Report pursuant to s42A Resource Management Act 1991

In the matter of:	A Notice of Requirement to construct and operate a new intermodal rail and freight hub on land between Palmerston North and Bunnythorpe
And:	A hearing by Palmerston North City Council pursuant to s100A
Requiring Authority:	KiwiRail Holdings Ltd
Hearing date:	9 August 2021

S42A Technical Evidence: Lighting

By: Glen Wright

1 Executive Summary

1. PNCC DP, section 12A, R14A.4.1 Permitted Activity, Performance Standards (f)I requires compliance with section 11, R11.6.1.1(a)(VI), which in turn requires *All exterior lighting must be designed and installed to ensure compliance with AS Standard 4282.* The standard has been recently superseded by AS/NZS 4282:2019 - Control of the obtrusive effects of outdoor lighting. Therefore, compliance with the recommendations of AS/NZS 4282:2019 is the appropriate standard for light effects.

2. The Stantec Preliminary Lighting Design Report has assessed the obtrusive light effects in accordance with the recommendations of AS/NZS 4282:2019 and its recommended limits for Lighting Environmental Zone A2. The limits for Zone A2 are those for rural sparsely inhabited rural and semi-rural area, they are lower than the limits for Zone A4 that would apply to the industrial environment. Therefore, they are applying the lowest limits across all surrounding dwellings and roads.

3. While the Stantec Preliminary Design Report shows that their preliminary lighting design does not fully comply with AS/NZS 4282:2019, particularly with respect to glare, Stantec do state that this glare can be mitigated in the lighting detailed design.

4. If compliance with the recommendations of AS/NZS 4282:2019 is a condition of NoR for the lighting, then the lighting effects would be acceptable under the PNCC DP.

5. Provided the lighting detailed design complies with the recommendations of AS/NZS 4282:2019 for Zone A2 it is my expert opinion that the lighting effects will be less than minor.

Contents

2 Introduction

6. My full name is Glen Andrew Wright. I hold the qualification of Registered Engineering Associate and am a member of Engineering New Zealand and Associate Member of the Illuminating Engineering Society of Australia and New Zealand.

7. I am a Principal of Stephenson & Turner New Zealand Limited (S&T), an architecture and engineering consultancy, I have 30 years of experience in lighting.

8. I have prepared this evidence on behalf of the determining authority, Palmerston North City Council, in relation to the Notice of Requirement (NoR) for the KiwiRail Regional Freight Hub ("the Freight Hub") lodged by KiwiRail Holdings Ltd ("KiwiRail"). I understand that my evidence will accompany the planning report being prepared by the determining authority under section 42A of the Resource Management Act 1991 (the "Act").

9. I have extensive experience in the assessment of the environmental effects of lighting, which is backed up by my extensive experience in the design of low impact outdoor lighting for prisons, stadiums, sports fields, tennis courts and urban spaces. I am the recipient of six National Lighting Design Awards.

10. I have assessed the environmental effects of many aspect of artificial and natural light which have included reflected glare, signage, digital billboards, navigation warning lights, stadium lights, sports field lights, pathway lights, carpark lights, bridge lights, Transmission Gully lights, America's Cup Village lights and Eden Park concert lights.

11. I am an expert on the effects of outdoor artificial light on sky glow and its effects on the quality of views of the night sky. I recently assisted South Wairarapa District Council with their plan change and new lighting standards to meet the International Dark-Sky Associations requirements for the proposed Wairarapa International Dark Sky Reserve.

12. Recent lighting environmental effects assistance provided to Palmerston North City Council includes Colquhoun Park Softball Lights and Central Energy Trust Arena Speedway Pits and Cuba Street Plaza. My experience with the assessment of effects for Colquhoun Parks new softball lights is of particular relevance to this NoR as it involved 25 and 27 metre high light towers, close

proximity to residential dwellings, roads and required assessment of effects on Palmerston North Airport, aviation and skyglow.

2.1 Expert Witnesses – Code Of Conduct

13. I confirm that I have read the Code of Conduct for Expert Witnesses 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 except where I state I am relying on information provided by another party, the content of this evidence is within my area of expertise.

3 Background and Scope of Evidence

3.1 Background

14. KiwiRail is seeking to designate approximately 177.7 hectares of land between Palmerston North Airport and Bunnythorpe for a new Regional Freight Hub.

15. The Freight Hub will consist of a centralised hub incorporating tracks, marshalling yards, maintenance and service facilities, a train control and operation centre, freight handling and storage facilities (including for logs and bulk liquids), provision of access, including road and intersection upgrades where required, and specific mitigation works including noise walls/bunds, stormwater management devices and landscaping. In addition, the North Island Main Trunk rail line will be relocated to sit within the new designation area and directly adjacent to the Regional Freight Hub. The activities that take place at KiwiRail's Tremaine Avenue freight yard (apart from the passenger terminal and the network communications centre) will be relocated to the new site to form part of the new Regional Freight Hub.

16. A detailed description of the Project is set out in 6.3 of the AEE submitted by the applicant and a summary description in the s42A Planning Assessment.

17. Lighting is proposed for the internal access roads, carparks, and outdoor operational areas. Internal access roads and carparks will be designed to lighting levels recommended in AS/NZS1159.3.1:2020 1158.3.1 (Part 3.1) – Pedestrian area (Category P) lighting – Performance and design requirements. Operational areas will be designed to lighting levels recommended in E-ST-EL-0131 – Traction and Electrical Standard.

3.2 Scope of evidence

18. I have been asked to assess the lighting elements of the NoR. My assessment considers the following matters:

    a) Key issues in contention.

    b) The statutory context.

    c) An overview of the existing environment in terms of the nighttime lighting environment.

    d) Adequacy of the applicant's Preliminary Lighting Design Report and its assessment of the lighting effects.

    e) Likely key effects (positive and adverse) on the environment of allowing the Project.

    f) Appropriateness of any proposed mitigation measures or monitoring.

    g) Submissions relating to lighting.

    h) Any other matters.

3.3 Reports and material considered

19. As part of preparing this statement of evidence, I have read the following reports and documents:

    a) Stantec Preliminary Design Report Prepared for KiwiRail dated 28 July 2020 (updated February 2020) Revision C dated 04/02/2021.

    b) Stantec S92 Requests and Responses – Lighting Revision 1 dated 12/02/2021.

    c) Standard AS/NZS 4282:2019 Control of the effects of outdoor lighting.

3.4 Site visit

20. At the time of writing this report I have not undertaken a site visit, but I believe that I am sufficiently familiar with the surrounding environment from my exploration of the environment via PNCC Geosite Local Maps and Google Earth's satellite and street view images.

21. I will endeavour to complete a site visit prior to any hearing.

3.5 Statutory Context

22. The relevant statutory documents and provisions relevant to the evaluation of the NoR have been set out in the s42A Planning Assessment. For the purposes of preparing this evidence, I have had particular regard to the following statutory provisions and direction that are particularly relevant to the topic area I address.

23. PNCC District Plan, section 12A, R14A.4.1 Permitted Activity, Performance Standards (a) Maximum Height requires *All buildings and structures shall comply with R13.4.7.1 (Airport Protection Surface) or 9 metres whichever is the lower.*

24. PNCC District Plan, section 12A, R14A.4.1 Permitted Activity, Performance Standards (f) Lighting has two requirements:

    i. Compliance with R11.6.1.1(a)(VI).

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

25. Rule R11.6.1.1(a)(VI) requires *All exterior lighting must be designed and installed to ensure* compliance *with AS Standard 4282.* This standard has been recently superseded by AS/NZS 4282:2019 - Control of the obtrusive effects of outdoor lighting. Therefore, AS/NZS 4282:2019 is the most relevant standard for light effects.

26. The above district plan standards and requirements have guided my assessment of the lighting impacts.

4 Existing Environment

27. The existing night-time ambient light conditions are predominantly those of a sparsely inhabited rural and semi-rural environment but there is also an industrial environment to the southwest of the NoR. AS/NZS 4282:2019 provides recommended lighting effects limits, with different magnitudes of limits provided for different lighting environment zones. I have assessed the sparsely inhabited rural and semi-rural environments as *A2 Low district brightness Lighting Environmental Zone* and the industrial environment as an *A4 High district brightness Lighting Environment Zone*.

5 Data Collection and Assessment Techniques

28. Stantec have used Lighting Analysts AGI32 lighting design software for modelling the performance and effects of the proposed lighting. AGI32 is widely used by New Zealand lighting designers, it is the software I use for all my outdoor lighting designs and assessments, and it is my experience that it provides a high level of accuracy with respect to the actual installed lightings performance and effects.

6 Project Effects

29. The Stantec Preliminary Lighting Design Report has assessed the obtrusive light effects in accordance with the recommendations of AS/NZS 4282:2019 and its recommended limits for Lighting Environmental Zone A2. I concur with their approach and the use of the Zone A2 limits across all neighbouring residential dwellings.

30. Stantec modelling of lighting effects on nearest residential dwelling is provided, this modelling included the proposed acoustic barriers, which provide some mitigation of spill light beyond the site boundaries but limited effect on mitigating glare.

31. Stantec modelling results show that spill light to residential dwellings will be to acceptable levels because they are within the AS/NZS 4282:2019 limits for Zone A2.

32. Stantec modelling results show that skyglow effects (Upward Light Ratio is the lighting technical parameter) will be to acceptable levels because it is within the AS/NZS 4282:2019 limits for Zone.

33. Stantec modelling results show that glare to residential dwellings will be significant, of the 32 dwellings considered, only 3 meet AS/NZS 4282:2019 curfew limits for glare and 50% do not meet every day (non-curfew) glare limits. The effects of these levels of glare on surrounding dwellings would be significant and unacceptable. I expect that glare can be reduced to meet the non-curfew and curfew limits of AS/NZS 4282:2019 as part of detailed design and can be satisfied as a condition of the NoR for the lighting detailed design, with a detailed design package to be submitted for technical review and certification by Council.

34. The Stantec Preliminary Design Report has not assessed or considered the effects of the proposed lighting on road users. AS/NZS 4282:2019 requires road user glare effects to be controlled via Threshold Increment calculations in accordance with recommendations of AS/NZS4282:2019. As Threshold Increment calculations are related to glare I expect that the effects of the Stantec preliminary lighting design on road users will also be significant and unacceptable levels. I expect that the effects on road users can be reduced to meet the Threshold Increment limits of AS/NZS 4282:2019. To ensure that these effects are considered in the lighting detailed design I recommended including this as a condition of the NoR for the lighting detailed design.

35. Under carriage lighting has not been assessed and will be developed as part of detailed design. Under carriage lighting is track level lighting that illuminates the under carriage of a train when it passes over it. I do not expect its effects to be adverse as it would be at ground level and directed upwards but recommend it is included in the lighting detailed design report to be submitted for technical review and certification by Council.

36. Low level security lighting has not been assessed and will be developed as part of detailed design. I do not expect its effects to be adverse as I expect it will be from 6-8m lighting poles with luminaires that direct light below the horizontal but recommend it is included in the lighting detailed design report to be submitted for technical review and certification by Council.

37. Stantec Design Report, clause 4.5 provides illuminance design results for the outdoor operational areas. I note that average illuminance level ranges from 31.6 to 39.4 lux, and in some instances, they are up to 50% higher than the recommended design target. The associated increase in effects is not significant here and does not have a significant effect on the magnitude of glare. Therefore, it is my opinion that this is an acceptable lighting level and contributes to the Health & Safety of Freight Hub occupants.

38. It is my opinion that the illumination levels proposed are appropriate for the health, safety, and security within the Freight Hub, they are similar to the levels provided within a supermarket carpark. As noted earlier these illumination levels are not resulting in unacceptable levels of spill light and skyglow effects to the surrounding dwellings.

39. I note that intervening trees are not included in the Stantec light spill calculations but are included in the glare calculations. Generally, you only

consider the mitigation offered by trees as a "last resort" mitigation measure. I expect in this case the trees have been added to mitigate the glare to neighbouring dwellings, but due to the height of the poles relative to the tree heights, the trees are not managing to block views of the glary floodlights. As the spill light complies with the AS/NZS4282:2019 recommended limits there was no need to include the trees in the spill light calculations.

40. Part of the proposed designation site is zoned industrial, but other parts are zoned rural and residential (and these zones will adjoin the site once established). In the lighting report Stantec have used the spill, glare and upward light limits recommend for an A2 low district brightness (rural) environment from AS/NZS 4284:2019, so they have applied the lowest limits to all of the surrounding dwellings irrespective of the zones. I support this approach as it provides protection of residential rural amenity to all surrounding dwellings.

6.1 Construction Phase Effects

41. If night-time construction works is planned, then I recommend that a Construction Lighting Management Plan (CLMP) is a NoR condition. The CLMP would be required to address the potential effects from construction vehicle headlight sweep, security lighting and working lights. The CLMP would require the effects of security lighting and working lights to be in accordance with AS/NZS4282:2019 and headlight sweep would be managed by ensuring that vehicles exiting the site at night do not project headlight beams onto the bedroom windows of surrounding dwellings.

6.2 Operational Phase Effects

42. The Stantec lighting report only provides the full build-out design. Light effects for each operational phase should be reviewed at each phase, first a review of the associated lighting detailed design prior to construction and then a review of the actual effects of the installed lighting immediately after commissioning of phase lighting. I have recommended appropriate conditions to capture this requirement.

7 Mitigation

43. The proposed acoustic barriers have been included in the Stantec lighting model, with the barriers providing some mitigation of spill light onto the nearest residential dwelling, but limited effect on mitigating glare.

44. To mitigate the lighting preliminary design's high levels of glare to surrounding dwellings I concur that the measures put forward in the s92 response 12 February 2021 would be effective to mitigate the glare. Additionally, selective dimming of offending floodlights to reduce their brightness could also be considered by Kiwirail.

45. The Stantec Lighting Report states the calculated Sky Glow UWLR of 0.003 which is well below the AS/NZS4282:2019 Zone A2 limit of 0.01. The Sky Glow could be reduced further by applying International Dark-Sky Associations recommendations on good lighting. These include the following which are applicable to the proposed lighting:

    a. Use lights with 3000K colour temperature LEDs in lieu of the proposed 4000K LED's, this can be expected to reduce the blue light content within the white light by up to 25%. The blue light spectrum produces more scattering of light in the atmosphere which is a primary contributor to sky glow.

    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. In the Stantec Lighting Design the following lights have tilts above the horizontal:

        - Type B, 7.3m height pole, 5° tilt
        - Type G, 22m height pole, 5° tilt
        - Types J & K, 22m height pole, 10° tilt.
        - Type L, 12m height mounted on face of buildings, 20° tilt

    c. Do not overlight, only provide the lighting level required for the user/task. It is my opinion that the proposed lighting design levels meet this recommendation.

d. Turn off lights when not required. An Operations Lighting Management Plan coupled with appropriate lighting control system is recommended, so that lights are turned off when not required for operational safety.

8 Review of submissions

46. Aviation risks have been raised by submitters S5 Palmerston Airport and S54 Airways Corporation. They request that KiwiRail submit a request to the Civil Aviation Authority NZ for a Part 77 determination. I concur with this request and recommend that this is completed prior to construction of light towers. From my experience with the Colquhoun Park softball lights RC where I assisted with the preparation of a Part 77 determination application, the proposed lighting effects do not present any issues for aircraft. Provided lighting poles and construction cranes are no more than 18m above surrounding trees then under CAA Rules Part 77 their structure is not considered a hazard in navigable airspace.

47. Effects on air traffic control services has been raised by submitter S54 Airways Corporation. From my experience with the Colquhoun Park softball lights RC where we met with PN Airways Corporation technical personal, visited the Airport Control Tower (ACT) and discussed lighting effects with the on-duty traffic controllers, it is important that any proposed lighting near the airport has no detrimental effect on traffic controller vision within the ACT, and in particular that they will not experience any discernible brightness that would hinder their observations. In relation to the proposed lighting, it will be the brightness of floodlights in the direction of the ACT that needs to be mitigated. Therefore, it is my recommendation that a condition of the NoR is that glare to the ACT also meets the AS/NZS4282 limits for Zone A2.

48. Roof glare and its associated hazard of presenting sun strike to pilots and traffic controllers has been raised by submitter S54 Airways Corporation. With the Hub buildings being located to the north of the PN Airport and the Air Control Tower it is important that the building design mitigates any potential roof glare to the south, consideration of roof material, roof orientation and roof slopes is required. I concur that this is a potential hazard that needs to be considered and therefore I recommend that a condition of the NoR is that the design of all buildings shall mitigate any potential roof glare to the south and particularly the PN Airport Air Control Tower.

49. Excessive light pollution is an issue for submitters S1, S2, S6, S7, S10, S22, S35, S36, S50, S57, S64, S70, S87, S90, S91 and S98. If the lighting effects are within the AS/NZS4282:2019 limits for Zone A2, it is my opinion that the effects of light pollution will be less than minor.

50. Effects of lighting on sleep is an issue for submitters S2, S34, S35, S36, S53, S57 and S84. If the spill light effects to windows on surrounding dwellings are within the AS/NZS4282:2019 limits for Zone A2, the level of spill light can be considered to be non-obtrusive and at a level I would not expect to affect sleep.

51. Loss of enjoyment of the night sky is a concern raised by submitters S7 and S15. The effect of sky glow is that it brightens up the sky and this reduces the viewed brightness of the stars. There will be some sky glow associated with the proposed lighting, but with the Upward Light Ratio being within the AS/NZS4282:2019 limits for Zone A2, the effect on the quality of views of the night sky will be minor. The effect could be mitigated further if the lighting detailed design implemented the mitigation measures I have outlined in section 6 Mitigation.

52. "*No process of evaluation or reviewing of light pollution stage by stage. Or even* after *the* event" is a concern raised by submitter S6. I concur with this concern and recommend in addition to the condition for review of the final lighting design, a condition for verifying that the installed lighting is in accordance with the submitted lighting design. The lighting effects should also be subject to review.

53. An increased risk of theft as the surrounding area will be more visible at night has been raised by submitter S53. Studies on the effects of outdoor night lighting levels show that crime is most often reduced with the increase in lighting levels.

9 Draft Requirement conditions

54. I have reviewed the draft conditions proposed by Kiwirail. I have the following comments.

55. Construction Traffic Management Plan, proposed Condition 57, should include a further bullet point along the following lines:

Consider if headlight sweep onto the windows of a residential dwelling bedroom is likely to occur because of construction traffic movements within the site and when exiting the site, if so, provide details for the measures to mitigate its effects.

56. In relation to Operational Lighting, proposed Condition 63, to ensure that obtrusive lighting effects are adequately mitigated, a requirement to comply with AS/NZS 4282:2019 Zone A2 limits is recommended. The last sentence can be added to along the following lines:

> and AS/NZS 4282:2019 – Control of the obtrusive effects of outdoor lighting, Zone A2 limits.

57. In relation to Operational Lighting, Condition 64, to ensure that the details and effects of the low security lighting and the under-carriage lighting are reviewed I recommend adding them to the list of items the submitted Lighting Design Plan is to include. Accordingly append to the bullet point list wording along the following lines:

> (d) details of low security lighting.
>
> (e)details of under-carriage lighting.

58. In relation to Operational Lighting, proposed Condition 64, to ensure that the effects of the lighting on road users is considered and mitigated to meet the recommendations of AS/NZS4282:2019 I recommend adding this requirement to the list of items the submitted Lighting Design Plan is to include. Accordingly append to the bullet point list wording along the following lines:

> (f) Threshold Increment in accordance with AS/NZS4282:2019.

59. In relation to Operational Lighting, proposed Condition 64, to ensure that there are no adverse lighting effects on traffic controller observations from the PN Airport Control Tower I recommend adding this requirement to the list of items the submitted Lighting Design Plan is to include. Accordingly append to the bullet point list wording along the following lines:

> (g) Show that glare to the PN Airport Control Tower meets the AS/NZS4282 limits for Zone A2.

60. In relation to Operational Traffic Management Plan, proposed Condition 67, include further bullet point to the requirements wording along the following lines:

> Consider whether headlight sweep onto the windows of a residential dwellings bedroom is likely to occur as a result of night-time traffic movements within the site and when exiting the site. If so, provide details for measures to mitigate its effects.

61. In my evidence I have provided recommendations for additional NoR conditions. They include the following:

62. To provide control of the effects of lighting associated with night-time construction I recommend adding a requirement for a construction lighting management plan to be submitted in advance of construction works. Suggested wording along the following lines:

> Prior to the commencement of construction works, submit Construction Lighting Management Plan (CLMP) for technical review and certification. As a minimum the CLMP shall detail how the effects of security lighting and working lights will comply with AS/NZS4282:2019 Zone A2 limits for spill light, glare and Threshold Increment. Also detail how headlight sweep is managed to ensure that vehicles exiting the site at night do not project headlight beams onto the bedroom windows of surrounding dwellings.

63. As requested by submitters S5 Palmerston Airport and S54 Airways Corporation add a requirement for Kiwirail to obtain a CAA NZ Part 77 determination in advance of construction works. Suggested wording along the following lines:

> Prior to the commencement of construction works, obtain a CAA NZ Part 77 determination for all proposed lighting poles and outdoor lighting effects.

64. Roof glare is a potential hazard that needs to be considered and therefore I recommend adding the following condition:

> The design of all buildings shall mitigate any potential roof glare to the south and particularly the PN Airport Air Control Tower.

65. To ensure the installed lighting is in accordance with the submitted and Council certified lighting design I recommend adding a requirement for

verifying the installed lighting is in accordance with the Council certified lighting design. Suggested wording along the following lines:

> Within 30 days of the commissioning of the lighting of a construction stage, submit to Council a report from a suitably qualified lighting practitioner that the installed lighting is in accordance with the Council certified lighting design and the spill light, glare, skyglow and effects on road users complies with AS/NZS 4282:2019 limits for Zone A2 environment.

Glen Wright

18 June 2021