Technical Report D, dated 23 October 2020, at pages 20 to 21.

11 Technical Report D, dated 23 October 2020, at page 21, Table 7.

12 Technical Report D, dated 23 October 2020, at page 22, Table 8.

13 Technical Report D, dated 23 October 2020, at page 32, Figure 10, and First Section 92 Response, Attachment 7, Figures 12 to 17.

14 Technical Report D, dated 23 October 2020, at page 11, Figure 1.

measurements were made by Mr Smith, and I have also personally observed the area around the Site on several occasions, including inspection of the locations of nearby dwellings.

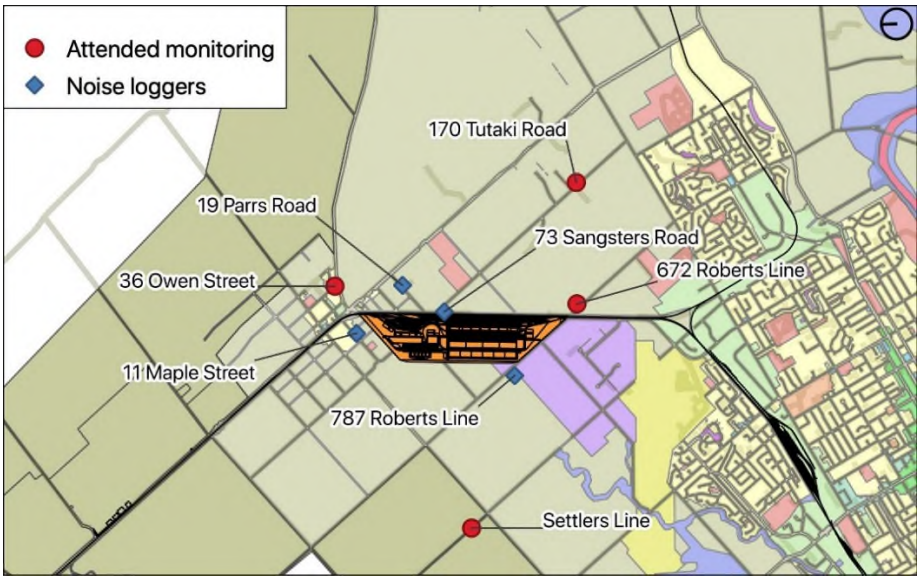

Figure 2: Survey Locations

5.3 I have found that the existing noise environment varies significantly around the Freight Hub Site and between different times of day. Parts of the area are in transition with the ongoing development of the North East Industrial Zone ("**NEIZ**"), whereby progressively more anthropogenic sounds are present. Many occupiers of dwellings in the area surrounding the Site are currently exposed to noise from road, rail, airport and industrial activity, as well as from general environmental sounds. At some locations individual trains, aircraft and trucks can cause relatively high sound levels as they pass.

5.4 However, at times and particularly in locations further from existing activity, there can be relatively quiet periods, although not akin to say a remote rural area. Detailed tables and graphs showing the measured sound levels are in the Acoustics Assessment.[15]

6. ASSESSMENT OF POTENTIAL ACOUSTIC EFFECTS

6.1 As summarised below, my assessment focuses on adverse noise and vibration effects from the operation and construction of the Freight Hub, which to some extent are inherent in large infrastructure of this nature.

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15 Technical Report D, dated 23 October 2020, at pages 11 to 15, Tables 1/2, Figures 2 to 7, and Appendix A.

Positive effects

6.2 In Section 6 of the Acoustics Assessment, I outline a number of positive noise and vibration effects associated with the Freight Hub.[16] In summary, these are:

(a) removal of activity at the Existing Freight Yard is likely to result in reduced noise exposure of nearby houses, particularly to the north;

(b) realignment of the NIMT between Roberts Line and Bunnythorpe which consequently enables construction of the east noise barrier will reduce noise and vibration at houses to the east. In particular:

(i) the NIMT will be further away from these houses;

(ii) the trains will be moving on a flattened section of the NIMT (this section of the NIMT currently undulates significantly but the Freight Hub will be a level site);

(iii) the new tracks on the NIMT on uniformly compacted ground will minimise discontinuities and structures likely to give rise to vibration; and

(iv) removal of all road crossings over the railway will reduce the need for any bells or use of train horns on that section of the NIMT;

(c) removal of a section of Railway Road between Roberts Line and just before Maple Street will reduce road-traffic noise at houses to the east; and

(d) closing Roberts Line at Railway Road will result in significantly less traffic to the south on Roberts Line and reduced road-traffic noise affecting nearby houses.

Adverse effects

Operational noise (on-site)

6.3 Without mitigation, as represented in Figure 3 below taken from the Acoustics Assessment,[17] the computer modelling shows the operation of the Freight Hub

16 Technical Report D, dated 23 October 2020, at page 33.

17 Technical Report D, dated 23 October 2020, at page 29, Figure 9.

could result in noise above recommended Category A criteria[18] over a wide area. In my experience, such noise exposure in this environment would be likely to result in disturbance to residential activities, with the extent being dependent on the specific relationship of each individual house to the Freight Hub and existing noise sources.

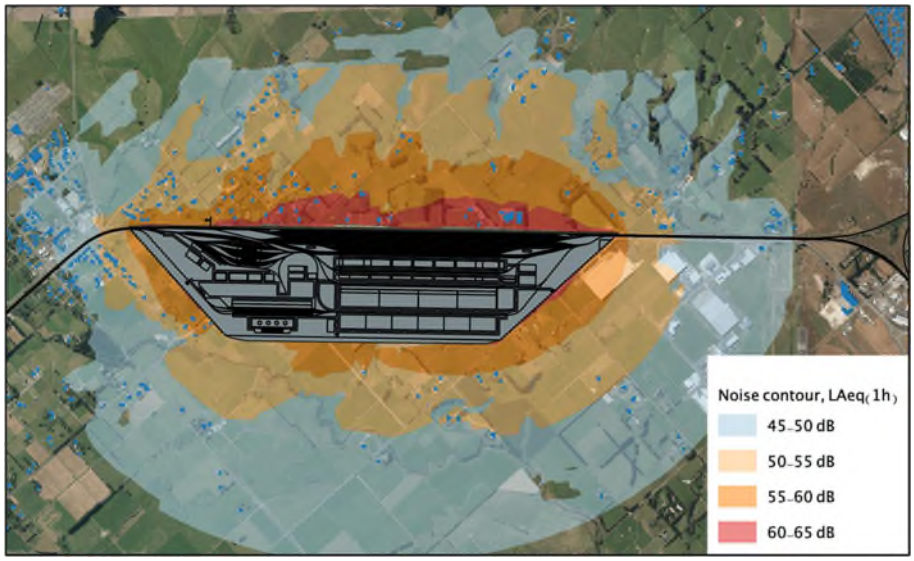

Figure 3: Noise modelling without mitigation

Operational noise (road-traffic)

6.4 The predicted noise level from road-traffic on the new perimeter road complies with the NZS 6806 Category A criterion. In my opinion, this indicates that while the noise from road-traffic will be clearly audible, it should be at a reasonable level compatible with residential activity.

6.5 As set out in Section 6 of the Acoustics Assessment,[19] I have found that changes in traffic volumes on other roads in the wider area that can be attributed to the operation of the Freight Hub, and the associated noise, are within reasonable expectations for the types of road. These roads being classified as arterials or primary collectors (One Network Road Classification), or as a strategic freight route in the District Plan.

Operational vibration

6.6 Due to the separation of the new rail tracks from houses, there should be compliance with the guideline criterion (NS 8176 Class C) based on indicative levels. In my opinion, operational activity should therefore have only minor

18 Technical Report D, dated 23 October 2020, at page 18, Table 5.

19 Technical Report D, dated 23 October 2020, at page 36.

vibration effects. Vibration may be felt in some locations, but the majority of people should not be unduly disturbed.

Construction noise and vibration

6.7 With normal good practice management, construction noise and vibration effects should be minor due to the separation of works from most existing houses, the scope to avoid night works in most locations, and the ability to provide mitigation such as permanent or temporary screening, if required.

Conclusion on effects without mitigation

6.8 For operational noise (road-traffic), operational vibration, and construction noise and vibration, there should be compliance with criteria with standard controls applied, such as asphaltic road surface/noise barriers, uniform ground and track formation, and a Construction Noise and Vibration Management Plan. For these aspects the activity may be heard and felt, but at reasonable levels that should not cause undue disturbance to most people.

6.9 Based on the predictions without mitigation for operational noise from the Freight Hub (on-site), I consider that substantial controls are required to manage noise effects. These controls are discussed in the next section of my evidence.

7. MEASURES TO ADDRESS EFFECTS

Operational noise (on-site)

7.1 A critical outcome of my input to the Freight Hub development has been the inclusion / creation of sufficient space for substantial noise barriers on the east and north boundaries of the Freight Hub, in addition to a more typical 3 metre high noise barrier on the west boundary.

7.2 The east boundary of the Site is critical as it adjoins the large open marshalling area, so the indicative design has a 3 kilometre long, 5 metre high noise barrier on this boundary. I anticipate during detailed design that the central part of this noise barrier may be slightly increased in height (to say 7 or 8 metres high) to account for the elevated position of some houses.

7.3 The north boundary of the Site is complex as the ground level of the houses on Maple Street are generally higher than the Site. To be effective the noise barrier needs to be located on the higher ground nearer the houses making it 8 metres above the Site (3 metres above the local ground level). For the most affected houses the barriers provide in the order of 5 dB reduction. With

appropriate landscaping they should also assist in reducing the perception of noise through visual screening.

7.4 With the above indicative noise barriers, the modelling set out in Section 7 of the Acoustics Assessment shows that predicted noise contours reduce, although guideline criteria would still be exceeded for unconstrained operation with no limit on the type of equipment or timing of activities. These noise contours are shown in Figure 4 below reproduced from the Acoustics Assessment.[20]

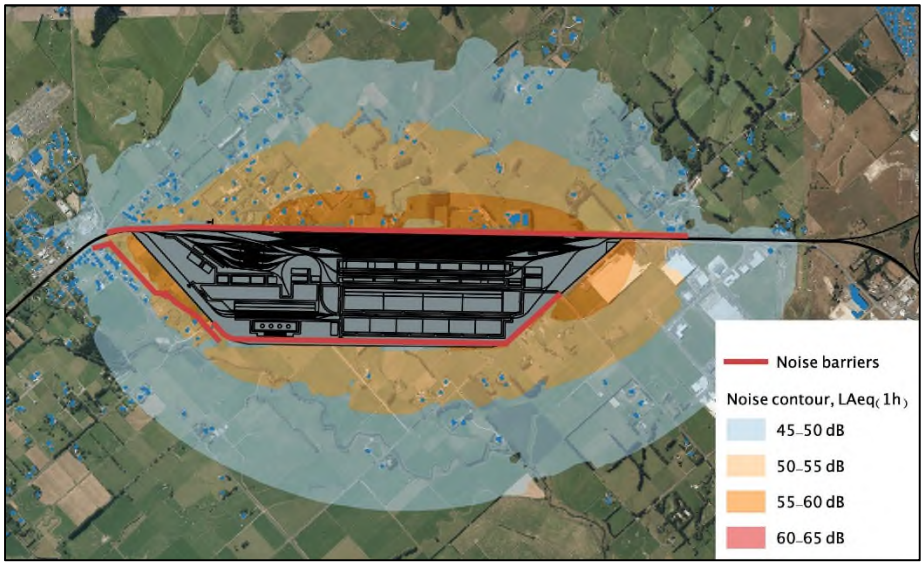

Figure 4: Noise modelling with mitigation

7.5 I have recommended extensive controls to address noise effects through an Operational Noise and Vibration Management Plan, as required by Proposed Conditions. These controls include:

(a) operation in accordance with noise criteria as set out in the Acoustics Assessment;

(b) implementation of substantial noise barriers;

(c) determination of where Category A noise criteria may be exceeded (at the time of detailed design) and treatment of affected existing houses where required to achieve internal noise criteria;

(d) modelling and monitoring of noise and vibration, including permanent noise monitors; and

20 Technical Report D, dated 23 October 2020, at page 38, Figure 12.

(e) good practice site management to avoid unreasonable noise.[21]

Operational noise (road-traffic)

7.6 As discussed above, I consider that no specific controls should be required for operational road-traffic noise.

Operational vibration

7.7 As discussed above, I consider that operational vibration should not need further control, but I recommend this should be verified under the Operational Noise and Vibration Management Plan during detailed design and commissioning.

Construction noise and vibration

7.8 I have recommended that construction noise and vibration effects should be managed in accordance with standard practice, including implementation of a Construction Noise and Vibration Management Plan, as required by the Proposed Conditions. The Construction Noise and Vibration Management Plan will include:

(a) details of the works including times/days, equipment including any noise / vibration controls, and projected noise and vibration levels;

(b) identification of affected dwellings;

(c) procedures for monitoring and reporting of construction noise and vibration; and

(d) good practice site management.

Conclusion on effects with mitigation

7.9 KiwiRail has accepted all of my recommendations for noise and vibration controls, and these are included in the Proposed Conditions.

7.10 The Freight Hub will alter the existing noise environment in some areas, and construction and operational activity will be audible over a wide area. However, with the mitigation and controls I have recommended, the residual noise and vibration should be at reasonable levels and effects should be acceptable in this environment.

21 Technical Report D, dated 23 October 2020, at pages 38 and 39.

8. RESPONSE TO SUBMISSIONS

8.1 I have read all submissions relating to the acoustics effects of the Freight Hub. I met a significant proportion of the submitters at two community meetings at Bunnythorpe School in 2020 (some people on both occasions), and from those conversations I was aware of many concerns now raised in the written submissions and had considered them when preparing the Acoustics Assessment. However, there are a number of additional matters that have been raised in written submissions, which I respond to generally by way of themes rather than individual submissions.

8.2 In terms of general matters, several submitters raise concerns around construction noise and vibration. In my opinion, the Proposed Conditions[22] are appropriate to manage the effects of construction noise and vibration as discussed in submissions. Various submitters also raise concerns about off-site road-traffic noise associated with changes to the network and traffic generated by the Freight Hub. I have set out above why I consider the Freight Hub will result in reasonable levels of off-site road-traffic noise with no specific controls required.

Site selection

8.3 Many submissions raise general concerns about adverse noise effects, particularly operational noise (on-site). This Site is relatively near to numerous existing residential properties and the operation of the Freight Hub will unavoidably change the existing noise environment. In the Acoustics Assessment and my evidence above, I have set out measures I have recommended to mitigate operational noise (on-site) and my finding that the resulting noise should be at reasonable levels.[23] However, there will still be a change to the noise environment currently experienced by many residents as a consequence of developing the Site.

8.4 Some submitters raise concerns that this location for the Freight Hub was not the best option in terms of operational noise effects. I provided information on noise effects to inform the site options assessment, with noise and vibration one of many considerations in choosing the preferred site. While other sites may have affected fewer people and had lesser noise effects, this consideration was balanced against other factors such as ecological effects, the proximity to industrial areas, and ability to efficiently integrate with the wider

22 Evidence of Karen Bell, dated 9 July 2021, at Appendix 1.

23 Technical Report D, dated 23 October 2020, at page 41.

transport network. Further detail on the site selection process is set out in the evidence of Ms Poulsen and Ms Bell.

Curfew

8.5 There are numerous submissions that seek to limit hours of operation of the Freight Hub by introducing a curfew with no activity at night. The evidence of Mr Moyle explains why it is essential to KiwiRail for the Freight Hub to be able to operate at all times.[24]

8.6 In terms of noise, some Freight Hub operations can be conducted in compliance with the Category A night-time noise criteria, set to avoid sleep disturbance. Such Freight Hub operations may include indoor activity, activity further from houses and lower noise generating vehicles and equipment. I do not consider there to be a valid reason to prevent such activity on the basis of noise effects.

8.7 For other activity that does not comply with the external Category A noise limits, the proposed operational noise (on-site) Category B criteria, would require houses to be treated to avoid sleep disturbance inside bedrooms. This process would occur through the Operational Noise and Vibration Management Plan as required by the Proposed Conditions. Again, if the noise effect is managed in this way, I consider it appropriate to allow this activity at night.

Detailed information

8.8 Many submitters have raised concerns around the level of details in the Acoustics Assessment (including in relation to night operations). In my opinion, the level of detail that submitters appear to be seeking should be provided at a later stage with Outline Plans, as the Freight Hub design is developed. I consider the level of detail in the Acoustics Assessment at this time to be sufficient to assess the envelope of noise effects, to establish the controls required as designation conditions and to have confidence there is sufficient space for practicable noise mitigation. I have been involved in notices of requirement for several state highway designations, without developed designs.[25] In my experience, it is normal in these cases for there to be only indicative designs rather than detailed designs at the time of the NoR.

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24 Evidence of Todd Moyle, dated 9 July 2021, at Section 7.

25 Warkworth to Wellsford, Woodend Bypass, Hamilton Southern Links.

Personal health conditions

8.9 Several submissions refer to personal health conditions that may cause or contribute to increased noise sensitivity of some residents. I do not have specific expertise in personal health. As is normal for environmental noise assessments, my evidence is based on criteria for community response to noise. I understand from an RMA perspective that the approach is to treat noise sensitivity based on normal responses.

Noise barriers

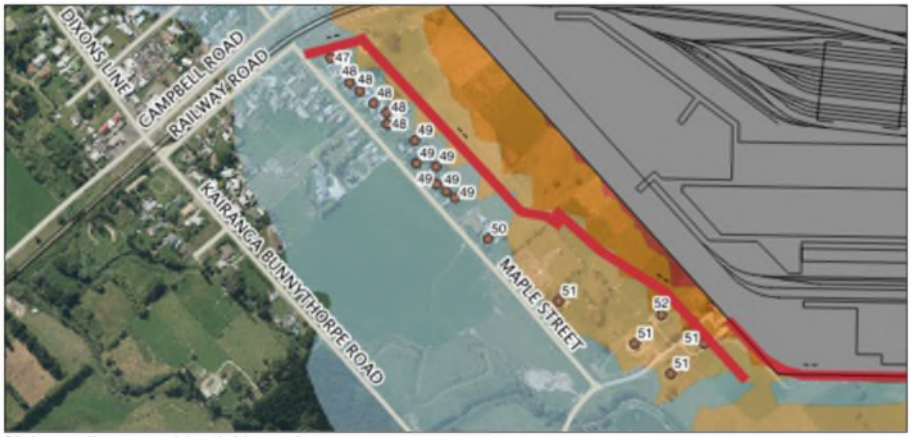
8.10 Various submitters seek for the indicative noise barriers to be established early in the construction process, although Glen and Karen Woodfield (Submitter 6) seek the opposite. In my opinion, noise barriers would provide a noise benefit if constructed early, as they would reduce construction noise and NIMT noise. However, the east noise barrier cannot be built until Railway Road is closed and the NIMT is moved, which, as set out in Mr Skelton's evidence, in turn need stormwater ponds, various earthworks and the new perimeter road to be completed.[26] I recommend that noise barriers be constructed as early as possible in the construction programme, but anticipate there will be practical constraints dictating the earliest timing for at least some parts of the barriers.

8.11 The earliest practicable timing for the construction of each noise barrier should be set out in the Operational Noise and Vibration Management Plan once the detailed design has been undertaken. I expect the north barrier by Maple Street will be constructed at an early stage before most other works, but the east and west barriers would be at a later stage. After construction for stormwater, earthworks, perimeter road, and NIMT, the east and west barriers should be constructed before further works on the Site. Any temporary localised barriers required to reduce construction noise would be identified in the Construction Noise and Vibration Management Plan.

8.12 Glen and Karen Woodfield seek that the indicative north noise barrier be realigned to the south away from the boundary with Maple Street houses. The north noise barrier location is constrained by the topography and to be effective it needs to be near the property boundary at both the east and west ends of Maple Street properties. However, towards the east there is scope for some refinement of the alignment. I have shown in Figure 5 below noise contours from the current noise model above an alternative illustrative barrier alignment. The practicality of this alternative alignment would need to be confirmed through detailed design and it needs to be adjusted to allow for the perimeter

[26] Evidence of Mike Skelton, dated 9 July 2021, at Section 7.

road. However, this indicates that there should be scope to refine the location of the bund away from some houses during detailed design.



Noise wall near residential boundary

Noise wall near site boundary

Figure 5: Alternative positioning of the north noise barrier

8.13 Helen and Pita Kinaston (Submitter 27) seek that the indicative west noise barrier to be realigned to the west of the new perimeter road, rather than along the boundary of the Freight Hub east of the new perimeter road. In this location the new perimeter road is in the order of 2 metres lower than the Freight Hub, primarily due to the existing height of Roberts Line at its proposed intersection with the new perimeter road. Therefore, a 3 metre high noise barrier to the west of the new perimeter road would only extend approximately 1 metre above the ground level of the Freight Hub and would not provide effective acoustics screening for vehicles and equipment operating along the west of the warehouse buildings. I therefore recommend the west noise barrier should remain at the Freight Hub boundary.

North Island Main Trunk

8.14 Several submissions raise concerns about noise and vibration from trains on the NIMT in the general area, including effects of longer trains and more

frequent trains. Letitia Stick (Submitter 39) questions why noise barriers do not extend from Palmerston North to Fielding. I have not considered these matters in my assessment as trains on the NIMT are operating in an existing designation authorising that activity.

8.15 Some submissions raise concerns with vibration from the portion of the NIMT through the Site. As set out in the Acoustics Assessment, vibration at the nearest houses to the east should significantly reduce due to the improved standard of the new NIMT alignment further from houses.[27]

MidCentral District Health Board ("MDHB")

8.16 Vern Goodwin advised MDHB (Submitter 94) on environmental noise. I met Mr Goodwin to discuss issues he had identified, prior to the MDHB submission being lodged. I agree with Mr Goodwin (MDHB submission point 6) that KiwiRail should offer to meet the costs of treating houses if necessary to comply with the proposed criteria. This is required under the Operational Noise and Vibration Management Plan in the Proposed Conditions. I also agree with Mr Goodwin (MDHB submission point 7) that KiwiRail should adopt the Best Practicable Option to avoid unreasonable noise. This should be implemented under the Operational Noise and Vibration Management Plan and the Construction Noise and Vibration Management Plan as required by Proposed Conditions.

8.17 There is one technical matter where Mr Goodwin and I appear to disagree to some extent. This relates to the application of a penalty for special audible characteristics ("**SACs**") as raised in MDHB submission point 4. I also discussed essentially the same issue in the response to the First Section 92 Request for requests 18 and 19.

8.18 I agree with Mr Goodwin that sounds with SACs can cause more annoyance and these are normally (but not always) subject to a penalty to account for this effect. Typically, the penalty can be the addition of 5 dB to a noise level before determining compliance with a noise limit. The application of a penalty can be triggered by either subjective or objective evaluations.

8.19 A key reason I have recommended that the Freight Hub should not be subject to penalties for SACs is that normal railway noise has audible characteristics, and in my experience there are frequently conflicting subjective evaluations of whether particular characteristics constitute SACs. In some cases, such as for tonality, an objective evaluation can be used to resolve conflicting subjective

[27] Technical Report D, dated 23 October 2020, at page 33.

evaluations, but in other cases there is no objective method. The operational noise criteria I have proposed are designed for railway noise including normal railway noise characteristics.

8.20 As a means to at least partially address the concern raised by Mr Goodwin through the MDHB submission, I propose to modify the operational noise criteria so that a penalty for SACs is applied if shown to be applicable by an objective test in accordance with NZS 6802:2008. This would allow for SAC penalties to be applied for any tonal noise, but would avoid dispute over subjective evaluations of other audible characteristics of normal railway noise. To give effect to my recommendation the Proposed Conditions attached to Ms Bell's evidence as Appendix 1 have been updated and I agree with these changes.

Ministry of Education

8.21 The Ministry of Education (Submitter 92) raises questions around potential noise effects at Bunnythorpe School. I have addressed this matter in the Third Section 92 Response. In summary, due to the separation of the school from the Site, there should not be disturbance from construction or operational noise. In my opinion, no specific additional controls are required in relation to the school as the Construction Noise and Vibration Management Plan and the Operational Noise and Vibration Management Plan required by Proposed Conditions address potential effects at all locations.

Assessment methodology

8.22 Various submitters raise concerns with aspects of my assessment methodology. I have reviewed all of these matters and confirm that in my opinion I have applied an appropriate methodology. I will comment on some specific matters raised.

8.23 Rochelle & Rex McGill (Submitter 7) question monitoring being during a period partially affected by COVID travel restrictions. I do not consider this to be material, but any influence would be likely to result in lower measured levels and hence if anything overstating adverse noise effects of the Freight Hub.

8.24 Martin Jones (Submitter 16) questions standards applied, although appears to conflate a Norwegian Standard applied for rail vibration with a New Zealand Standard referenced with respect to aircraft noise. I confirm that I consider appropriate standards to have been applied. I note that the Norwegian Standard for rail vibration has been used as it has recommended criteria based

on surveyed response curves, rather than other standards Mr Jones quotes which are related but do not provide such criteria.

8.25 Danelle O'Keeffe and Duane Butts (Submitter 72) assert that significant baseline noise monitoring is required at various distances and directions from the Site. In my opinion, the monitoring that has been conducted is appropriate to provide an understanding of the existing environment. In terms of future compliance monitoring, this would be based on absolute levels so does not require a baseline in the same manner as say wind farms (under NZS 6808).

9. RESPONSE TO SECTION 42A REPORT

9.1 I have reviewed the sections of the Section 42A Report relevant to my evidence, particularly the report / evidence of Nigel Lloyd dated 18 June 2021.

9.2 Mr Lloyd has made an extensive commentary on my Acoustics Assessment. While Mr Lloyd and I have set some matters out in different ways or reached a conclusion for different reasons, my reading of his evidence is that, subject to comments below, we are generally in agreement on fundamental matters of the nature and extent of noise and vibration effects from the Freight Hub, and the appropriate operational and construction noise and vibration criteria. Some of the areas where Mr Lloyd and I diverge appear to relate primarily to legal or planning questions rather than technical acoustics matters. I will discuss these below.

9.3 I will focus my comments on key areas of difference between my Acoustics Assessment and Mr Lloyd's evidence. I will address changes to the proposed conditions recommended by Mr Lloyd in the appendix to his report. Where Mr Lloyd has raised issues with the wording of my assessment or minor details, while I do not necessarily agree with him, I do not comment on these unless they are material to outcomes.

North Island Main Trunk Line

9.4 Mr Lloyd has disagreed with my approach to the existing NIMT, by omitting it from the assessment of noise and vibration effects. The status of the existing operational NIMT and existing designation (which is not being altered by this NoR) a legal point rather than a technical acoustics matter and I therefore do not address this further in my evidence.

Detailed design

9.5 In numerous places in his evidence Mr Lloyd has expressed concern at the lack of detailed design, and lack of detailed acoustics calculations arising from that design. I understand the extent to which the designation process in the RMA allows for major infrastructure to be developed in a two-stage process with details (including detailed noise and vibration assessment and mitigation) following in an Outline Plan is a legal point rather than a technical acoustics matter. In my experience of large infrastructure projects like this, this is a common or well understood approach.

Special Audible Characteristics (SACs)

9.6 In paragraphs 70 and 110 of his evidence, Mr Lloyd considers that penalties for SACs should apply to operational noise. I have set out above (in relation to Mr Goodwin's comments) how I have modified my position on this point in response to the submission by MDHB. I agree that penalties should be applied if SACs are shown to exist by objective evaluation. This is addressed in the Proposed Conditions.

9.7 I note that Mr Lloyd makes reference to rules in the District Plan relating to new houses (and other noise sensitive activities) being constructed by existing railway designations. Those rules do not require the house designs to take account of any railway noise SACs, and my approach to the Freight Hub is consistent with those district plan rules.

Extended designation

9.8 Mr Lloyd considers that extending the designation should have been considered to allow for the purchase of houses to the east of the Site. During the MCA process I identified a particular issue with the Site as being the potential noise exposure of houses to the east. Consequently, as other factors indicated this was the emerging preferred site option, KiwiRail engaged me to undertake significant analysis into this issue.

9.9 I agree with Mr Lloyd that one potential option would be to purchase houses and from an acoustics perspective that would avoid any noise and vibration effects on those people. However, such an approach may be undesirable from other perspectives, such as poor sustainability in decommissioning / demolishing functional houses and impacts on an existing community in removing people and 'sterilising' land.

9.10 To assess alternative options, I worked with Mr Skelton, Ms Rimmer and others, to explore options for integrated treatment of the east boundary.

Together we concluded that the NIMT had to be moved to provide sufficient space for a substantial noise barrier and landscape treatment. Indicatively this noise barrier is a combined bund and wall extending 5 metres above the Freight Hub, but as set out above, I anticipate the central section may need to increase slightly during detailed design due to the elevation of some houses.

9.11 With the substantial eastern noise barrier, I consider there is scope to manage operational noise to comply with the criteria, without the need to extend the designation to purchase houses. This barrier was introduced after the MCA, so comments made at the MCA did not account for the potential benefit of the barrier.

House treatment

9.12 Mr Lloyd and I appear to be in agreement that KiwiRail should offer to fund building upgrades to any houses exposed to on-site operational noise over 45 dB $L_{Aeq(1h)}$ at night or 55 dB $L_{Aeq(1h)}$ during the day as required to meet internal noise criteria, with ventilation systems if windows need to be closed. We agree this should also apply if exposures are exceeded at upper floors of houses overlooking noise barriers. We agree this should happen before the noise exposure occurs.

9.13 Mr Lloyd proposes a system for implementing building upgrades based on assumptions that noise exposure will extend to the proposed control boundary and that night-time exposure will be the same as daytime exposure. In my opinion, both assumptions are incorrect.

9.14 The daytime and night-time noise exposure will not be known until the detailed design for each stage of the Freight Hub occurs. The noise control boundary and indicative contours provide an envelope of potential effects, but all efforts should be made to operate the Site with a smaller noise footprint if practicable. The need to investigate houses for building treatment within the actual noise contours should in itself provide a significant incentive to constrain the noise footprint.

9.15 Mr Lloyd references port and airport noise controls. However, a critical difference is that most port and airport building treatment I have been involved with includes existing noise exposure and therefore the controls are often structured accordingly. The difference here is that the noise exposure does not yet exist. While I agree houses should be treated before the exposure occurs, I do not consider it warranted for treatment to be speculative over a wide area in advance of the detailed design.

West barrier

9.16 Mr Lloyd recommends that the west noise barrier be moved to the west of the new perimeter road. I have discussed above how due to the topography a barrier to the west of the new perimeter road would be too low to effectively screen noise sources on the Site to the west of the warehouse buildings. Mr Lloyd does not set out any objective basis for a noise barrier being required on the west of the new perimeter road. My analysis of road-traffic noise is that a reasonable level of noise, consistent with NZS 6806, will be achieved without a barrier. In my opinion this indicative noise barrier should remain on the Site boundary to the east of the new perimeter road.

Designation conditions

9.17 As I have discussed above, Mr Lloyd and I appear to be in agreement on fundamental matters of appropriate noise and vibration criteria. Differences in the way these criteria could be applied through designation conditions is primarily a planning or legal matter rather than a technical acoustics matter. My comments below relate to the technical acoustics aspects of the amendments to designation conditions Mr Lloyd has proposed. These comments are with reference to the amended conditions as set out in Appendix A attached to Mr Lloyd's evidence. The conditions proposed by Mr Lloyd have been considered in more detail by Ms Bell and where appropriate, included in the Proposed Conditions at Appendix 1 to Ms Bell's evidence.[28]

9.18 For construction noise and vibration, Mr Lloyd's proposed conditions WW and XX specify criteria consistent with my Acoustics Assessment. Ms Bell has considered the appropriateness of these conditions in her evidence.[29]

9.19 Mr Lloyd proposes an addition to the Proposed Conditions requiring any night works to be assessed to show they will comply with noise and vibration limits. While I agree with the intent of this addition, in practice works such as road tie-ins, can only be conducted at night and cannot always comply with the noise limits. In such cases alternative measures should be taken to manage noise effects. In my opinion, such works are best addressed through the Construction Noise and Vibration Management Plan as required by the Proposed Conditions.

9.20 The general intent of Mr Lloyd's proposed additions relating to the Construction Noise and Vibration Management Plan are in accordance with how I consider

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28 Evidence of Karen Bell, dated 9 July 2021.

29 Evidence of Karen Bell, dated 9 July 2021.

a Construction Noise and Vibration Management Plan should operate, but there are minor drafting issues to resolve. The updated Construction Noise and Vibration Management Plan condition is included at Appendix 1 to Ms Bell's evidence.[30]

9.21 I disagree with Mr Lloyd's proposed condition YY1 as the criteria should apply at notional boundaries and not site boundaries, and there should be scope for consideration of specific houses. For example, if the exposed land is a utility space such as a driveway, rather than an outdoor living space, then noise effects may be acceptable.

9.22 Mr Lloyd's proposed condition YY2 (first instance of that number) sets a noise limit consistent with my Acoustics Assessment, subject to clarification that it applies to on-site activity and excludes the NIMT and new perimeter road. Mr Lloyd includes a note that an additional 45 dB contour is required. I disagree. Compliance assessment of 45 dB is generally impracticable and unnecessary. For ports and airports, while there are often multiple control boundaries for graduated actions relating to new sensitive land uses establishing around the infrastructure, the limit on the infrastructure noise emissions is only at one of those boundaries. For airports there is often an Air Noise Boundary and an Outer Control Boundary for land use controls outside the airport, but airport noise emissions are only regulated at the Air Noise Boundary. In practice compliance at one boundary results in compliance at others further out. The Proposed Conditions include a single management boundary.

9.23 Mr Lloyd's proposed condition YY2 (second instance of that number) sets a vibration limit consistent with my Acoustics Assessment, subject to clarification that it applies to on-site activity and excludes the NIMT. This is now included under Operational Noise and Vibration in the Proposed Conditions.

9.24 Mr Lloyd's proposed condition ZZ1 sets a requirement for widespread speculative treatment of houses as I have discussed above. I consider that this requirement needs to apply after detailed design but before noise exposure occurs. In this proposed condition Mr Lloyd appears to take numeric criteria from the district plan and then apply an additional correction for SACs that is not part of those criteria in the district plan.

9.25 Mr Lloyd's proposed amendment to Proposed Condition 72(b)(iii) relates to the road surface of the new perimeter road, consistent with my Acoustics Assessment. If specified I recommend the terminology should be to require

30 Evidence of Karen Bell, dated 9 July 2021.

"an asphaltic mix" to maintain noise outcomes but allow for any other engineering requirements. This is now included under Operational Noise and Vibration in the Proposed Conditions.

Stephen Chiles

9 July 2021

APPENDIX A

Project:	Regional Freight Hub	**Memo No:**	01
Subject:	Noise measurements of shunting activities		
To:	Stephen Chiles, Chiles Ltd		
From:	Michael Smith, Altissimo Consulting Ltd		
Date:	4 June 2021	**Reference:**	18-133/M01/A

1 Introduction

A sound survey was performed at KiwiRail's Tremaine Avenue depot in Palmerston North on 27 May 2021 to quantify the sound of wagons being shunted together.

2 Survey details

I was accompanied by KiwiRail staff and observed several movements of the shunting loco as part of normal operation. No shunting using mainline locos was observed. Survey details are listed in Table 1.

Table 1 Survey details

Parameter	Value
Operator	Michael Smith
Equipment	NTi XL2-TA Type 1 SLM Serial A2A-17220-E0 calibrated 24/1/20 NTi M2230 Type 1 Microphone Serial A20314 calibrated 25/2/21 Larson Davis CAL200 Type 1 Calibrator Serial 9063 calibrated 21/11/20 Leupold RX-1400i laser range finder
Position	9-18m from source, confirmed with rangefinder Handheld approx. 1.5m above ground and pointed towards source.
Wind	No significant wind

3 Results

The results in terms of the maximum sound level (L_{AFmax}) corrected to a standard distance of 10m are provided in Table 2. The reported level refers to the coupling sound only.

Table 2 Results

Event	L_{AFmax} @ 10m
Shunting loco connecting to train	94 dB
Two half-completed trains being connected (loco not audible)	88 dB
Loco + 2 wagons being connected to train	91 dB
Loco + 1 wagon joining empty train.	93 dB
Shunt connecting to short train	92 dB
Average	**92 dB**
Standard deviation	**2.1 dB**

Based on this information, an updated sound source detail in the format of Table 10 of the acoustics assessment included in the Notice of Requirement is presented in Table 3. The coupling noise makes negligible difference to the noise modelling for the site.

4 Other observations

During the site visit, other sources of noise with notable peaks were observed. In particular, brake noise was observed on a log train starting to drive from rest. I understand that it takes some time from when the driver disengages the brake in the cabin, for sufficient air pressure to develop to fully retract the brake shoes on all wagons (otherwise brakes can generate noise). I also understand there is a pressure indicator, and KiwiRail procedures are for the driver to wait for full pressure before commencing movement.

In addition, it was observed that during marshalling, wagons were being separated without the air pressure systems being manually released via a valve. This was not measured to be significant in terms of total noise emissions, but it is still a noise source that can be reduced though operation in accordance with KiwiRail procedures.

Table 3 Updated noise source detail

Item	Indicative sound levels at 10m	Photograph
Marshalling Noise from a loco approaching, idling, connecting, and departing When coupling wagons together, or a loco to a wagon	75 dB $L_{Aeq(15min)}$ 92 dB L_{AFmax} 93 dB L_{AE}	

UNDER the Resource Management Act 1991 ("**RMA**")

AND

IN THE MATTER of a Notice of Requirement ("**NoR**") for a designation by KiwiRail Holdings Limited ("**KiwiRail**") for the Palmerston North Regional Freight Hub ("**Freight Hub**") under section 168 of the RMA

STATEMENT OF EVIDENCE OF LISA RIMMER
ON BEHALF OF KIWIRAIL HOLDINGS LIMITED

LANDSCAPE AND VISUAL

1. SUMMARY

1.1 The existing environment and baseline landscape of the proposed site for the Freight Hub ("**Site**") includes:

(a) streams and tributaries of low natural character;

(b) natural landscape characteristics that have been shaped by the Mangaone Stream including rolling landforms dissected by numerous tributaries and flood events; and

(c) urban (built) landscape characteristics that reflect the area's continuing role as a transport and infrastructure 'node' and which show the combined transition of this landscape through, (likely) early use by Māori, clearance for rail and productive farms to small rural holdings and recent rural residential and industrial activities.

1.2 Together these natural character, natural and urban landscape and visual amenity characteristics combine to create an intricate landscape with physical (natural science), sensory (perceptual) and shared and recognised (associative) factors.

1.3 Context photographs showing representative views of the Site and the surrounding landscape are included in **Appendix A**.

1.4 Comprehensive mitigation planting, using indigenous species once typical of the area, has been incorporated into the design of the Freight Hub to manage the potential adverse visual and landscape effects, as shown in the concept Landscape Plan, illustrated in **Appendix B**. Cross sections through the Landscape Plan, are illustrated in **Appendix C** and a draft planting palette is included in **Appendix D**.

1.5 Even with the proposed mitigation planting and preferred layout, to locate larger structures closer to the existing North East Industrial Zone ("**NEIZ**"), the potential adverse landscape effects range from **low-moderate to high** (on a 7 point scale) due to the nature and scale of the project. There will also be a range of positive effects provided in terms of natural character, overall, compared to the existing environment and for urban (built) landscape and visual amenity, in some locations.

1.6 I have made a number of recommendations to further mitigate the potential adverse landscape effects as detailed design is advanced, in order to further integrate the Freight Hub into the surrounding environment. This includes a Landscape and Design Plan which has been incorporated into the proposed conditions for the Freight Hub attached to Ms Bell's evidence as Appendix 1 ("**Proposed Conditions**").

2. INTRODUCTION

2.1 My full name is Lisa Gayle Rimmer. I am a Principal Landscape Architect at Isthmus. I hold the qualifications of a Bachelor of Horticultural Science (Massey University) and a Master of Landscape Architecture (Lincoln University).

2.2 I am a registered member of the New Zealand Institute of Landscape Architects Tuia Pito Ora. I am also a member of the Resource Management Law Association.

Experience

2.3 I have 14 years' professional experience throughout New Zealand in a range of project types including infrastructure, policy and guidelines work, land development, public places, and streetscape design.

2.4 Of relevance to this hearing, I have worked on a number of large-scale infrastructure projects including the Waitohi Picton Ferry Terminal Redevelopment, Ngā Ūranga ki Pito One Shared Path, Mt Messenger Highway, RiverLink and Ōtaki to north of Levin Highway. I have also worked

on a number of projects for Palmerston North City Council ("**PNCC**") including Plan Change C: Kikiwhenua residential area, the Square East City Centre Streetscape Development and the Manawatū River Wayfinding Signage Strategy.

Involvement in the Freight Hub

2.5 I have been involved in the Freight Hub project since 2019. I am familiar with the existing site and the surrounding Bunnythorpe and Palmerston North City area. I prepared the Landscape and Visual Effects Assessment that was included with the Assessment of Environmental Effects ("**AEE**") and have undertaken a number of visits to the Site and the surrounding area through 2019 to 2021 to inform this assessment.

2.6 I also provided input to KiwiRail's section 92 response dated 15 February 2021 ("**First Section 92 Response**").

2.7 Further to that response, and in response to submissions, I have carried out an additional site visit to take photographs from representative viewpoints that are now included in the context photograph appendix, attached as **Appendix A** to my evidence. This includes additional representative residential viewpoints from Roberts Line west, Clevely Line west, Te Ngaio Rd and Sangsters Rd and representative viewpoints for motorists along Sangsters Rd (as Figures 22-30 in **Appendix A**).

2.8 In addition, further development to the lighting design for the Freight Hub has resulted in an update to the Landscape Plan and Illustrative Cross sections for the project, attached as **Appendix B** and **C** to my evidence. Consideration of lighting elements forms part of the assessment of effects on landscape and visual amenity, as considered in section 7 of this evidence.

Code of conduct

2.9 I confirm that I have read the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2014 and that I agree to comply with it. I confirm that I have considered all the material facts that I am aware of that might alter or detract from the opinions that I express, and that this evidence is within my area of expertise, except where I state that I am relying on the evidence of another person.

3. SCOPE OF EVIDENCE

3.1 This statement of evidence will:

(a) describe the Freight Hub insofar as it is relevant to the Landscape and Visual Effects Assessment;

(b) provide an overview of the methodology and the existing environment, as set out in the Landscape and Visual Effects Assessment;

(c) explain the landscape and visual effects of the Freight Hub;

(d) respond to the submissions received that relate to the landscape and visual effects on the environment; and

(e) address relevant matters raised in the Section 42A Report.

4. PROJECT DESCRIPTION

4.1 An overall description of the Freight Hub is included in the AEE and evidence of Ms Bell and Mr Skelton.[1] In the following section, I outline the aspects of the concept design for Freight Hub that are particularly relevant to my assessment.

4.2 The primary operational elements of the Freight Hub itself will be built over 130 ha at a constant level, RL50. This includes:

(a) The marshalling yard will be located alongside the existing Railway Road (which will be closed) and then used to relocate the North Island Main Trunk Line ("**NIMT**"). The existing rail embankment will be modified, replanted and used to develop the noise barriers on the eastern side of the Freight Hub.

(b) The Container Terminal to the west of the marshalling yard, which will be serviced by rail and road and provide for up to 12 m high stacks (3 container units) over 880 m.

(c) Maintenance facilities which are proposed to be located to the north of the terminal and marshalling yards, including a larger scaled building (approximately 1,700 m^2) with a maximum height of 16 m.

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[1] Evidence of Karen Bell, dated 9 July 2021; Evidence of Michael Skelton, dated 9 July 2021.

(d) Freight forwarding facilities are expected to be located to the west of the marshalling yards and container terminal, also serviced by road and rail. These will provide for distribution and freight forwarding type warehousing. These buildings are proposed to be set back from the new perimeter road and from Roberts Line by at least 40 m with a maximum height of 14 m (stepping up from the road edge maximum height of 11 m).

(e) Log yard and bulk storage yards will be located to the north of the warehouses, including the potential for four tanks with a maximum height of 6 m serviced by road and rail connections.

(f) Lighting is proposed in the Freight Hub to provide for safe 24/7 operation including 20 m high flood lights and 7 m high poles with building mounted lights set at 12 m in some locations, as shown in the Landscape Plan and Cross Sections in **Appendix B.**

Planting

4.3 Significant mitigation planting is proposed over 50 ha within the Designation Extent. As shown in the proposed Landscape Plan, the planting approach uses naturalised groupings including mass planting to the stream channel and Freight Hub boundaries. Taller trees are used to help integrate, rather than screen, the Freight Hub development into the surrounding environment, and to complement the river terrace and river plains planting proposed elsewhere in the designation. The proposed planting associated with the Freight Hub has a minimum depth of approximately 16 m, at the corner of the distribution buildings and the 'bend' in the new perimeter road, near its intersection with Roberts Line. The planted area is typically more than 35 m deep along the full extent of the distribution buildings. A draft palette of planting types, as shown on the Landscape Plan is included in **Appendix D** of my evidence.

Access and noise mitigation

4.4 Access in and out of the Freight Hub will be provided for in three locations from the new perimeter road. The Freight Hub will be secured, either with fencing or noise mitigation structures. The proposed planting has a depth of at least 5 m to the new perimeter roadside of any noise mitigation wall or fence. Noise mitigation will be required, to the edges of the designation, excluding the boundary east of Richardsons Line. Vertical walls are expected to be located directly alongside the Freight Hub, either as part of the security fencing or on top of the Sangsters Road embankment. These walls will be screened over

time by the proposed mitigation planting as shown in Cross Sections 3-9 in **Appendix B**.

4.5 For a short extent, to the south and north Te Ngaio Road, a vertical wall is proposed near the edge of the designation boundary, to the west of the perimeter road. This wall transitions into a 3 m high noise mitigation earth bund north of 245 Te Ngaio Rd (which is then offset from the rear of residential properties along Maple St). In the south, the vertical wall will be a 3 m structure which provides noise mitigation 'overlap' with a wall located on the opposite side of the proposed perimeter road. The vertical wall will reduce in height as it transitions into the earth bund.

4.6 Alongside 242 Te Ngaio Rd, there will be a 3m high wall located 90 m to the east of the residence (and 8.5 m to the east of the existing utility shed) with a top of wall RL55.2. However, as the house at this location is on higher ground, the top of the wall will be located less than 500mm above the line of sight (at 1.5m) and it will be partly screened by the shed. Its setting inside the Designation Extent also allows for planting to screen this wall over time.

4.7 The same relationship will exist for the residence at 241 Te Ngaio Rd, where the wall will be located approximately 80 m from the house.

4.8 At 245 Te Ngaio Rd, the 3m vertical concrete wall will be located approximately 30 m from the eastern wall of the house, and, although it can be screened by planting over time, half the wall will be above eye height and any planting to screen this element would screen views to the east. Properties along Te Ngaio Rd have been identified in my recommendations for further investigation, to confirm the potential for high adverse visual amenity effects and any additional mitigation required.

4.9 North of the Te Ngaio Rd area, the 3 m earth bund will continue and wrap around to the end of Maple St. This bund will have a 1v:3h sloped profile and 2 m wide crest. The top of bund RL will vary, as required to provide effective noise mitigation. At its highest it will be set at RL58, as shown in the Cross Sections 1-2 in **Appendix B**. This bund is proposed to be planted with low river terrace type species or grassed to retain more open views to the east. It is unlikely to impact views from the cemetery, due to existing vegetation along the boundary. Views of the bund from Maple St properties will vary, depending on existing screening elements such as planting to their back boundaries. Refer to Context Photographs Viewpoints, 6-9 **Appendix A**.

Stormwater ponds

4.10 Two stormwater ponds totalling approximately 13.1 ha are proposed outside the Freight Hub to the west, and one to the south. These ponds will provide storage capacity to manage flooding and wetland areas for the treatment of on-site stormwater. These features are able to be naturalised, to include a more varied profile in long and cross section, as will the stream channel within the Freight Hub. The ponds and naturalised stream channel will be directly connected to the Mangaone Stream via culverts and outfall to an existing tributary. Taller river plains type mitigation planting will be integrated around these features as shown in Cross Section 5 of **Appendix B.**

4.11 The proposed naturalised stream channel will be set within broader areas of naturalised planting. The width and depth of the channel provides scope to vary the long and cross section; to naturalise its profile and include woody and wetland species.

Te Araroa Trail and other tracks

4.12 Te Araroa Trail will be reinstated alongside Sangsters Rd and this will be set to the base of the new revegetated embankment. The design integrates an opportunity to include a lookout point on top of the embankment, where the noise mitigation walls are offset, as shown in Cross Section 8, **Appendix B.** This lookout feature could be detailed to include interpretation of the history of the landscape.

4.13 The Freight Hub also includes a proposed off-road 3 m recreation track**,** to the west of the new perimeter road. This offers an alternative pedestrian and cycle route to and from Maple St and the Roberts Line intersection, including a short section of the perimeter road footpath. This track is proposed to include 'loops' around the naturalised stormwater ponds.

Perimeter Road and other road changes

4.14 The new perimeter road will contribute to the required fill and cut batters for the project, and these will be limited to approximately 2.5 m in height (to the south and north of Te Ngaio Rd). All batters will be gently sloped and replanted. Lighting, with 7 m high poles, will be required at the new perimeter road intersections and at the three entry / exit gates to the Freight Hub. The road reserve will accommodate a footpath along its western edge. The road reserve provides sufficient width for 2.5 m wide path with a 1 m buffer to the kerb. Other road closures will remove the level rail crossings from Railway Rd

to Sangsters Rd. Roberts Line east will become a cul de sac, removing direct access to Railway Rd.

5. METHODS OF ASSESSMENT

5.1 My assessment methodology has followed best practice guidance set out by the New Zealand Institute of Landscape Architects' Best Practice Guidance Note 10.1 with reference to the Te Tangi a te Manu - Aotearoa Landscape Assessment Guidelines adopted as a guidance document by the institute May 2021 (this guide was available in draft form in 2020 and was used to inform my assessment).

5.2 The assessment has not been informed by photo simulations. For the purpose of the NoR, the Context Photographs, Landscape Plan and Illustrative Cross Sections, as included in **Appendix A and B** are appropriate visual guides to the assessment of landscape, visual amenity and natural character effects at this stage of the project.

5.3 Preparation of photo simulations would require a detailed 3-dimensional model of the ground plane works which will only be confirmed through the Outline Plan phase. Further, the design for the buildings (which will be important contributors to potential adverse visual amenity effects) will be developed at the detailed design stage. Showing these buildings at this concept design phase would over or under state the potential effects, as the design is not confirmed. Photo simulations are not required by the NZILA guidelines and, due to the design development required, these would not act as an accurate representation of the proposal at this early stage.

Definitions of key concepts

5.4 There are a number of key concepts for assessing the landscape and visual effects of the Freight Hub, which are described below.

Landscape

5.5 Landscape is the cumulative expression of natural and human features, patterns, and processes in a geographical area, including physical components, perceptions, and associations. This term captures both the natural and urban (built) landscape matters including urban (built) design. Landscape components include the physical (natural science), sensory (perceptual) and associative (shared and recognised) matters which result from both natural and urban (built) landscape factors such as landform,

waterways, vegetation, existing buildings, road networks, heritage features and activities (noting this is not an inclusive list).

Visual amenity

5.6 Visual amenity is a component of landscape. It is the amenity derived from views of a landscape area. Amenity is the natural or physical qualities and characteristics of an area that contribute to people's appreciation of its pleasantness, aesthetic coherence, and cultural and recreational attributes.

Natural character

5.7 Natural character is a type of character, resulting from the balance of physical, sensory, and associative factors that have been influenced by human intervention. In this context, and with reference to section 6(a) of the RMA, natural character relates to the Mangaone Stream and its environs, what is perceived as the 'river and their margins'.

Assessment approach

5.8 With reference to best practice NZILA guidance:

(a) The existing degree of natural character is able to be rated on a 7-point scale, from very low to very high, as part of a summative evaluation, along with the identification of natural science (physical) and sensory (perceptual) qualities and characteristics, that contribute to this. The NZILA guidelines, Te Tangi a te Manu, defines natural character as:

> the distinct combination of an area's natural characteristics and qualities, including degree of naturalness.

The degree of naturalness, or significance of natural character, can be rated on a 7-point scale. The range, from pristine to modified, is one aspect of natural character. The existing degree of natural character and the qualities and characteristics that contribute to this, are addressed in my assessment.

(b) Landscape character is not assessed on a 7-point scale. Unlike natural character, there is no credible scale of evaluation that can be applied to it. There is no 'very low' or 'very high' landscape character, just the factors that contribute to it. Character results from the unique combination of natural and built components including natural

science, sensory and shared and recognised (associative) matters, as are identified and described in my assessment.

(c) Existing factors that contribute to visual amenity are identified and described in my assessment. With reference to aesthetic conventions, this includes factors such as the presence of streams, mature vegetation, distinct landforms, openness, retained patterns of rural activity (including early buildings) and distant views of the Tararuas. Outside of district wide landscape visual amenity evaluation, where there is greater scope for calibration, existing environment visual amenity ratings have less utility and are not considered necessary to inform the assessment of effects.

5.9 The potential natural character (where applicable), natural and urban (built) landscape and visual amenity effects are assessed in terms of the main components of the Freight Hub, being the operational Freight Hub itself, the noise mitigation structures, the stormwater ponds and new road connections and trail / path connections. I have used this approach to ensure that the overall assessment identifies both the source of the effects and the design and mitigation measures that contribute to it.

5.10 The effects are assessed against the existing environment including the reasonably foreseeable future environment. The effects assessment includes the mitigation proposed as outlined in the AEE and illustrated in the Landscape Plan and Cross Sections in **Appendix B** and **C**. Effects can be positive, neutral or adverse. Landscape effects are measured against landscape values. They comprise the nature of effect, its magnitude, and its significance in context. Magnitude is assessed against the 7-point scale, but magnitude should be considered together with the nature of the effect and the context.

5.11 In the evaluation of the existing environment, and the assessment of effects, I have drawn from the technical reports and evidence prepared by other specialists including Mr Garrett-Walker, Mr Leahy, Mr Parker, Mr Georgeson, Dr Chiles, and Ms Austin as they provide information that is relevant to natural character, landscape and visual amenity matters. The consideration of values to tangata whenua, as a landscape matter, addresses known values based on desktop research only. These values are appropriately assessed through cultural impact assessment(s).

6. EXISTING ENVIRONMENT

6.1 The existing environment has been considered in three contexts as shown in Figure 1 below:

(a) the broader Manawatu stream plains and terraces;

(b) the Bunnythorpe – Palmerston North environs; and

(c) the Freight Hub Designation Extent.

Manawatu – Mangaone Stream Plains and Terraces

6.2 The Site is located between Roberts Line, Railway Rd, Maple St, and the Mangaone Stream, near the township of Bunnythorpe and the existing development in the NEIZ of Palmerston North City. The Context Photographs shown in Figures 2-5 of **Appendix A** represent views of the wider landscape from public roads around the Site.

6.3 The relevant landscape context for the Freight Hub is the flood plain of the Mangaone Stream and the elevated landforms to the east between Bunnythorpe and Palmerston North. This area extends between Kairanga–Bunnythorpe Rd and Mangaone Stream to the west, the Sangsters Rd slopes to the east, the north-eastern industrial land and interface, with the regional airport to the south and the Bunnythorpe township to the north.

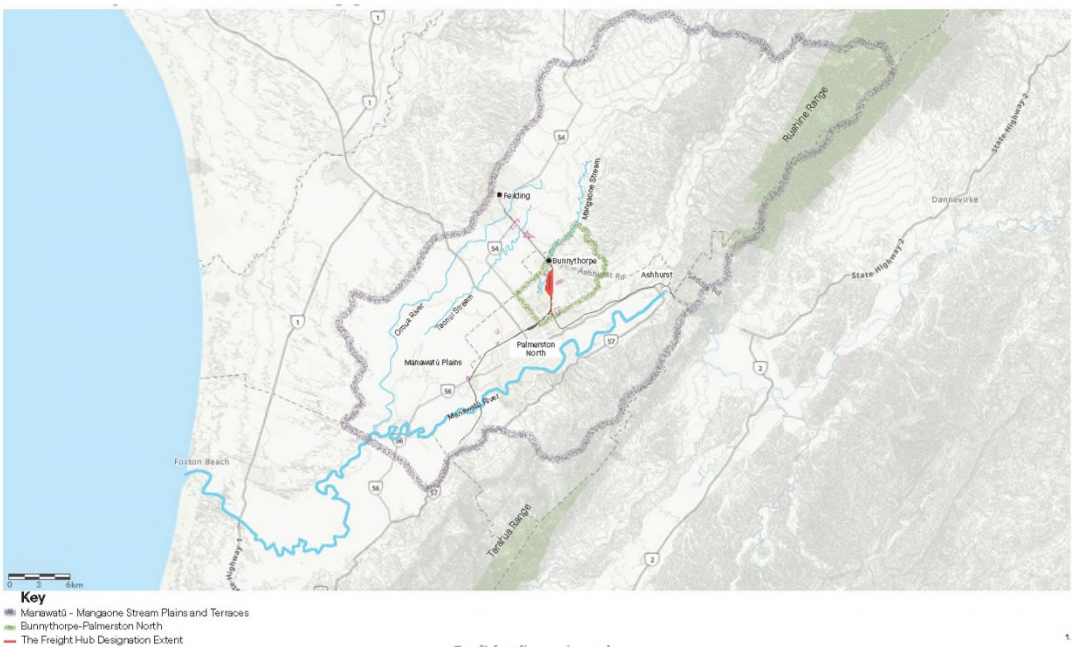

Figure 1 – Freight Hub - Landscape Context

6.4 The broadscale context for the Freight Hub includes the Ōroua River Plains and setting within the wider Manawatū River catchment backdropped by the Tararua and Ruahine Ranges. Figure 1 above shows the setting of the Freight Hub within these contexts.

6.5 The patterns of natural and urban (built) landscape in the broadscale context establish the Site and the Freight Hub as part of:

(a) a diverse river-based landscape with an intricate relationship between waterways and existing commercial, industrial, residential, and recreational activities;

(b) an area with a rich history of settlement for mana whenua over the past 800 years with continued ahi kā and a marae at Aorangi near the Ōroua River; and

(c) an important junction point for rail and road connections with a long history of road, rail and infrastructure development and area with natural and urban (built) landscape patterns that fit with and have the potential to contribute to Palmerston North's role as an inland port.

Bunnythorpe - Palmerston North

6.6 The immediate landscape context for the Freight Hub, shown in Figure 1, has diverse landscape characteristics. The Context Photographs at **Appendix A** noted above (Figures 02-05) and those taken from other public roads and locations within the site (Figures 06-30) show views of this landscape setting.

6.7 To the west of Railway Road, the topography is less pronounced. The rolling landforms have been shaped by the Mangaone Stream and its highly modified tributaries. Vegetation patterns reflect a transition from lowland kahikatea dominant forest to productive rural land use, including naturalised exotic weeds along the waterways and mature shelter belts and trees. Indigenous vegetation is limited to short sections of recent planting along the Mangaone and naturalised low growing plants along the tributaries. Recent subdivision has included a finer grain of rural residential development. Larger historic land holdings, such as the Clevely farm, as recognised in naming of local roads, are now much reduced in size. With this transition, has come the progressive removal or demolition of older rural vernacular structures and homes.

6.8 To the east of the NIMT embankment, the landforms are dissected by numerous tributaries of the Mangaone stream. The topography in this area is elevated, with greater variation in contours, compared to the Mangaone stream

plains to the west of Railway Road, and slopes up to Kelvin Grove 'terrace' above the Manawatū River. The pattern of rural residential development and curtilage planting is more established in this area compared to that of the west, with most residences located between Tutaki and Stoney Creek Rd.

6.9 Te Araroa Trail follows Sangsters Road reserve including its unformed sections at the base of the existing rail embankment. The NIMT line traces the toe of this landscape and varies in height. Although the Mangaone tributaries are culverted through this embankment, it acts as a barrier to water flow such that low lying properties can be impacted by flooding.

6.10 To the north is the small township of Bunnythorpe established along the NIMT line in the late 1800s. A number of features trace the town's history and add to its character, including the primary school along Baring Street, the Bunnythorpe cemetery on Maple Street, and Glaxo factory on Campbell Road. Heritage matters are discussed in further detail in the evidence of Mr Parker.[2]

6.11 To the south of the township, Roberts Line marks the edge of the current development within the NEIZ. Recent development has included the Foodstuffs warehouse which is of a similar scale and height to the freight forwarding facilities proposed on the Site and, beyond this, the regional airport. To the south of Roberts Line east, there is an area of rural zoned land retained, that features larger lot rural residential land use, and minor commercial activities, for example off Midhurst St.

The Freight Hub Designation Extent

Freight Hub natural landscape

6.12 The Site's natural landscape is characterised by the rolling landforms of the Mangaone Stream that have been shaped by tributaries and past flooding events. The Site's contours vary by approximately 5 m. Low lying areas are included in the flood hazard patterns identified in PNCC planning maps.

6.13 A number of the tributaries flow across the Site, including through culverts under Railway Rd and the NIMT line. These tributaries follow a naturalised path, influenced by farming activities and access bridges, with minor patterns of vegetation on their edges, predominantly exotic weeds. They support degraded habitats. On a 7-point scale these waterways have low natural character values.

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[2] Evidence of Daniel Parker, dated 7 July 2021.

6.14 Land cover across the Site is characteristic of existing rural land use, pasture and a mix of exotic trees, including shelter belts with a minor patter of indigenous species. Recent rural residential development has added a finer grain pattern of amenity planting to the Site, particularly along Clevely Line and Te Ngaio Rd.

Freight Hub urban (built) landscape

6.15 The Freight Hub's urban (built) landscape patterns are set to a framework of existing transport routes including:

(a) the existing single line NIMT and its varied height embankment;

(b) the arterial routes that follow the rail, Railway Road – Campbell Rd that connect Palmerston North City, Bunnythorpe and Feilding, the links to SH54 and SH3 via Kairanga Bunnythorpe Rd and Ashhurst Rd and alternative routes through to Palmerston North City via Tutaki Rd and Stoney Creek Rd; and

(c) the pattern of connecting streets and cadastral boundaries that follow a distinct grid off Railway Rd.

6.16 Land use across the Site combines rural and rural residential activities and associated utility buildings with current landholdings subdivided off larger farms. There are a number of sites marking older homesteads, now demolished, such as the original Clevely homestead which was located at 489a Railway Rd (as are addressed in Mr Parker's evidence). Recent patterns of rural residential development with larger scaled homes, are located within the Site.

6.17 Together these features combine to characterise the Site as relatively open rolling land with remaining rural and recent rural-residential land use. This landscape is set to a busy rail and road corridor and a wider context of urban growth, including recent development and industrial zoning across part of the Site and recent rural-residential and residential growth to the north of the city.

6.18 Significant landscapes have not been identified in the vicinity of the Site. The Tararua Ranges has been identified as an Outstanding Natural Feature and Landscape in the One Plan and as a Landscape Protection Area in the Palmerston North District Plan. These ranges can be viewed from public area and private properties, mainly to the west of the Site, for example, along Maple St.

7. ASSESSMENT OF LANDSCAPE AND VISUAL EFFECTS

7.1 I have assessed the summative natural character, landscape and visual effects of the Freight Hub itself, noise mitigation and stormwater ponds during construction and from its operation. This assessment includes a consideration of the proposed mitigation as shown on the Landscape Plan and Cross Sections, as shown in **Appendix B.**

Natural character

7.2 I have assessed the overall effects of the Freight Hub on the natural character of the Mangaone Stream environs as **moderate positive** (on a 7-point scale).

7.3 The existing tributaries through the site are highly modified, have low natural character values, and are not accessible to the public. Culverting these waterways will remove opportunities for restoration in the future. However, the length of tributary removed is small in the context of the overall catchment and fish passage will be maintained upstream (or has the potential to be enhanced, as outlined in the evidence of Mr Garrett-Walker).[3]

7.4 Adverse effects resulting from the loss of these tributaries are mitigated by the design for a naturalised channel and the stormwater ponds and by the integration of mitigation planting around these features, including river plain and wetland species. Given time for establishment, and their scale, these features will result in positive natural character effects due to their physical and perceptual connections with the stream environment and their setting within a significant area of naturalised planting that would have been typical of the area historically.

7.5 The proposed planting will create a significant area of naturalised lowland bush and wetland vegetation near the stream, and compared to the existing environment, this will enhance indigenous habitats. The channel and stormwater features and the planting surrounding these, are directly connected to, and will be perceived as part of the Mangaone environment, when viewed from public areas. Compared to the existing environment, and including the proposed pedestrian and cycle loop tracks, they provide greater access to the stream margins which will enhance perceptions of natural character.

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[3] Evidence of Jeremy Garrett-Walker, dated 9 July 2021, at section 7.

Natural and urban (built) landscape

Natural landscape

7.6 I have assessed the effects of the Freight Hub on natural landscape as **moderate-high adverse.**

7.7 This is a large-scale industrial development requiring significant earthworks. Excavation required will level a large area of land for rail and associated activities. However, these effects have been mitigated and reduced by the earthworks approach. The scale of the cut and fill batters have been reduced by the RL proposed for the Freight Hub and these batters are able to be revegetated. Natural landscape matters are further mitigated by the construction of naturalised features, including the proposed stormwater channel and ponds and significant areas of river plain, terrace and wetland mitigation planting.

Urban (built) landscape

7.8 The effects on the urban landscape will be **low-moderate adverse**. While the concept design layout provides for the best interface with the surrounding land uses, it is of a different scale and character to the surrounding environment. Some of these effects have been mitigated by the preferred layout to accommodate the larger structures to the south within the NEIZ, where industrial land use is anticipated. The removal of level crossings and provision of logical alternative routes impacted by road closures, has also limited these effects.

7.9 The proposed footpath and off-road track increases options for walking and cycling in the area. Combined with the opportunities for a lookout along Te Araroa Trail and planting to its edges, these paths will provide **positive urban (built) landscape effects**. Mitigation planting proposed along the edges of the perimeter road will also help to improve the gateway experience to Bunnythorpe, compared to the existing environment.

Visual amenity

7.10 While the potential effects will vary, I have assessed the adverse visual amenity effects as no more than **low-moderate adverse** for most viewing audiences. Adverse effects have been mitigated by the proposed layout of the Freight Hub, where the larger structures are located to the south, and the significant areas of planting proposed.

7.11 The mitigation planting proposed will, overtime, improve the visual amenity of the entrance to Bunnythorpe and along the edge of Te Araroa Trail edge.

7.12 As expected for a project of this scale and nature, there are a number of residential properties where there is the potential for residual **high adverse** visual amenity effects. These are properties with close open views towards the Freight Hub and where noise mitigation structures are proposed in close proximity. As set out in section 8 of my evidence, I have recommended further investigations should be carried out in the next stages of the project, to determine whether these effects can or need to be reduced further, including by additional mitigation planting, if required.

Construction

7.13 The effects of construction for natural character, landscape and visual amenity are likely to range from **high to moderate-high adverse**, assuming mitigation planting can occur early in the staging, outside of the Freight Hub, as is addressed in Landscape and Design Plan condition.

8. MEASURES TO ADDRESS EFFECTS

8.1 I have made a number of recommendations to manage adverse natural landscape, urban (built) landscape and visual amenity effects from the Freight Hub.

Additional planting in the Mangaone Stream environs

8.2 I have recommended additional planting be integrated into the proposal, beyond that already provided for in the Landscape Plan, as attached to my evidence as **Appendix B**. Appropriate areas would potentially include the flood hazard land between the two stormwater ponds and alongside the tributary to Mangaone Stream which will be the outfall for the naturalised channel. This additional planting would further mitigate adverse effects on natural landscape, enhance the natural character of the Mangaone Stream environs and, for nearby residents, help to mitigate adverse visual amenity effects. This can be addressed through the proposed Landscape and Design plan (discussed below).

Landscape and Design Plan

8.3 I have recommended that a Landscape and Design Plan be prepared and submitted with the Outline Plan of works. This plan should outline the extent to which the design of the Freight Hub aligns with the industrial and rural values

highlighted in the NEIZ Design Guide. Where any departure from the NEIZ Design Guide is proposed, the Landscape and Design Plan will outline the reasons for that departure and why the alternative approach is preferred.

8.4 I consider the guide covers the range of factors that are relevant to the management of effects of the Freight Hub. In particular, as the Outline Plan progresses, design development in keeping with the guide is needed to ensure the Freight Hub minimises the perceived bulk and scale of the buildings. Matters to be addressed will include final location, form, materials, colours used and the articulation of the building facades such that they can be further integrated into the surrounding Bunnythorpe, rural and rural-residential landscape.

Integrated noise mitigation structures

8.5 Similarly, design of noise mitigation structures, where guided by the NEIZ principles, will confirm the location, final form, finish, and planting for screening alongside Sangsters Road and Maple Street, and will consider the views from those streets and residential properties nearby. The guide will provide opportunities for further integration through design. For example, opportunities to improve the gateway experience into Bunnythorpe at the end of Ashurst Rd and the new perimeter road – Maple Rd intersection through appropriate detailing of noise mitigation structures and planting. Such an approach would provide urban (built) landscape and visual amenity benefits.

Integrated roading design

8.6 The Proposed Conditions provide that the Landscape and Design Plan will outline how roads and walkways will integrate with the character of the surrounding area including the rural residential properties, township and existing NEIZ. Design matters to consider for new road connections will include required carriageway widths, requirements for curb and channel, intersection type options, lighting, and associated planting to ensure the quality of the urban (built) environment is improved and the design fits with the broader patterns of mitigation planting proposed.

Lighting design

8.7 To further manage visual amenity effects, including on the night sky, I have recommended lighting design considers opportunities for a 'zoned' approach to fit particular uses across the Site which can be considered under the Operational Lighting Design Plan in the Proposed Conditions. Visual clutter should be limited by balancing the number of lighting poles with maintaining

lower tower type lighting to minimise light spill. I have recommended the Landscape and Design Plan has particular regard to lighting design to mitigate adverse visual amenity effects.

8.8 I understand that Mr McKensey has considered skyglow in his evidence. There is zero light tilt for most lights to avoid this, and there are opportunities to consider turning off lights in certain areas when not required, where this is practical and meets safety requirements.

8.9 Mr McKensey agrees that the Site should not be "over lit", but in his opinion the Updated Lighting Design has been optimised and is not "over lit".[4]

Integration with Te Araroa Trail where possible

8.10 I have recommended opportunities to integrate the rural cycle path be considered, in consultation with PNCC, along with a possible lookout over the Freight Hub. This would enhance the urban (built) landscape. Alternatively, this rural cycle path could be accommodated along the perimeter road footpath or off-road trails proposed to access the stormwater ponds. Any opportunities to integrate with Te Araroa Trail will also be outlined in the Road Network Integration Plan, and the Landscape and Design Plan in the Proposed Conditions.

Further investigation of opportunities to minimise adverse visual amenity effects

8.11 As discussed in my evidence above, I have recommended further investigation (including desktop and site work) at the Outline Plan stage to confirm additional planting, beyond that shown on the Landscape Plan as shown in **Appendix B**, which may be necessary to mitigate for adverse visual amenity effects for specific residential properties.

8.12 As a starting point, to be confirmed in both desktop and field investigation, and in response to the confirmed design, the residential properties recommended for further investigation are located:

(a) between Richardson's Line to 873 Roberts Line;

(b) 163 Clevely Line West;

(c) Te Ngaio Rd properties east of Maple St; and

[4] Evidence of John McKensey, dated 9 July 2021, at paragraph [8.7].

(d) residential properties directly alongside the NIMT that have an open and or elevated view towards the site which could include properties along Sangsters Rd, Tutaki Rd, Parrs Rd, Clevely Line east, Nathan Pl and Stoney Creek Rd.

8.13 A 3 D model, as will be confirmed in the next stages of the Freight Hub, would usefully inform this investigation, by providing exact location and height references that can be calibrated with the existing environment.

8.14 The extent to which any additional planting may help to address visual amenity effects would depend on early implementation of the proposed mitigation planting. This would ensure earth worked areas are replanted and achieve good coverage as quickly as possible and larger shrubs and trees are established prior to the main buildings being constructed. The timing of planting will be outlined in the Landscape and Design Plan in the Proposed Conditions at detailed design stage.

9. RESPONSE TO SUBMISSIONS

9.1 I comment below on submissions relating to the landscape, natural character and visual effects of the Freight Hub on the environment.

9.2 I respond to these submissions by way of the following themes, rather than individual submissions:

(a) mana whenua values;

(b) access to waterways;

(c) positive landscape effects;

(d) landscape character and amenity;

(e) lighting;

(f) conditions; and

(g) the multi criteria analysis ("**MCA**") process.

Mana Whenua values

9.3 Values associated with the site surrounds, of the landscape characterised by the Mangaone Stream and its tributaries, are noted in submissions by mana whenua Ngāti Kauwhata, Rangitāne o Manawatū, Ngāti Raukawa ki te Tonga.

I acknowledge these submissions as they relate to values to mana whenua, and the physical, perceptual and associative components of landscape. As set out in the Landscape and Visual Effects Assessment, my assessment has not addressed values to mana whenua, other than through a desktop review of shared and recognised values associated with the Ōroua and Mangaone area.

9.4 My assessment acknowledges continuing associations and use of the awa and whenua (streams and land) historically, and through continuing association and as part of the rohe for marae in the area. KiwiRail has proposed to prepare a Mana Whenua Engagement Framework in collaboration with mana whenua to recognise and provide for mana whenua values including in the development of the Landscape and Design Plan, and the design principles that underpin that plan. This is outlined in the Proposed Conditions. I agree with these conditions. This collaborative approach would acknowledge mana whenua values and the principles of partnership, included in the NZILA guidelines, Te Tangi a te Manu, as being important to the management of landscape, visual amenity and natural character effects in Aotearoa.

Access to waterways

9.5 With respect to public access to waterways, it is my assessment that this has been improved, compared to the existing environment. Sections of existing tributaries on private properties will be culverted under the Freight Hub and others diverted through a naturalised channel inside security and safety fencing. However, the Landscape and Design Plan, as conditioned, proposes public access in the Mangaone Stream environs, through the mitigation planting areas including recreation loop tracks around large, naturalised stormwater ponds.

9.6 There is no existing public access to the stream or the tributaries within the site currently. The land is in private ownership and the natural character of these waterways is low. Overall, I have assessed natural character gains provided by the naturalised features and mitigation planting in the Mangaone stream environs as moderate and positive, including perceptions that will be enhanced by public access.

Positive landscape effects

9.7 Some submissions note positive effects in terms of the proposed planting with indigenous species and they are supportive of the conditions to put this in place prior to construction. The submitters highlight visual amenity and natural environment benefits, associated with the mitigation planting, naturalised

stormwater ponds and the improved planted edge to Te Araroa Trail. The mitigation planting is also recognised as providing an opportunity to enhance the gateway entrance to Bunnythorpe and there is support for the naturalised channel and stormwater ponds, as having the potential to improve habitats and the streams to *'looking after the native flora and fauna and making efforts to improve the natural environment around the hub'* (23).

9.8 In terms of urban (built) landscape matters related to transport, the submissions highlight the benefits of removing the level crossings, moving the NIMT line away from residential properties and the inclusion of enhanced cycling and walking facilities. This includes specific reference made to the opportunity for a Te Araroa Trail lookout *'to watch the trains'* and the proposed tracks around the stormwater ponds for their *'recreational value'* (23). The location of the new perimeter road to the west, and connection through to the existing level crossing, is supported, in that it bypasses the centre of Bunnythorpe, therefore helping to retain village character. The submissions support the use of the NEIZ Design Guide and include general recognition of the importance of detailed design in avoiding potential adverse effects on the urban (built) landscape and make specific reference to the importance of measures to retain Te Araroa Trail.

9.9 I agree with these submissions.

9.10 There are a number of other submissions in support (for example, Jim Jefferies, Christopher Clarke, and the Central Economic Development Agency) that address how the Freight Hub fits with existing broadscale urban (built) landscape patterns, including reference to adopted growth and regional transport plans.

9.11 In terms of broad scale urban (built) landscape patterns, I agree with the submissions. There is a logic to the location of the Freight Hub in this area, as it ties into existing rail and road transport networks and developing infrastructure zone.

Landscape character and amenity

9.12 A number of submissions raise concerns in relation to adverse effects on landscape character and the related issue of amenity.[5] However, the majority

[5] Submissions addressing these matters include: Bruce and Alison Hill (4) , Glen and Karen Woodfield (6) Maree Woods (15), Ian and Alexander Shaw (21) Fiona Hurly (22), Bunnythorpe Community Committee (30) Stuart Robinson (34) Helen S Thompson (36), Aaron Fox (47), John Austin and Rosaleen Wapp (57), Joanne Kathrine Whittle (59) ,Peter Gore and Dale O'Reilly (61), Danelle O'Keeffe and Duane Butts (72), Kate

of concerned submissions address character and amenity through the issues they raise, including changes in transport patterns, noise, dust, fumes and lighting. While these matters are addressed by other specialists on technical grounds, they are noted as relevant to this evidence and my response, given that urban (built) patterns and sensory matters contribute to landscape character and amenity.

9.13 A number of submissions reference the loss of physical features, sensory or perceptual matters and ongoing associations or connections related to the existing rural land use of the site, and how the Freight Hub will fit within the immediate context of Bunnythorpe and surrounding rural and residential areas.

9.14 I acknowledge the concerns raised in these submissions and that the Freight Hub will result in a change to the existing landscape. As outlined at section 4 of my evidence, these types of concerns have been a central consideration in the design of the Freight Hub to date and have informed a number of aspects of the proposal, such as the layout of the Freight Hub, including the mitigation planting, building setback and approach to earthworks.

9.15 For example, the concept design layout:

(a) aggregates much of the proposed planting to the edges of the Freight Hub, as shown on the Landscape Plan in **Appendix B**. This provides for a continuous area of naturalised River Terrace, Plain and wetland species to be located alongside the perimeter road, the Mangaone Stream environs and Te Araroa Trail where it will be viewed and experienced from public roads, recreation tracks and residential properties;

(b) provides for building setback, to the edges of adjacent roads (of at least 40 m) and the stepping of building height (with the tallest bulkier buildings located to the centre of the site and at a greater distance from residential areas) which will assist these larger scale forms to be integrated; and

(c) includes an integrative approach to earthworks. By setting the Freight Hub at RL50, this has reduced the height and extent of cuts and fills required to the edges of the perimeter road. As these batters are gently sloped, they can be tied back into existing contours and

McKenzie (79), Raewyn Carey (84), Justine Jensen (90),Ministry of Education – Bunnythorpe School (92).

planted. This further integrates the development into the landscape, which reduces the potential for adverse effects.

9.16 However, there will be adverse effects on landscape character and amenity ranging from low-moderate to high (as contributed to by the natural and urban (built) landscape and visual amenity). These adverse effects are due to the nature and extent of the development.

9.17 My assessment concludes that adverse potential effects on landscape character and amenity have been avoided and mitigated by the proposed design and I have made a number of further recommendations that are intended to inform the detailed design process and ensure that further opportunities to landscape character and amenity effects can be mitigated, as outlined at section 8 of my evidence.

9.18 In my opinion, these adverse effects are able to be reduced further in the process of detailed design and in the approach taken to construct the Freight Hub and the Proposed Conditions outline how those opportunities will be considered through the Landscape and Design Plan. These include:

(a) the preparation of design principles and design outcomes for the Freight Hub, using the NEIZ Design Guide, but also departing from it (and adding to it) where necessary;

(b) how roads and walkways will integrate with the Freight Hub, including paths and cycleways;

(c) the timing of planting to maximise establishment before construction starts;

(d) the final form and articulation of the buildings; and

(e) the final form and finish of the noise mitigation structures and associated planting.

9.19 I consider that the measures outlined in the proposed condition for the Landscape and Design Plan will address these matters and help to limit adverse effects on the values associated with existing landscape character and amenity.

Existing views

9.20 In addition to landscape character and amenity issues, Karen and Greg Woodfield of 9a Maple St raise concerns relevant to specific elements in their

existing views. A representative view from their property is included in the Context Photograph **Appendix A**. Figure 7 and 8 and cross section 1 and 9, in **Appendix C,** shows the proposed levels through this area. Their concerns relate specifically to the location and height of the proposed earth bund for noise mitigation, and they request that this be lowered in height or other such measures as to ensure that views of the NIMT, the windmills and hills are retained, as is important to their family, including their son with autism.

9.21 I consider that the matters raised in the submission are most appropriately addressed through detailed design. At that stage of the process, the best location of the earth bund and options to plant or grass this area will be confirmed. While I acknowledge the specific concerns of the submitter, and that a lower earth bund would have less of a screening effect, it will be important to ensure there is a consistent approach applied which considers all properties along Maple St and integration with the village and wider rural residential context.

Walking and cycling

9.22 There are a number of submissions relating to walking and cycling which are addressed in detail within the evidence of Mr Georgeson.[6] I have addressed these submissions where they raise urban (built) landscape and visual amenity concerns, for example, as associated with the loss of privacy and public access to waterbodies.

9.23 Amenity benefits related to new paths and the lookout to the edges of Te Araroa Trail are considered above in my evidence. I have also addressed concerns relating to public access to waterways, as raised by mana whenua, noting that the proposed paths include areas in the vicinity of the Mangaone Stream, and that these areas are currently in private ownership. The recommendation to increase areas of mitigation planting between the ponds, over flood prone land, would provide further opportunities to enhance public access to waterways noting they are existing tributaries to be retained in this area that currently flow through private land.

9.24 Loss of privacy, due to the proximity of the proposed loop track around the stormwater ponds is raised by Helen and Pita Kinaston (27) at 824a Roberts Line. They also make the request that any public car park be located at a distance from their property. The loss of privacy is a particular matter addressed in the NIEZ Design Guide and the integration of walkways within

6 Evidence of Mark Georgeson, dated 9 July 2021, at section 9.

the designation is specifically noted as a factor to consider in the development of the detailed Landscape and Design Plan. Access to the tracks is currently proposed via the footpath along the new perimeter road and there is no provision for a public car park. Fencing to the edges of the ponds and proposed mitigation planting of taller River Plains species are also relevant to the consideration of privacy effects. Overall, I consider the submission matters raised are able to be addressed in detailed design through the Proposed Conditions proposed.

Noise mitigation

9.25 Some submitters have raised concerns regarding the technical aspects of the proposed noise mitigation. These are addressed in detail in Dr Chiles' evidence.[7] As a sensory matter relevant to landscape, I have also considered noise as being a contributor to character and amenity.

9.26 Concerns raised regarding the design of the earth bund alongside Maple St have been addressed above. Two other submissions raise concerns relating to the screening of the vertical noise mitigation walls and of the timing of mitigation planting.

9.27 These matters are addressed by the proposed Landscape and Design Plan which will outline the location of the proposed noise mitigation structures including the final form, finish and planting of these structure. The proposed plan will also address the location, type and timing of mitigation planting.

Lighting

9.28 A number of submissions relate to lighting which are addressed in detail within the evidence of Mr McKensey.[8] My assessment of lighting matters is limited to the consideration of the proposed layout and types of lighting structures (including flood light poles 20 m in height) as they will from part of the new built environment. The evidence of Mr McKensey is that the relevant standards for glare and light spill have been met.[9]

9.29 My assessment recognises there will be adverse effects on the urban (built) landscape associated with the Freight Hub, due to the scale and character of the development, and this relates, in part, to changes to the night sky. This is to be expected for a project of this nature and scale in this environment. However, measures to ensure adverse lighting effects are minimised through

7 Evidence of Stephen Chiles, dated 9 July 2021, at section 8.

8 Evidence of John McKensey, dated 9 July 2021, at section 7.

9 Evidence of John McKensey, dated 9 July 2021, at section 6.

detailed design are further addressed in the Landscape and Design Plan and through the Operational Lighting Design Plan, as outlined in the Proposed Conditions.

10. RESPONSE TO SECTION 42A REPORT

10.1 I have reviewed the sections of the Section 42A Report relevant to my evidence, particularly the Section 42A Technical Evidence prepared by Chantal Whitby.[10]

10.2 Ms Whitby concludes that the site "*is not necessarily an inappropriate location for the Freight Hub*" but that "*the landscape will fundamentally change due to the scale and natural of the activity in the proposed rural setting*" and therefore the adverse effects will require "*appropriate mitigation and management.*"[11] She recommends further conditions to address effects.

10.3 I broadly agree with Ms Whitby and the Council Officers, subject to a number of qualifications below.

Design framework

10.4 Ms Linzey and Ms Whitby have recommended a "design framework" be prepared specific to the Freight Hub to provide for an integrated and interactive approach to addressing potential effects such as social, noise, lighting and transport.[12]

10.5 I do not consider that a bespoke design framework is necessary for the Freight Hub. The existing NEIZ Design Guide already provides guidance for how the design of the Freight Hub can integrate with the surrounding area. However, I do agree with Ms Whitby that establishment of design principles and outcomes that will inform the design of the Freight Hub should be prepared using the NEIZ Design Guide as a base. There would be flexibility in the preparation of the design principles and design outcomes to allow for departure from the NEIZ Design Guide, or additional matters to be considered, where it is appropriate to do so. This could be to recognise, for example, how integration with Bunnythorpe to the north can be best achieved.

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10 Section 42A Technical Evidence: Landscape and visual effects, dated 18 June 2021.

11 Section 42A Technical Evidence: Landscape and visual effects, dated 18 June 2021,, at paragraph [111].

12 Section 42A Technical Evidence: Landscape and visual effects, dated 18 June 2021,at paragraph [100].

10.6 A set of design principles and design outcomes would help to manage successive phases of development in an integrated and iterative manner.[13] These design outcomes would act as a benchmark against which to assess future Outline Plans of work.

10.7 In light of Ms Whitby's recommendations, I have recommended that the Landscape Plan be updated to a Landscape and Design Plan to reflect this. In preparing that plan, KiwiRail will prepare a set of design principles and design outcomes to inform the design of the Freight Hub. This is reflected in the Proposed Conditions.

10.8 The Community Liaison Forum proposed by KiwiRail would also allow the community opportunities to provide input on the preparation of the design principles and outcomes. It is anticipated that mana whenua would be involved through this process as part of the Mana Whenua Engagement Framework.

The approach to considering natural character

10.9 The main matter on which Ms Whitby and I disagree is the net effect on natural character. I assessed a net positive effect because of the creation of the naturalised channel, large stormwater ponds and extensive planting of river plain and wetland indigenous species in association with these features.

10.10 Ms Whitby considers there will be net adverse effects on natural character and that the measures discussed above are mitigation for landscape character.

10.11 We have different theoretical interpretations of 'natural character'. Ms Whitby states that natural character is firstly established from a scientific focus with a subsequent evaluation of how natural character would be perceived and experienced.[14] She considers the ponds may contribute to perceptions of natural character but that they would not be considered natural from an ecological perspective and would have limited ecological value.

10.12 By comparison, I consider natural character is a subset of landscape character. That natural character is a perceived value and, while scientific understanding helps inform perception, natural character is not primarily a scientific matter (it does not take the place of matters such as ecology and related matters addressing stream length loss, addressed by that discipline).

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13 Section 42A Technical Evidence: Landscape and visual effects, dated 18 June 2021, at paragraph [107].

14 Section 42A Technical Evidence: Landscape and visual effects, dated 18 June 2021, at paragraph [49].

10.13 Setting aside the theoretical matters, there may be little difference between Ms Whitby and my assessment. I acknowledge that there will be 'moderate-high' adverse effects on the 'natural landscape' (including the extent of modification of natural landform and loss of tributary streams), and Ms Whitby acknowledges the proposed planting measures will have some benefit in mitigating for landscape character (32).

10.14 Ms Whitby raised several other matters relating to methodology, effects, and mitigation which I respond to briefly for completeness:

(a) I do not consider the effects are diluted by being assessed at too wide a scale. The context is properly described at three spatial levels. Visual amenity effects are assessed with respect to the primary viewing 'audiences'. Effects on landscape character (natural and urban or built) are assessed firstly with respect to the Site, and then in terms of the surroundings to the extent necessary to understand the effects. For example, the disruption of streams within the Site is acknowledged and contextualised as being confined to parts of the tributaries with low natural character within the catchment (the Site being selected and configured to avoid the main stem of the Mangaone Stream).

(b) The terms 'natural and urban' mean the same as 'natural and built' (LVA page 6), and distinguish the layers collectively comprising landscape character, rather than compartmentalising into separate areas. I agree the area is the rural outskirts on the edge of the Palmerston North urban area. I assessed effects in that context.

(c) As discussed above, I do not consider that photo simulations are required at this stage of the process. I consider the visual effects, other than that on the night sky, can be analysed from the use of cross-sections and viewpoints.

(d) While the Freight Hub will unavoidably result in a 'fundamental change' on the Site and its adjacent rural surrounds (as acknowledged in the LVA) a key landscape matter is whether the Site is appropriate. The Site's adjacency to the NIMT, straddling the NEIZ on the edge of the city, and its modified nature are relevant considerations. (I note that it is the second time in Palmerston North's history that the rail yard has been moved from within the city to its outskirts).

(e) While I agree with Ms Whitby that landscapes are experienced through all the senses, including sound, I consider this should not be conflated with the specialist noise assessment. The character of the sound from the Freight Hub will be consistent with its landscape character of a transport and distribution facility. Likewise, the lighting will be consistent with the character of a transport and distribution facility. Such landscape effects should be interpreted in terms of the site's context on the edge of the Palmerston North urban area and have been considered in my assessment under urban (built) landscape and visual amenity. However, they should not be conflated with specialist light assessment including such things as light levels and glare.

(f) Ms Whitby raised the question of cumulative effects associated with natural character, due to the loss of streams. Stream loss is a matter addressed in the evidence of Mr Garrett-Walker.[15] The natural character of waterways on this area of the plains has been considerably diminished over time. An aspect of the alternatives assessment was to minimise further effects on streams (for instance, a characteristic of the site is its small tributaries, reasonably near the watershed and with relatively low natural character values). While the proposal will have adverse effects on the existing natural character, which is low, the proposal also includes restoration and rehabilitation.

10.15 Ms Whitby acknowledges she has not assessed the alternative locations for the proposed Freight Hub.[16] I confirm that I was involved throughout that process. I compared the different sites with respect to potential landscape, visual, and natural character effects, had input to the broad configuration of the Freight Hub, and took part in MCA workshops. These matters are documented in the alternative's assessment. I consider the Site is appropriate from a landscape perspective.

11. RESPONSE TO RECOMMENDED CONDITIONS

11.1 I have reviewed the recommended conditions in the Section 42A Report, including those taken from Ms Whitby's suggestions. In my opinion, a "design framework" developed afresh is not necessary where the NEIZ Design Guide

15 Evidence of Jeremy Garrett-Walker, dated 9 July 2021, at section 8.

16 Section 42A Technical Evidence: Landscape and visual effects, dated 18 June 2021, at paragraph [98].

can be used as a foundation from which to build upon the design principles and outcomes to be achieved for the Freight Hub. Those principles and outcomes will then form part of a Landscape and Design Plan, with input from mana whenua, the community and the project specialist team (including, but not limited to, terrestrial and freshwater ecology, noise, lighting, social impacts, stormwater, historical heritage, archaeology).

11.2 As outlined above, I have recommended a Landscape and Design Plan that provides for the establishment of design principles and design outcomes that have informed the design of the Freight Hub, using the NEIZ Design Guide as a base. The proposed Landscape Plan, in the conditions lodged with the NoR, has been updated to a Landscape and Design Plan as incorporated into the conditions attached as Appendix 1 to Ms Bell's evidence.

11.3 My recommendation is that the Landscape and Design Plan is to be submitted for approval as part of the first Outline Plan of works. The Landscape and Design Plan will set out landscape and design principles and outcomes to guide successive stages of development and on-going management of the landscape.

11.4 I recommend that:

(a) The Landscape and Design Plan provides for the following key outcomes:

(i) positive net effects for natural character of the Mangaone stream environs through restoration and rehabilitation measures;

(ii) integration of the Freight Hub with the landscape character and amenity values of the surrounding area, including Bunnythorpe Village; and

(iii) connectivity of cycle / footpaths around the perimeter of the site, and realignment of Railway Road to maintain connectivity between Bunnythorpe and Palmerston North.

(b) The Landscape and Design Plan shall have regard to the following:

(i) the principles of the NEIZ Design Guide;

(ii) contouring of earthworks to integrate with the surrounding topography, with cut and fill batters graded and topsoiled to enable planting where necessary;

(iii) landscape buffers around the perimeter of the Site. The recommended buffer depth is a typical minimum of 5 m to any noise mitigation wall (there may be minor, short length, departures to this minimum depth, for example, to accommodate paths and essential infrastructure). These depths will be confirmed through the Landscape and Design Plan;

(iv) planted building setbacks from adjoining land to mitigate for adverse effects. The recommended minimum building setbacks are 30 m from Sangsters Rd and the new perimeter road and a minimum of 8 m at the corner of this and Roberts Line. These depths will be confirmed through the Landscape and Design Plan process, and it may be appropriate to consider some variation to these recommended minimum depths where adverse effects are able to be mitigated appropriately. For example, should the final design provide for 9 m high distribution warehousing along the perimeter road, a narrower planted building setback may be appropriate;

(v) planting to screen noise walls from areas around the Site and design measures to confirm their final form and finish contributes positively to the urban (built) landscape;

(vi) guidelines for treatment of rooflines and upper walls of taller buildings (those over 10 m in height) to soften unrelieved building expanses;

(vii) naturalised form and margins for the two major stormwater ponds;

(viii) naturalised form and margins for the diverted tributary stream (channel) at the north end of the Site, including consideration of alignment;

(ix) restoration of indigenous river plain, river terrace, and wetland plant communities that would naturally have

occurred in the area including enhanced indigenous biodiversity;

(x) detailed design of lighting to reduce adverse effects on the urban (built) landscape and visual amenity integrating the required Operational Lighting Design Plan;

(xi) opportunities for a lookout over the Freight Hub and Bunnythorpe gateway improvements to be integrated into the final design; and

(xii) opportunities for mitigation of visual amenity effects from residential properties.

11.5 I consider that these outcomes and matters to have regard for are reflected in the Proposed Conditions attached to Ms Bell's evidence. The Council Officers have also recommended that a planting establishment plan be prepared.[17] I consider that the planting, including the timing for its establishment is addressed through the Landscape and Design Plan such that a separate condition is not required.

Lisa Rimmer

9 July 2021

17 Section 42A Report, dated 18 June 2021, at paragraph [422].

APPENDIX A

KiwiRail Regional Freight Hub
Context Photographs - Appendix A
Landscape and Visual Evidence

June 2021

NOTE: FOR SCREEN VIEWING ONLY. TO BE PRINTED AS AN A3 2 PAGE SPREAD INCLUDING CROP MARKS.

Land.
People.
Culture.

Isthmus.

Isthmus.

Document record

Issue	Revision	Author	QA	Date
EVI	A	TW	LR	30/06/2021
EVI	B	CD	LR	06/07/2021

Contents

Viewpoint Location Map

Figure 01

Viewpoint Locations

Designation Extent

N

0m 200m 400m 1000m

Scale: 1:20,000 @ A3

Viewpoint 01 - Corner of Roberts Line & Railway Road

Figure 02

View from the corner of Roberts Line and Railway Road, looking north towards the site.

KiwiRail Regional Freight Hub

Original Photo Lisa Rimmer | 50mm | DSLR Nikon D700 | 05:03pm 28 July 2020 | N 5534435 E 1823644 (NZTM)
Reading distance for correct scale: 400mm | Viewpoint Elevation: 48m :
Field of View Approximately 110˚ horizontal (across 2 x A3 pages) & 34˚ vertical

Viewpoint 01 - Corner of Roberts Line & Railway Road
Figure 02
Page 2 of 2 page spread.

Viewpoint 02 - Corner of Roberts Line & Kairanga Bunnythorpe Road

Figure 03

View from the corner of Roberts Line and Kairanga Bunnythorpe Road, looking east towards the site.

KiwiRail Regional Freight Hub

Original Photo Lisa Rimmer | 50mm | DSLR Nikon D700 | 04:54pm 28 July 2020 | N 5536337 E 1822070 (NZTM)
Reading distance for correct scale: 400mm | Viewpoint Elevation: 35m :
Field of View Approximately 110˚ horizontal (across 2 x A3 pages) & 34˚ vertical

Viewpoint 02 - Corner of Roberts Line & Kairanga Bunnythorpe Road
Figure 03
Page 2 of 2 page spread.

Viewpoint 03 - Campbell Road, Bunnythorpe

Figure 04

View from Campbell Road, Bunnythorpe, looking south-east towards the site and the north island main trunk line (NIMT).

KiwiRail Regional Freight Hub

Original Photo Lisa Rimmer | 50mm | DSLR Nikon D700 | 04:48pm 28 July 2020 | N 5537445 E 1823726 (NZTM)
Reading distance for correct scale: 400mm | Viewpoint Elevation: 48m :
Field of View Approximately 110˚ horizontal (across 2 x A3 pages) & 34˚ vertical

Viewpoint 03 - Campbell Road, Bunnythorpe
Figure 04
Page 2 of 2 page spread.

Viewpoint 04 - Corner of Clevely Line & Stoney Creek Rd intersection

Figure 05

View from the corner of Clevely Line and Stoney Creek Road, looking south-west towards the site.

KiwiRail Regional Freight Hub

Original Photo Lisa Rimmer | 50mm | DSLR Nikon D700 | 04:42pm 28 July 2020 | N 5536955 E 1823134 (NZTM)
Reading distance for correct scale: 400mm | Viewpoint Elevation: 51m :
Field of View Approximately 110˚ horizontal (across 2 x A3 pages) & 34˚ vertical

Viewpoint 04 - Corner of Clevely Line & Stoney Creek Rd intersection
Figure 05
Page 2 of 2 page spread.

Viewpoint 05 - Parrs Road & Sangsters Road intersection

Figure 06

View from the corner of Parrs Road and Sangsters Road, looking south-west towards the site.

KiwiRail Regional Freight Hub

Original Photo Lisa Rimmer | 50mm | DSLR Nikon D700 | 04:37pm 28 July 2020 | N 5536355 E 1823806 (NZTM)
Reading distance for correct scale: 400mm | Viewpoint Elevation: 46m :
Field of View Approximately 110˚ horizontal (across 2 x A3 pages) & 34˚ vertical

Viewpoint 05 - Parrs Road & Sangsters Road intersection
Figure 06
Page 2 of 2 page spread.

Viewpoint 06- 9A Maple Street, lower deck

Figure 07

View from the ground level deck at 9A Maple Street, looking south east towards Railway Road and the site.

KiwiRail Regional Freight Hub

Original Photo Lisa Rimmer | 50mm | DSLR Nikon D700 | 2:36pm 23 September 2020 | N 5537234.638 E 1823559.064 (NZTM)
Reading distance for correct scale: 400mm | Viewpoint Elevation: 49m :
Field of View Approximately 110˚ horizontal (across 2 x A3 pages) & 34˚ vertical

Viewpoint 06- 9A Maple Street, lower deck
Figure 07
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Viewpoint 07 - 9A Maple Street, upper deck

Figure 08

View from upstairs deck at 9A Maple Street, looking south east towards Railway Road and the site.

KiwiRail Regional Freight Hub

Original Photo Lisa Rimmer | 50mm | DSLR Nikon D700 | 2:46pm 23 September 2020 | N 5537232.325 E 1823555.875 (NZTM)
Reading distance for correct scale: 400mm | Viewpoint Elevation: 50m :
Field of View Approximately 110˚ horizontal (across 2 x A3 pages) & 34˚ vertical

Viewpoint 07 - 9A Maple Street, upper deck
Figure 08
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Viewpoint 8 - 51 Maple Street (Bunnythorpe Cemetery)

Figure 09

View from 51 Maple Street (Cemetery), looking south east towards the site.

KiwiRail Regional Freight Hub

Original Photo Lisa Rimmer | 50mm | DSLR Nikon D700 | 03:04pm 28 July 2020 | N 5536976 E 1823351 (NZTM)
Reading distance for correct scale: 400mm | Viewpoint Elevation: 42m :
Field of View Approximately 110˚ horizontal (across 2 x A3 pages) & 34˚ vertical

Viewpoint 8 - 51 Maple Street (Bunnythorpe Cemetery)
Figure 09
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Viewpoint 9 - 51 Maple Street (Bunnythorpe Cemetery 2)

Figure 010

View from 51 Maple Street (Cemetery), looking south-east towards the site

KiwiRail Regional Freight Hub

Original Photo Lisa Rimmer | 50mm | DSLR Nikon D700 | 03:15pm 28 July 2020 | N 5537082 E 1823359 (NZTM)
Reading distance for correct scale: 400mm | Viewpoint Elevation: 49m :
Field of View Approximately 110˚ horizontal (across 2 x A3 pages) & 34˚ vertical

Viewpoint 9 - 51 Maple Street (Bunnythorpe Cemetery 2)
Figure 010
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Viewpoint 10 - 363 Tutaki Road

Figure 011

View from 363 Tutaki Road, looking south west towards the site.