

BEFORE THE ENVIRONMENT COURT
WELLINGTON REGISTRY

ENV-2023-

I TE KŌTI TAIAO O AOTEAROA
TĀMAKI MAKAURAU ROHE

IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of direct referral of an application under s 88 of the Act
for the determination of Resource Consent Application
RM220103

BETWEEN **FAR NORTH SOLAR FARMS LIMITED** a duly incorporated
company having its registered office at Level 1, 65 Main
Road, Kumeu

Applicant

AND **SOUTH WAIRARAPA DISTRICT COUNCIL**

Consent Authority

**AFFIDAVIT OF LAILA ALKAMIL IN SUPPORT OF NOTICE OF MOTION FOR
DIRECT REFERRAL**

Dated: 12 October 2023

TOMPKINS WAKE

Solicitor: Theresa Le Bas
theresa.lebas@tompkinswake.co.nz

Counsel: Theresa Le Bas
theresa.lebas@tompkinswake.co.nz

Westpac House
Level 8
430 Victoria Street
PO Box 258
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Hamilton 3240
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I, **LAILA ALKAMIL**, of **AUCKLAND**, **PLANNER**, affirm:

INTRODUCTION

1. I am a planner employed by Williamson Water & Land Advisory (**WWLA**), an environmental consultancy based in Kumeu, Auckland and Whangārei, Northland.
2. I hold a Bachelor of Urban Planning (First Class Honours) from the University of Auckland. I am a member of the Resource Management Law Association and an intermediate member of the New Zealand Planning Institute. I have approximately five years' experience in natural resource and infrastructure planning and policy development, largely specialising in large-scale wastewater, water supply, electricity, and transport infrastructure projects throughout New Zealand.
3. WWLA was engaged on 21 March 2022 by Far North Solar Farm Limited (the **Applicant**) to prepare and lodge an application for a land use consent (**Application**) with South Wairarapa District Council (**Council**). WWLA prepared an Assessment on Environmental Effects report (**AEE**) as part of the Application to fulfil the requirements of the Resource Management Act 1991 (**Act**).
4. I make this affidavit in support of the Applicant's Notice of Motion for its Application (Consent Reference RM220103) to be determined by the Environment Court instead of Council. I am authorised to make this affidavit on behalf of the Applicant.

RESOURCE CONSENT APPLICATION

5. The Applicant is a renewable asset developer based in Auckland with the objective of accelerating the use of renewable energy in New Zealand by establishing solar assets across the country.

6. The Applicant proposes to develop a solar farm in Greytown, in the Wairarapa. The site is an optimal location for a solar farm as it is relatively flat, which helps to reduce visual impact, and it is sufficiently proximate for connection to Transpower's grid. The total proposed site is 235 hectares, and the electricity generated is estimated to be capable of powering 40,000 homes.
7. On 21 December 2022, I lodged the Application with Council on behalf of the Applicant to establish and operate a 175-megawatt (peak) solar farm. The proposal includes:
 - (a) 321,160 photovoltaic solar panels on tracking tables, with a maximum height of 4.5m above the ground.
 - (b) 40 inverters and associated electricity infrastructure.
 - (c) Buildings not required for primary industry or residential purposes exceeding 25m².
 - (d) Associated site works and site accessways.
 - (e) Screen planting.
8. The Application site (**Site**) is located at:
 - (a) 415 Moroa Road, Greytown;
 - (b) 312 Bidwills Cutting Road, Greytown;
 - (c) 1942 State Highway 2, Greytown; and
 - (d) 18 Pharazyns Road, Featherston.
9. The Site is zoned Rural (Primary Production) in the Wairarapa Combined District Plan (**District Plan**). There are no other plan notations, overlays, or management areas applying to the Site that are relevant to the Application.
10. The Site is currently principally used for pastoral grazing and there are no waterbodies or wetlands on the site other than water races to provide drinking water for stock. It is a relatively flat site, the majority of which is grassed and is currently accessible from five vehicle access points.

11. Land use consent is required for a discretionary activity (Rule 21.6(a)) and a restricted discretionary activity (Rules 4.5.5(c) and 4.5.5(e)(i)) under the District Plan. A 35 year consent duration is sought.

REQUESTS FOR FURTHER INFORMATION

12. On 2 February 2023 Council requested further information from the Applicant pursuant to s 92 of the Act. I attach Council's request at **Annexure 1**. Council sought the information to better understand the proposal and its potential landscape and visual effects.
13. On 1 March 2023 I provided the Applicant's response to the Council's further information request which included the following documents:
 - (a) Amended site plan;
 - (b) Landscape mitigation plan;
 - (c) Proposed screening plan;
 - (d) Glint and glare effects and mitigation plan; and
 - (e) LUC soil map.
14. I have attached the Applicant's response at **Annexure 2**.
15. Council then engaged Boffa Miskell to review both the Application and the Applicant's further information to assist Council to determine the appropriate notification process to apply to the Application. The Boffa Miskell review was conducted by Emma McRae, Registered Landscape Architect, who concluded that the landscape effects were moderate due to the scale of change in the existing landscape pattern and the introduction of electricity infrastructure to a pastoral area. I have attached a copy of the Boffa Miskell review at **Annexure 3**.

PUBLIC NOTIFICATION

16. Council determined that the adverse effects associated with the proposal (namely noise and vibration during construction, and altered landscape characteristics) were more than minor under s 95A(8) of the Act and that public notification of the Application was required. It was acknowledged that whether the effects were more than minor was a finally balanced assessment, so Council went on to also consider whether there were special circumstances that would warrant public notification.
17. Council considered that at the time the District Plan was drafted, solar farms were not an anticipated activity but a distant possibility. Council noted the Application is the first of its kind in the Wairarapa and introduces a new type of land use into the rural environment. In combination, the Council concluded that these factors constituted special circumstances under s 95A(9) of the Act. Council therefore determined that the Application would be publicly notified.
18. The Application was notified on 8 May 2023. Submissions closed on 6 June 2023; 46 submissions were received. Of these, five submissions were partially or fully in support and 41 submissions were opposed to the proposal. 38 submitters stated that they wished to attend a hearing and speak in support of their submission. I have attached, at **Annexure 4**, a table dated 7 June 2023 summarising the submissions.
19. A number of submitters are well informed and, in some instances, recognised experts in the matters relevant to Council's considerations under s 104 of the Act.
20. In response to submitter comments, the Applicant sought additional technical assessments and updated the proposed Site layout.
21. Council sought further information from the Applicant on 27 June 2023 to address several issues raised by submitters. The information requested

included effects on transmission lines, glint and glare for road users, effect on aircraft operations, decommissioning plans, possible soil and water contamination, and noise and heating effects. The Council's additional further information request under s92 of the Act is attached as **Annexure 5**.

22. A copy of the Applicant's response, which I lodged with Council on 11 August 2023, is attached as **Annexure 6**.

REQUEST FOR DIRECT REFERRAL

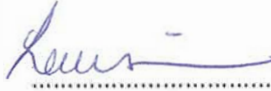
23. I lodged the Applicant's request for direct referral, under s 87D of the Act, with Council on 9 June 2023. A copy of the request I lodged is attached as **Annexure 7**.
24. The grounds relied on in the request for direct referral of the Application were:
- (a) The submitters are well informed and in some cases are recognised experts in the matters relevant to Council's consideration under s 104 of the Act.
 - (b) Elected Local Board members in some submissions have been confirmed by the Applicant.
 - (c) Against this background, the application process would benefit from the comprehensive range of case management tools available to the Court.
 - (d) The strength of the opinions within the community indicates that, in all likelihood, this application would inevitably be appealed to the Environment Court if heard by Council in the first instance.



25. On 11 September 2023, Council issued its decision agreeing to the Applicant's request to directly refer the Application to the Environment Court under s 87E of the Act. A copy of the Council's decision is attached as **Annexure 8**.
26. Council provided its report under s 87F of the Act to me on 6 October 2023 however on 11 October 2023 Council subsequently issued an updated copy of their report. This update is the s87F report I refer to in my affidavit and a copy of said report is attached as **Annexure 9**.
27. Following receipt of the Council's s87F report, I can confirm that the Applicant maintains that direct referral of its Application will enable the proposed development to be determined in a more cost-effective and timely manner, while enabling public participation in the resource consent process.
28. Matters in contention will be subject to expert evidence which can best be tested through cross-examination and other procedures available to the Court. The Application is also likely to benefit from the comprehensive range of case management tools available to the Court to best enable meaningful participation by submitters.
29. With the strength of the differing opinions held within the community, it is likely, in my opinion, that the Application would otherwise be appealed to the Environment Court if it was heard by Council in the first instance. Having the Application instead heard by the Environment Court will avoid duplication of cost and time for the Applicant, Council and submitters.

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30. Accordingly, the Applicant seeks the direct referral of of its Application to this Court under s 87G of the Act on the grounds set out in the accompanying Notice of Motion.

Signed: 
.....
Laila Alkamil

Affirmed at Auckland this th 12 day of October 2023

Before me: 
.....
A Solicitor of the High Court of New Zealand

DINO MONTEPARA
Barrister & Solicitor
Auckland



Ref: 220103

2 February 2023

Far North Solar Farm Limited
c/o Williamson Water and Land Advisory
Unit 10 1 Putaki Drive
Kumeu
Auckland 0841

Attention: Laila Alkamil
Email: Laila.Alkamil@wwla.kiwi

This is the annexure marked " 1 " referred to in the affidavit of Laila Alkamil affirmed at Auckland this 12 day of October 2023 before me:

Signature.....

A Solicitor of the High Court of New Zealand

DINO MONTEPARA
Barrister & Solicitor
Auckland

Dear Sir/Madam

**APPLICATION FOR RESOURCE CONSENT – SOLAR FARM IN RURAL ZONE,
MOROA ROAD, GREYTOWN
PLANNING APPLICATION NO 220103**

Request for Further Information

I refer to your abovementioned application for Resource Consent.

South Wairarapa District Council has reviewed your application for a 175-megawatt peak solar farm at 415 Moroa Road, Greytown. This includes an assessment against the provisions of the Wairarapa Combined District Plan (WCDP) and the information contained in the Assessment of Effects on the Environment and supporting assessments.

In accordance with section 92 of the Resource Management Act 1991 (RMA), the South Wairarapa District Council requests further information in order to obtain a better understanding of the nature and effects of your proposal, and the ways in which any adverse effects may be mitigated. The information required is as follows:

Assessment of Effects on the Environment

A digital copy of the Assessment of Effects on the Environment at a lower resolution for easier downloads, while ensuring the content of the document, particularly the figures and plans, are legible.

Plans

- Please provide a site plan, easily printable and legible at 1:10,000 at A3 size, that clearly shows details of the proposed farm, including:

LA

- The location and extent of the different arrays and the locations of the proposed inverters for each array
- The location of any buildings or other structures (including temporary buildings and structures for construction and permanent buildings and structures) other than inverters and arrays
- Clear identification of the proposed culvert crossings
- Clear location of screen tree planting

Landscape Mitigation Plan

A copy of the Landscape Mitigation Plan referred to in the AEE (for example, Section 5.4.2, page 17), including a plan showing the proposed location and types of screen planting, supported by document providing details over the proposed planting and its maintenance, prepared by a suitably qualified and experienced landscape architect.

Features Worthy of Conservation

Under Section 2.3.1 of the AEE, last paragraph, reference is made to the site including “some features worthy of conservation” (taken from section 5.0 of the Assessment of Landscape Effects). Could further clarification and description be provided as to the nature and location of such features, the potential effects of the proposal solar farms on these features and their proposed treatment (avoidance or mitigation measures).

Works in Proximity to High Voltage Transmission Lines

In section 3.5 of the AEE, a discussion of the measures proposed to mitigate any effects on the 110kV transmission lines traversing part of the site is provided. Further details on the mitigation measures are sought in relation to dust, maintenance of access to transmission line structures, and machinery working in proximity to lines.

It is stated that all panels and associated structures will be located a minimum of 20m from the centreline of the transmission line. In the Site Plan, two transmission line towers are shown outside the centreline, located close to the arrays to the north. Please clarify.

In addition, please clarify whether any consultation with Transpower has occurred and, if so, the outcomes of such consultation. We would note that any work or activity within the substation designation may require the prior approval of Transpower and/or Powerco under Section 176 of the RMA.

Construction Effects

Clarification whether a Construction Management Plan is proposed to be prepared to manage the potential adverse effects from construction activities (for example, dust generation).

Vehicular Access

Clarification as to the number of access points from public roads: in section 3.6 of the AEE, reference is made to three entrances are to be provided to the site, while five entrances are shown on the Site Plan.

- Please confirm how many and which existing access points would be upgraded and to what level.
- Based on the preliminary design provided with the application, it is unclear whether there is one main access point to the site or if all access points will be used: please clarify. In addition, please provide information on the nature of the vehicles that would be using the access points, particularly construction traffic.
- Please provide the distances between different access points and information on whether all appropriate sightlines can be maintained along the roads to all access points.
- Please confirm if there are any changes to the public roads proposed.

Operational Activities

In section 3.7 of the AEE, reference is made to a consent duration. Can you please clarify whether a consent duration is being sought? If so, what is this duration?

Buildings and Other Structures

Clarification whether the proposal involves the construction or placement of any buildings or other structures such as an office and associated facilities, whether permanent or for construction purposes), and any details of such structures, including their bulk, height, appearance, and location.

Visual simulations

Please provide a visual simulation from the following viewpoints:

- VP4, Moroa Road, in between two sections of site east/west
- VP7, Moroa Road, eastern extent of larger site parcel
- VP8/9, from Moroa Road looking into the site
- Views south from Moroa Road
- A representative view from along the northeastern boundary of the site looking towards an existing dwelling, with the solar farm behind.
- A representative viewpoint at some point along Moroa Road, preferably near the main entrance of the solar farm.

Planning Assessment: Wairarapa Combined District Plan

In section 4.2.1, the assessment against the rules of the Combined District Plan identified that consent is required under Rule 4.5.5(e)(i), with the matter of discretion identified as “avoiding, remedying, or mitigating of any effects deriving from non-compliance with the particular(s) that is not met.” Please clarify which area of non-compliance have been assessed.



Other Consents and Approvals Required

Please clarify whether any resource consents would be required from Greater Wellington Regional Council. If any are required, when is it anticipated they will be applied for?

Glare Effects

Further information sought on how glare effects are to be mitigated: in particular, further clarification is sought in how backtracking will reduce glare, using clearer larger diagrams.

National Policy Statement for Highly Productive Land

- Please provide the LUC Class(es) of the land at the site, supported by a map of local LUC classes overlain with the proposed solar farm.
- Please provide a further evaluation of the proposal against Policy 3.9(2)(j) and (3) of the National Policy Statement for Highly Productive Land regarding the construction of specified infrastructure.

National Policy Statement on Electricity Transmission

Please provide an evaluation of the proposal against the objective and policies of the National Policy Statement on Electricity Transmission.

Wairarapa Combined District Plan Assessment

Please provide an assessment on how the proposal will avoid or mitigate reverse sensitivity effects in accordance with Policy 4.3.5(d).

Advisory Notes

1. Written Approvals

Without the written approval of Transpower New Zealand Limited and Powerco Limited as the requiring authorities of the Greytown Substation, it is likely that these parties will be notified of the resource consent application.

2. Moroa Water Race culverts

An application will need to be made to the South Wairarapa District Council for a Moroa Water Race Bylaw 2007 approval, providing sufficient evidence that the culvert will not constrict flows or cause obstruction to routine maintenance. This will need to be sought and approved to ensure the activity can be lawfully carried out.

You can object to this request for further information in accordance with Section 357 by writing to the Council within 15 working days of receiving this request.

In the meantime, processing of your application has been placed on hold.

If you have any queries regarding your application, or the resource consent process please contact me on 06 306 9611 or email me at james.witham@swdc.govt.nz.

Kind Regards

James Witham
Planning Manager
South Wairarapa District Council

Approved for release by:



Timeline for Further Information

I advise that under Section 92A(3) of the Resource Management Act 1991 (the Act), your application may be considered even if the further information requested is not provided. Please note that the Council may exclude certain time periods relating to the provision of further information under section 88C of the Act.

Pursuant to Section 92A(1) of the Act, *within 15 working days* of the date of this letter (i.e. by **24th February 2023**), you must either:

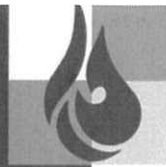
- (a) provide the further information; or
- (b) agree (in writing) to provide the further information (after which the Council will set a reasonable timeframe); or
- (c) refuse (in writing) to provide the further information.

Upon receipt and assessment of the requested further information, an assessment will be made if the effect of the development is considered to be more than minor and/or if there are any affected parties.

Please note that Section 92A(3) of the Act allows the Council to consider the application under section 104 even if you:

- (a) do not respond to the request; or
- (b) agree to provide the information but do not do so; or
- (c) refuse to provide the information.

Section 104(6) allows Council to decline an application on the grounds it has inadequate information to determine an application. Should you not respond or provide information requested, Council is required (under Section 95C) to publicly notify your application. The deposit for public notification of a resource consent is \$2200.



Annexure 2

South Wairarapa District Council

Attention: James Witham
james.witham@swdc.govt.nz

1 March 2023

Dear James

Resource Consent Application 415 Moroa Road, Greytown (Planning Application No. 220103) – Response to Further Information Request

This letter provides a response to your letter dated 2 February 2023 which requested further information pursuant to section 92(1) of the Resource Management Act 1991 (RMA). The requests are presented in *blue* italics, followed by our responses.

Assessment of Effects on the Environment

A digital copy of the Assessment of Effects on the Environment at a lower resolution for easier downloads, while ensuring the content of the document, particularly the figures and plans, are legible.

A copy of the compressed application documentation can be found here:

https://www.dropbox.com/s/ra1tzuvrjfluajv/WWLA_FINAL%20AEE_Greytown%20Solar%20Farm%20Final%20for%20Lodgement-compressed.pdf?dl=0

Plans

- *Please provide a site plan, easily printable and legible at 1:10,000 at A3 size, that clearly shows details of the proposed farm, including:*
 - *The location and extent of the different arrays and locations of the proposed inverters for each array*
 - *The location of any buildings or other structures (including temporary buildings and structures for construction and permanent buildings and structures) other than inverters and arrays*
 - *Clear identification of the proposed culvert crossings*
 - *Clear location of screen tree planting*

Please see the updated site plan and sections in **Appendix A**.

Landscape Mitigation Plan

A copy of the Landscape Mitigation Plan referred to in the AEE (for example, Section 5.4.2, page 17), including a plan showing the proposed location and types of screen planting, supported by document providing details over the proposed planting and its maintenance, prepared by a suitably qualified and experienced landscape architect.

L.A

A Landscape Mitigation Plan was provided as Figure 2a in the Landscape and Visual Assessment provided with the application (reattached as **Appendix B** for ease of reference). The plan

This is the annexure marked " 2 " referred to in the affidavit of Laila Alkamil affirmed at Auckland this 12 day of October 2023 before me:

Signature.....
A Solicitor of the High Court of New Zealand

DINO MONTEPARA
Barrister & Solicitor
Auckland

WWLA0589

provided with the application is not specifically labelled as Landscape Mitigation Plan however this plan shows the proposed planting, including spacing and grading. It is suggested that the provision of a planting maintenance plan be prepared and submitted to Council for certification as a condition of consent.

For further information on the proposed screen planting, refer to the memo in **Appendix C**.

Features Worthy of Conservation

Under Section 2.3.1 of the AEE, last paragraph, reference is made to the site including “some features worthy of conservation” (taken from section 5.0 of the Assessment of Landscape Effects). Could further clarification and description be provided as to the nature and location of such features, the potential effects of the proposal solar farms on these features and their proposed treatment (avoidance or mitigation measures).

The Landscape and Visual Assessment references “features worthy of conservation” as a landscape guideline criteria in order to assess site’s current landscape value. As described in Section 6.3 of the Landscape and Visual Assessment, the site is described as inhabiting expansive and pastoral landscape, which is structured by shelterbelts. The wider landscape is described as a grid pattern, with drainage ditches and shelter belts creating a distinctive patchwork. Combined, these characteristics contribute to there being features worthy of conservation as identified in the Landscape and Visual Assessment.

Works in Proximity to High Voltage Transmission Lines

In section 3.5 of the AEE, a discussion of the measures proposed to mitigate any effects on the 110kV transmission lines traversing part of the site is provided. Further details on the mitigation measures are sought in relation to dust, maintenance of access to transmission line structures, and machinery working in proximity to lines.

It is stated that all panels and associated structures will be located a minimum of 20m from the centreline of the transmission line. In the Site Plan, two transmission line towers are shown outside the centreline, located close to the arrays to the north. Please clarify.

In addition, please clarify whether any consultation with Transpower has occurred and, if so, the outcomes of such consultation. We would note that any work or activity within the substation designation may require the prior approval of Transpower and/or Powerco under Section 176 of the RMA.

As noted in Section 3.5 of the AEE, no works will be carried out within the 20 m of the centreline of the transmission lines. On that basis, there will be no machinery operating in proximity to the transmission lines and no earthworks will be undertaken within the 20 m setback. For this reason, no specific mitigation measures, with respect to dust and operation of machinery, are considered necessary given the separation distance provided.

Access to the transmission lines and support structures for Transpower will be maintained at all times and no solar panels or structures will be placed within the 20 m setback corridor. The site plan has been updated to reflect this (refer to **Appendix A**).

Furthermore, we note that the Applicant is in contract with Transpower regarding the connection of the solar farm to the National Grid and therefore Transpower is fully aware of the proposal.

Construction Effects

Clarification whether a Construction Management Plan is proposed to be prepared to manage the potential adverse effects from construction activities (for example, dust generation).

Given the proposal involves minimal earthworks and will adhere to NZECP:34 regulations, we anticipate the Construction Management Plan will have a limited scope and will include details regarding:

- Details of the proposed works, including earthworks;
- Construction traffic management protocols; and
- Protocols for working in proximity to high voltage transmission lines and structures.

A construction management plan will be prepared once a contractor has been appointed. It is suggested that a condition of consent be included that this is submitted to Council for certification prior to works commencing.

Vehicular Access

Clarification as to the number of access points from public roads: in section 3.6 of the AEE, reference is made to three entrances are to be provided to the site, while five entrances are shown on the site plan.

- *Please confirm how many and which existing access points would be upgraded and to what level.*
- *Based on the preliminary design provided with the application, it is unclear whether there is one main access point to the site or if all access points will be used: please clarify. In addition, please provide information the nature of the vehicles that would be using the access points, particularly construction traffic.*
- *Please provide the distances between different access points and information on whether all appropriate sightlines can be maintained along the roads to all access points.*
- *Please confirm if there are any changes to the public roads proposed.*

Five accessways will be constructed on the site – this is shown on the updated site plan (refer to **Appendix A**). Of these five, two accessways already exist but are not up to the required specifications as outlined in Appendix 5 of the WCDP.

All proposed accessways on the site will be used for the construction and operation of the solar farm. Construction traffic will involve small trucks and diggers / excavators. Operational traffic will be very limited and consist of staff arriving in small vans to the site.

The distance between the proposed accessways vary between 10-20 m. The proposed accessways will be constructed or upgraded in accordance with the specifications in Appendix 5 of the WCDP, including ensuring all appropriate sightlines are maintained.

No changes are proposed to the public roads.

Operational Activities

In section 3.7 of the AEE, reference is made to a consent duration. Can you please clarify whether a consent duration is being sought? If so, what is this duration?



An unlimited consent duration is sought pursuant to section 9 of the Resource Management Act 1991.

Buildings and Other Structures

Clarification whether the proposal involves the construction or placement of any buildings or other structures such as an office and associated facilities, whether permanent or for construction purposes, and any details of such structures, including their bulk, height, appearance and location.

The proposal involves a staff office and SCADA (data) room, that is required for the operation of the solar farm. This will be provided in the form of a 40 ft container and will be located by the switch yard (refer to the site plan in **Appendix A**). Water tanks will also be located across the site for irrigation and firefighting supply. No other buildings or structures are proposed as part of the construction or operation of the site.

Visual simulations

Please provide photos from the following viewpoints:

- *VP4, Moroa Road, in between two sections of site east/west.*
- *VP7, Moroa Road, eastern extent of larger site parcel.*
- *VP8/9, from Moroa Road looking into the site.*
- *Views south from Moroa Road.*
- *A representative view from along the northeastern boundary of the site looking towards an existing dwelling, with the solar farm behind.*
- *A representative viewpoint at some point along Moroa Road, preferably near the main entrance of the solar farm.*

Photos will be provided in due course, following our site visit with Mr Schofield on 6 March 2023.

Planning Assessment: Wairarapa Combined District Plan

In section 4.2.1, the assessment against the rules of the Combined District Plan identified that consent is required under Rule 4.5.5(e)(i), with the matter of discretion identified as “avoiding, remedying, or mitigating of any effects deriving from non-compliance with the particular(s) that is not met”. Please clarify which area of non-compliance have been assessed.

The proposed solar panels will be located approximately 12 m from the road boundary, and therefore will not be able to comply with the relevant setback requirements for unsealed roads under Standard 4.5.2 (c)(ii). The proposal complies with all other relevant zone standards.

Standard 4.5.2 (c)(ii) refers to Policies 4.3.2(d) and 4.3.5(c) of the WCDP.

Policy 4.3.2(d) states the following:

Maintain and enhance the amenity values, including natural character, of the differing Rural character areas through appropriate controls over subdivision and the bulk, location and nature of activities and buildings, to ensure activities and buildings are consistent with the rural character, including an appropriate scale, density and level of environmental effects.

Policy 4.3.5(c) states the following:

Manage the establishment and operation of a range of other activities in the Rural Zone, such that their adverse effects on the environment are appropriately avoided, remedied or mitigated.

Section 5 of the AEE assesses landscape and visual effects of the proposal, including effects on natural character and visual amenity. As noted in the application, effects on rural character and amenity values are assessed as being less than minor with the proposed screening in place. On that basis, we consider the application adequately addresses the relevant areas of non-compliance.

Other Consents and Approvals Required

Please clarify whether any resource consents would be required from Greater Wellington Regional Council. If any are required, when is it anticipated they will be applied for?

No resource consents are required from Greater Wellington Regional Council. As noted in the application, approval is being sought currently from the Wellington Water and Land Team in relation to the proposed crosses over the water races, in accordance with Rule 2.3.20 of the Moroa Water Race Bylaw 2007.

Glare Effects

Further information sought on how glare effects are to be mitigated, in particular, further clarification is sought in how backtracking will reduce glare, using clearer larger diagrams.

For further information on glint and glare effects and mitigation, please refer to the memo provided in **Appendix D**.

National Policy Statement for Highly Productive Land

- *Please provide the LUC Class(es) of the land at the site, supported by a map of local LUC classes overlain with the proposed solar farm.*
- *Please provide a further evaluation of the proposal against Policy 3.9(2)(j) and (3) of the National Policy Statement for Highly Productive Land regarding the construction of specified infrastructure.*

Based on the information provided by the Manaaki Whenua Landcare Research Institute¹, the entire site has a Land Use Classification (LUC) of Class 4. For further information, refer to the LUC map in **Appendix E**. A LUC of Class 4 describes soil that is arable but with significant limitations for arable use or cultivation, very limited crop types and suitable for occasional cropping, pastoralism, tree crops and forestry. On that basis, the site is not considered to be highly productive under the National Policy Statement for Highly Productive Land (NPS-HPL).

Policy 3.9(2)(j) and (3) therefore do not apply to the proposal.

National Policy Statement on Electricity Transmission

Please provide an evaluation of the proposal against the objective and policies of the National Policy Statement on Electricity Transmission.

The National Policy Statement for Electricity Transmission (NPS-ET) is for activities on existing electricity transmission lines. As noted previously, no structures or activities are taking place

¹ https://ourenvironment.scinfo.org.nz/maps-and-tools/app/Land%20Capability/Iri_luc_main



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within 20 m of the transmission lines on the site. Furthermore, the NPS-ET does not apply to the construction of electricity generation and therefore is not relevant to this application.

Wairarapa Combined District Plan Assessment

Please provide an assessment on how the proposal will avoid or mitigate reverse sensitivity effects in accordance with Policy 4.3.5(d).

A solar farm is not a sensitive activity and therefore will not constrain any future rural activities, or other permitted activities, from establishing in the future. Therefore Policy 4.3.5(d) is not relevant to this application.

Conclusion

We trust that there is now sufficient information available for you to continue processing the application. Please do not hesitate to contact Laila Alkamil on 027 266 8405 if you require further clarification of any aspects of this letter.

Yours sincerely,



Laila Alkamil

Planner | 027 266 8405

Laila.Alkamil@wwla.kiwi | www.wwla.kiwi

Appendix A: Updated Site Plan



INV

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R

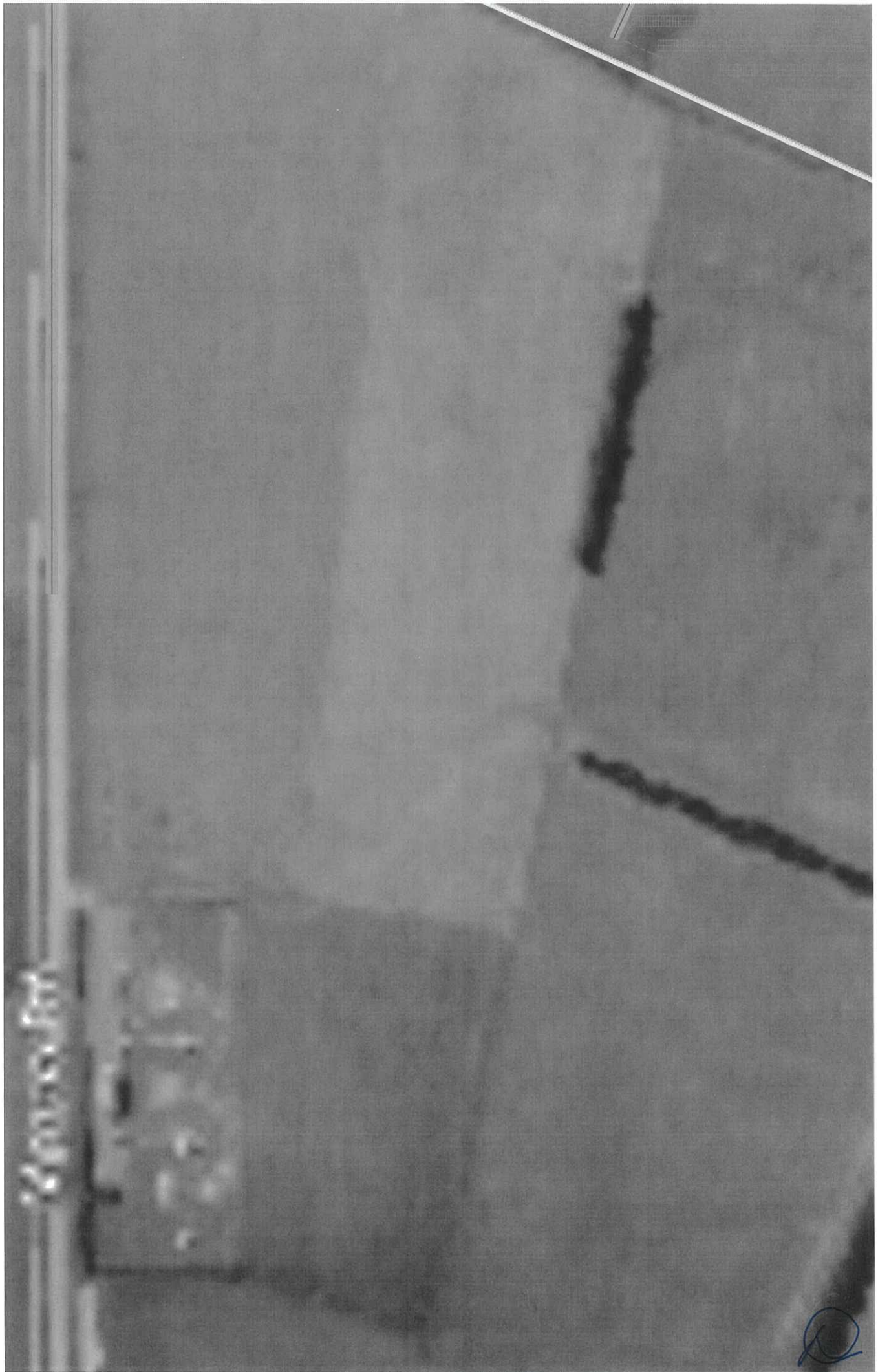
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Appendix B: Landscape Mitigation Plan

Far North Solar Farm Ltd. Moroa Road, Greytown

FIGURE 2a: The Proposal



Appendix C: Proposed Screening – Memo

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Tree planting for screening of FNSF's solar farm

Introduction

Far North Solar Farm Limited (FNSF) has gained resource consents to build four solar farms in the North Island of New Zealand, and is currently working on consent for others, spread across different regions of both Islands. This experience and ongoing work allows FNSF to understand the issues and solutions around the visual aspects and possible glint and glare from utility sized solar farms in rural and semi-rural areas. FNSF teams have visited the two currently operating solar farms in NZ and studied the location and screening of these, to check the assumptions used in our designs. FNSF staff have also visited solar farms in Australia and Europe to see how the issue is dealt with in other countries.

This paper discusses the process for selecting the locations for solar farms, the screening proposed and how the screen planting will be implemented and maintained.

Site Selection

FNSF aims to have solar farms on flat land, in rural areas, with suitable nearby electricity infrastructure to connect the solar farm to the electricity grid. While much of this is driven by economics and land availability, it also ensures the sites have fewer neighbours and the landscape already has features such as electricity pylons, substations and roading. For example, the Far North site in Pukenui is adjacent the Top Energy Limited Pukenui substation, on land that is currently cropped and grazed, and is not overlooked by houses (although there are dwellings nearby, they do not see the solar farm due to planting on their land or in the sight lines). The same is true for Waiotahi, where the solar farm wraps around a large Transpower grid point, Foxton, where no houses can see the site, and Edgecumbe, where only the landowners can see the site directly.

The issue can arise where homes have been built in rural areas that are sited to look through rural land to a distant view, or where roads adjacent to the site will have extended viewing of the solar farm.

Screen Planting

At the planning stage, FNSF takes into consideration nearby viewing points of the solar farm. This considers where the desired view is towards (i.e. distant ranges, the sea, the sky) and issues such as setbacks from roads and boundaries, waterways and shading. A large part of this includes consideration of existing screening, the distances and the angle of view. As an example, at Pukenui the nearest home to the site looked towards the west, and was sited north of the solar farm. The entire boundary was planted with 4-6m high bamboo, meaning the entire site was already screened from the house and most of the land. FNSF has proposed maintaining the bamboo to 3m height to avoid shading, and ensure the growth stays dense.

The Landscape and Visual Effects Assessment carried out by the landscape architect makes a study of these issues and proposed solutions. These solutions include the location and species of planting, and these reports have been the starting point for discussions with neighbours of our solar farms, as well as part of our resource consent applications.

In most cases, the planting plan submitted by the landscape architect is part of the approval from the council.

Trees, heights, widths and locations

Solar farms require some security, low shading and easy access around the site. This entails layouts that have low fencing on the boundary, and a higher security fence 3-6m inside that fence, with a 6-10m gap to any solar panels from that inner fence. This provides the ideal location for planting screening trees, and this can be seen in the layouts of FNSF farms and others, such as the Kapuni Solar Farm in Taranaki.



Figure 1. View of Kapuni Solar Farm showing width of planting. FNSF will screen all boundaries on their sites.

This planting area is fully utilised with species recommended by the landscape architect as being suitable for the location and purpose of minimising views of the site and glint or glare effects. The planting does not aim to cover entrances or even distant views of the site, but aims to remove the immediate effect from most viewpoints while being kept low enough to prevent shading and allow for the distant views that are desired.

The species selected, and the density of planting, is provided by the landscape architect based on experience with other projects, and the local environment.

All of FNSF's consented projects require a mix of native species planted in an arrangement to provide depth as well as height. At a new site, the predominant screening plant is not a native, and the area has many plantings of a single species planted in an offset manner of two or three rows. The species is Japanese Cedar (*Cryptomeria Japonica*), which when trimmed and topped provides a dense, good looking shelter belt and visual screen. The planting and maintenance for the first year is contracted to a specialist arborist, and these specialists normally have experience in the area (such as working with Waka Kotahi.) FNSF also includes plans for pest control on the sites, to improve the success rates of new plantings.



Japanese cedar on Moroa Road. (also below at Gun Club, Moroa Road)





Example of maintained Japanese cedar

When planted, trees are less than 1m high. It is planned that with proper maintenance, these will reach 3m within 3-5 years, and need ongoing maintenance.

Overseas' experience

Visiting solar farms in other countries revealed that in many cases, no effort was made to obscure the solar panels, except from main highways and airports. In Europe it was noted that housing tended to be clustered, with only occasional farm houses in remote locations. All solar farms visited had no screening apart from the security fence.

At the Melbourne airport, the solar farm has no screening, even though the area is fertile trees are common in the general area.



Melbourne Airport solar farm. Note the absence of screening.

Details of Greytown solar farm screening



The screening plan above shows the site is screened by trees on all sides. There are three types of screening shown:

- Yellow dashed - normal trees from nursery, around 1 year, 1m high
- Red dashed - Trees purchased one year earlier and now 2-2.5m high
- White dashed with yellow or red - existing shelter belt trees, 5-6m to be trimmed to 4m

The trees are expected to grow at 1m per year or more, and to encourage good growth, irrigation has been proposed for the site. This will make use of the onsite water storage tanks which are refilled from the farm's existing bore.

The mix of mature and new trees is aimed to provide a faster screen for neighbours who may see the solar farm from their dwelling, and some road approaches where the viewing time may be extended. An example of this is the approach on Moroa Road from Featherston (West) where the vehicles start to see the solar farm from 300m or more as they clear other trees. The sight lines to the solar farm are planted in the mature trees. Other viewpoints have had similar treatment. Other areas of mature trees are designed to minimise views from dwellings.



Existing trees

The Greytown site has existing pine and macrocarpa shelter belts, plus some gum species planted for firewood/shelter. Where these trees are inside the solar farm area, they will be removed by the landowner before the solar farm is started. Where the trees are on boundaries, they will be either trimmed to 3 or 4m (each row will be considered for its effects on shade, neighbours etc) or removed and replaced with new screening trees. In many cases this will improve the distant views, as these trees are in general over 8m high, in some cases much more. Feedback we have received on this from neighbours is positive as they will gain better outlooks to the ranges, and already have low trees in place for privacy.

Appendix D: Glint and Glare Effects and Mitigation Memo

Glint and Glare Considerations for FNSF Solar Farms

Introduction

Far North Solar Farm Limited (FNSF) has commissioned Renewable Engineering Group Ltd (REG) to investigate the effects of glint and glare from solar farms for each of FNSF's sites being consented. This has provided insight into the causes and mitigation of these effects on neighbours, nearby roads and in one case, an adjacent airstrip.

The investigation has included running a full glint and glare study at one site, and reviewing studies and mitigation plans from other solar farms in New Zealand and overseas.

The conclusion that has been drawn is that glint and glare is less of a concern as more experience with solar farms is gained. This is demonstrated by the case of solar farms being constructed and operated by airports, with studies recommending mitigation that is similar or less than the standard visual screening that FNSF plans for every solar farm proposed.

With each new solar farm, FNSF proposes a high degree of screen planting on all boundaries, with a target height that exceeds the height of the panels, the use of tracking panels in many sites, which removes most of the glint and glare potential, and siting solar farm away from populated areas.

Cause of glint and glare

Solar panels have a large, flat glass panel that faces the sun. A large number of panels can create multiple opportunities for a reflection (similar to a window flash from a car or house).

People could consider that the effect could be many times that of a single window glint, and occur more often or for longer than what may have been experienced without being near a solar farm.

We consider that solar farm glint and glare is less than expected for several reasons:

- The solar panel glass is a matt finish, which is designed to absorb light rather than reflect it;
- The panels are not mounted at an angle that is as likely to reflect towards an observer due to the panel facing directly towards the sun, as much as possible; and
- The solar farms are located in generally flat and rural sites.

Reflectivity

As the solar panels are very carefully designed to absorb light, rather than reflect it, research has shown that panels reflect less than glass, bodies of water, many house roofs and even some sealed surfaces. The small patterns and pits in the glass, as well as the glass material itself, means that any reflections are more random in direction and of less of a magnitude than experienced from window glass. The papers referenced below cover this matter well.

Angle of refraction

The angle of incidence determines the angle of refraction, so the positioning of the panel is a key factor. The experience at the site with the adjacent airstrip showed that fixed tilt, north facing panels can create glint and glare as the panels do not turn towards the sun, so have reflections towards some points of view, including on the ground, at a few times per year.

The higher the angle of tilt towards the north, the greater the chance of a downwards reflection at some times of the day on specific days of the year. This can occur at very low or very high sun angles. The low angles tended to be mornings and evenings in summer, and the higher angles when the sun was at or above the angle of the panels, causing a ground reflection.

This effect is greatly reduced with tracking solar systems, as the panels face either east or west, and are flat at noon. This means the reflection is always upwards (away from all ground based observation points) once the sun is even slightly above the horizon. The reflection is also generally to the south, and in-line with the sun itself, which is a direction that is already receiving natural glare.

Screening

In all the studies we have reviewed, the mitigation for glint and glare was to propose screening to a height equal to the panel height. This was to prevent the worst-case situations from very low sun angles being reflected at a low angle towards observation points. With screening in place, the low angles of reflection will be stopped by the trees.

In all FNSF's solar farms, trees are proposed for screening on all sides, planted early in the project and maintained at either 3m or 4m height. Where trees already are in place on the boundaries, these will be trimmed to a similar height, possibly higher if they are on a southern boundary.

Use of backtracking to maximise solar production and minimise glint and glare

Tracking solar systems (single axis trackers, which have a north south axis and tilt from east to west) aim to maximise the angle of incidence of the sun on the panels. This places the panels flat at noon (causing the glint to be upwards at an angle equal to the sun angle, but southwards into the sky) and have higher tilt angles earlier in the day. If the system did not allow for self-shading (where one row of tilted panels would shade the rows behind) the reflections at dawn and dusk would be low and not in the same position as the real sun.

However, there is no value in having panels shade each other, as this would reduce electricity generation significantly. To avoid this, the trackers use a backtracking algorithm, which lowers the panels to prevent shading. The result is that low angles of the sun generate low panel angles, reflecting the sunlight upwards, rather than forward towards the sun (and possible observers). The reflections that do occur are caught by the screening and are unlikely to be an issue due to the screening in the line of the sun. Backtracking prevents the very high angles of panels that are most likely to cause glint and glare.

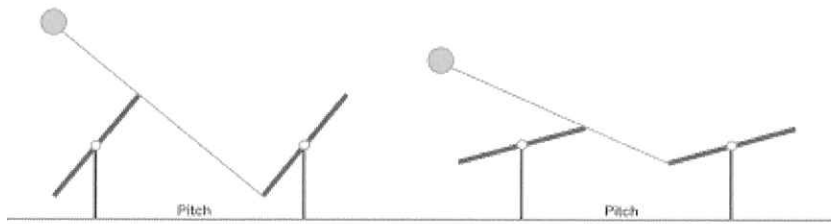


Figure 1. Example of how panel tilt decreasing after the start of shading, therefore avoiding high tilt angles that may cause low angle reflections (i.e. towards ground observers).

Summary

FNSF's solar farms are located on flat locations that minimise the number of locations that overlook the solar panels.

All FNSF's solar farms are designed and consented with high levels of tree screening, covering as many boundaries as possible, and maintained to a height that exceeds the height of the panels.

In areas where fixed tilt panels are used and there is a chance of glint and glare, studies have been conducted to minimise the issue. This was adjacent to an airstrip, where screening would not be between the solar farm and the approaching aircraft. The panels have been re-orientated to minimise the effect.

Even with screening, single axis tracking systems minimise glint and glare by directing the reflection upwards and towards the sun. Back-tracking algorithms reduce the high angles of the panel early and late in the day, preventing any low angle reflections.

All glint and glare studies with tracking solar systems have recommended screening to remove the effects. As all FNSF's solar farms are screened by design, we consider that they have already achieved the outcomes that such a study might recommend.

References:

Glint and glare study for Tauhei solar farm:

<https://www.epa.govt.nz/assets/Uploads/Documents/Fast-track-consenting/Tauhei-Solar-Farm/Application-documents/Appendix-H-Solar-Photovoltaic-Glint-and-Glare-Study-25Aug21.pdf>

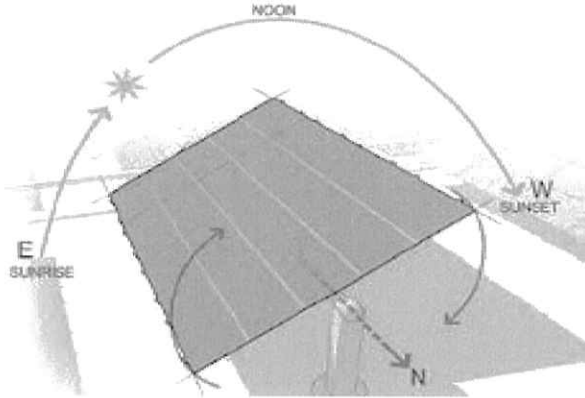
National Renewable Energy Laboratories:

<https://www.nrel.gov/state-local-tribal/blog/posts/research-and-analysis-demonstrate-the-lack-of-impacts-of-glare-from-photovoltaic-modules.html>

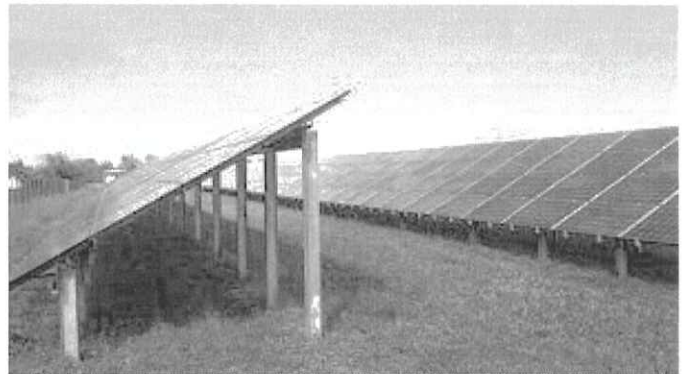
Solar Photovoltaic Glint and Glare Study - GOV.UK (Page 47 has table)

<https://www.nottinghamshire.gov.uk/planningsearch/DisplayImage.aspx?doc=cmVjb3JkX251bWJlcj02NjY5JmZpbGVuYW1IPVxcbnMwMS0wMDI5XGZpbGVkYXRhMiRcRElwMy0wMDMwXFNoYXJIZEFwcHNcRExHU1xQbGFuc1xQTEFOTklOR1xGLTMzNzNcMTMgQXBwZW5kaXggRSBHbGludCBhbmQgR2xhcmUgQXNzZXNzbWVudC5wZGYmaW1hZ2VfbnVtYmVyPTEzJmItYWdlX3R5cGU9cGxhbm5pbmcmcbGFzdF9tb2RpZmllZF9mcm9tX2Rpc2s9MTcvMDkvMjAxNSAwODo0OTozMA==>

Solar mounting options:



Single Axis tracker



Fixed tilt solar farm



East-West solar mounting





Appendix E: LUC Soil Map

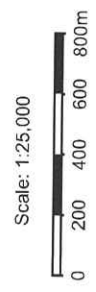
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OURENVIROMENT



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Legend

Land Use Capability

-  LUC Class 1
-  LUC Class 2
-  LUC Class 3
-  LUC Class 4
-  LUC Class 5
-  LUC Class 6
-  LUC Class 7
-  LUC Class 8

OUR ENVIRONMENT



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Annexure 3

This is the annexure marked '3' referred to in the affidavit of Laila Alkamil affirmed at Auckland this 7th day of October 2023 before me:

Boffa Miskell

Signature.....

DINO MONTEPAPA
Barrister & Solicitor
Auckland

A Solicitor of the High Court of New Zealand

Memorandum

- | | | | | |
|--|--|---|---|---|
| <input type="checkbox"/> Whangarei 35 Walton Street Whangarei 0110 +649 358 2526 | <input type="checkbox"/> Auckland PO Box 91250 Auckland 1142 +649 358 2526 | <input type="checkbox"/> Hamilton PO Box 1094 Hamilton 3240 +647 960 0006 | <input type="checkbox"/> Tauranga PO Box 13373 Tauranga 3141 +647 571 5511 | <input checked="" type="checkbox"/> Wellington Level 4 1 Post Office Square Wellington 6011 PO Box 11340 Wellington 6142 +644 385 9315 |
| <input type="checkbox"/> Nelson 51 Halifax Street Nelson 7010 +643 548 8551 | <input type="checkbox"/> Christchurch PO Box 110 Christchurch 8140 +643 366 8891 | <input type="checkbox"/> Queenstown PO Box 1028 Queenstown 9348 +643 441 1670 | <input type="checkbox"/> Dunedin 49 Water Street Dunedin 9016 +643 470 0460 | |

Attention: Robert Schofield

Company: Boffa Miskell

Date: 7 March 2023

From: Emma McRae, Landscape Architect

Message Ref: Review of Landscape and Visual Impacts Assessment for Far North Solar Farm, 415 Moroa Road, Greytown

Project No: BM220982

Introduction

Boffa Miskell has been engaged by South Wairarapa District Council (SWDC) to review the application for a proposed 175MW solar farm at 415 Moroa Road, Greytown. The application included an assessment of landscape effects prepared by Simon Cocker Landscape Architecture Ltd (8 December 2022) which was reviewed as part of the application documents. While this assessment provided some understanding of the site and its surroundings and the potential landscape and visual effects associated with the proposed development, a section 92 Further Information Request was made to provide further understanding of the proposal and its potential effects, including landscape and visual effects. Further information was received in February 2023 from the applicant, including visual simulations prepared by Virtual View. Following this, a site visit was carried out on 6 March 2023 to view the site and its surroundings, and to provide an understanding of potentially affected parties. The weather for this visit was fine and clear, with light winds.

The below review has been carried out by Emma McRae, a NZILA Registered Landscape Architect, in accordance with Te Tangi a te Manu: Aotearoa New Zealand Landscape Assessment Guidelines¹.

The Proposal

The proposal is described in section 3 of the assessment of landscape effects. It notes that the site covers an area of 237ha, with the proposed solar panels covering 66ha of the site. The proposed site straddles Moroa Road, occupying an area to the north of the road covering an area of 170ha, extending around 2km in length along Moroa Road. To the south of the road two discrete areas are proposed, bound by Moroa Road on the north boundary, one area to the west of 44ha and another to the east of 24ha.

¹ Te Tangi a Te Manu: Aotearoa New Zealand Landscape Assessment Guidelines, Tuia Pito Ora New Zealand Institute of Landscape Architects, July 2022.

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The site will comprise of 4,270 arrays, covered with 300,000 solar panels, along with 32 centrally located inverters. The panels will be mounted on tracking tables, mounted in portrait format, which rotate on a single axis 2.2m above the ground, with a maximum full tilt height of 4m above ground. The project will also involve a connection (an improvements to) the existing substation located at the corner of Morora Road and Bidwills Cuttings Road.

The development will involve the removal of all shelterbelts and vegetation within the site footprint, with shelterbelts on the site boundary being either trimmed to a height of 4m or removed where trimming would not provide the required screening.

The applicant proposes screen planting of *Cryptomeria japonica* (Japanese cedar) hedging planted in double staggered rows at a spacing of 1.5m, as illustrated on Figure 2a in the assessment of landscape effects. A 2m high security fence is also proposed around the site boundary, similar to the fencing at the existing substation. A 3m wide spacing will be provided between the existing fence line and the security fence line in which the proposed planting will sit. Larger grade plants are proposed for the sections of the boundary identified as being more visually sensitive to the proposed development. Planting is expected to occur in August 2024 with commissioning of the solar farm planned for December 2025. The assessment of landscape effects states that the proposed larger grade plants are expected to reach 2.5-3m in height, and others 2-2.5m in height by the date of commissioning.

Existing Environment

The existing environment is well described in section 4 of the assessment of landscape effects. The site is located 4km to the south west of Greytown, within the Wairarapa Valley and forms a part of the Palins and Lowlands landscape type, as identified in the Wairarapa Landscape Study. The Remutaka Range to the west and Aorangi Range to the east dominate views from the valley, with the Ruamahanga River and its tributaries are also a dominant feature of the plain. The plains are intensively grazed, with areas of horticulture declining.

It is noted that the site is positioned within the Central Plains character area, as defined in the Wairarapa Landscape Study. Within this area land use is diversified, including dairy, sheep and beef farming, scattered areas of market gardens and orchards. Land parcels follow a regular linear pattern, with drainage ditches and shelterbelts creating a distinctive patchwork landscape. Not noted within the landscape character description in the assessment (although mentioned in the visual catchment discussion) and observed during the site visit was that there are also two areas where rural lifestyle development dominates within the vicinity of the site. There is one such area to the northeast of the site on Bidwills Cutting Road, and another to the south along Battersea Road/ Settlement Road.

The site itself is not described within the assessment, but it is typical of this landscape, being comprised of pastoral fields used for sheep grazing, with a number of mature shelterbelts throughout which form part of the characteristic linear patchwork of the plains. An existing transmission line also crosses the site from the

substation to the east of the site towards State Highway 2 to the west. There are also a number of existing sheds and farm buildings located within the site.

Discussion

Having reviewed the application package, including the assessment of landscape effects dated December 2022, along with the further information provided in February 2023 by the applicant (including the visual simulations prepared by Virtual View) and following the site visit of 6 March 2023, I have drawn the following conclusions in relation to the landscape and visual effects of the proposed development.

Landscape Effects

The assessment of landscape effects considers the proposal against both the physical and perceptual aspects of the landscape and concludes that "any landscape effects would be limited to an area that has been previously modified (cleared of vegetation). The proposal will result in very limited localised change in the abiotic and biotic attributes of the site, but the landform and vegetation character of the site will be maintained and will reflect the character of the surrounding area." It is concluded in Section 8 of the assessment of landscape effects that the landscape effects as described above will be low.

While I agree that the proposal will have limited change in terms of the abiotic attributes of the site (i.e. the proposal involves minimal earthworks) and the underlying plains landscape remains, there will be a change to the biotic attributes of the site with the wholesale removal of shelterbelts within the site and trimming of shelterbelts to a height of 4m at the site boundaries. While this vegetation removal and trimming is a permitted activity, there will still be a perceptual landscape change, as there will be a change with the proposed hedging of the entire site boundary with Japanese cedar. While this proposed screen planting uses a shelterbelt species found within the local area, the wholesale removal of shelterbelts within the site and proposed hedging of the site perimeter will contribute to eroding the existing smaller scale patchwork landscape pattern which is characteristic of the area. There will also be a landscape change within the site itself, from an open, rural pastoral landscape to a built landscape of energy infrastructure. While this may be somewhat comparable to nearby orchard shelter structures as asserted in the assessment, the built intensity of the proposed development is much greater than these structures. For these reasons I consider the landscape effects to be moderate adverse.

Visual Effects

The visual catchment of the site is described in Section 4.3 of the assessment of landscape effects, and Table 1 in the report provides a list of potentially affected private properties with Table 2 providing an assessment of effects on these properties. I generally agree with the broader findings of the assessment of visual effects, that effects for users of Moroa Road will be low-moderate initially, diminishing to low within 5 years due to the establishment and growth of the proposed screen planting. I consider the effects for users of State Highway 2 to be low, given the speed of traffic, distance from the site, and angle of view towards the site in relation to the road. I agree with the findings for road users of Bidwills Cutting Road and other roads in the assessment. Visual effects for users of Pharazyn's Road, to the south of Bidwills Cutting Road, on the eastern side of the southern land parcel of the site have not been considered in the assessment. As this road lies similarly on a site boundary, I consider the effects for users of this road would be similar to that of users of Bidwills Cutting Road, that is low-moderate adverse.

With regard to effects from private properties, the assessment of landscape effects finds that visual effects for all dwellings in the vicinity of the site are either low or very low, with the exception of the two-storey dwelling at 268 Bidwills Cuttings Road which is considered to have low to moderate adverse effects during construction, following completion and into the longer term. I agree with this finding for the property at 268 Bidwills Cutting Road. However, after undertaking the site visit, I consider there are several other properties which will experience a greater level of effect than that defined in the assessment, as outlined in the following table:





| | | | Applicant's LVA | | | | BML Assessment | | | | |
|--|-----------------------------|---|----------------------|--------------------|-------------------|---|--|---|---|--|---|
| Address | Distance from site boundary | Nature of view | Construction effects | Short term effects | Long Term effects | Construction effects | Short term effects | Long Term effects | Construction effects | Short term effects | Long Term effects |
| 489 Moroa Road ² | 50m | House located on corner next to substation. Will experience near, oblique views of solar farm construction and near views of substation improvements. Proposed planting will screen views once established. | Low | Low | Nil | Low-moderate adverse, due to distance from site and angle of view, with some existing screening | Low-moderate adverse | Low adverse, due to establishment of proposed screening | Low-moderate adverse, due to distance from site and angle of view, with some existing screening | Low-moderate adverse | Low adverse, due to establishment of proposed screening |
| Lot 2/3 DP57088 New dwelling, corner Battersea and Moroa Road | 90-100m approx | New Dwelling with side winds which face out towards gap in shelterbelt with view through to site. View from upper storey into site. Views of construction activity and the solar farm will be visible. Once established planting will screen from lower windows | Not assessed | Not assessed | Not assessed | Low-moderate adverse, due to proximity to site and direct, open views through gap in shelterbelt | Low-moderate adverse | Low adverse, due to establishment of proposed screening | Low-moderate adverse, due to proximity to site and direct, open views through gap in shelterbelt | Low-moderate adverse | Low adverse, due to establishment of proposed screening |
| 286 Moroa Road | 160m | Views towards site from front windows of dwelling, through gap in the shelterbelt. Removal of road boundary shelterbelt within site will open up views into the site from this dwelling. Proposed planting will screen views once established. | Low | Low | Very Low | Low-moderate adverse, due to distance to site and open views through gap in shelterbelt, with views into site opening up further due to removal of shelterbelt on site boundary | Low-moderate adverse | Very Low adverse, c | Low-moderate adverse, due to distance to site and open views through gap in shelterbelt, with views into site opening up further due to removal of shelterbelt on site boundary | Low-moderate adverse | Very Low adverse, c |
| 56 Settlement Road | 90m | Open views from front of house and verandah directly towards site. | Low | Low | Nil | Moderate adverse, due to near distance, open views from | Low Moderate adverse, with screening provided by | Low adverse, as views of development reduced due to | Moderate adverse, due to near distance, open views from | Low Moderate adverse, with screening provided by | Low adverse, as views of development reduced due to |

² Listed as 489 Bidwills Cutting Road in Applicant's assessment

| | | | Applicant's LVA | | | | BML Assessment | | |
|----------------------------------|-----------------------------|--|----------------------|--------------------|-------------------|--|--|---|--|
| Address | Distance from site boundary | Nature of view | Construction effects | Short term effects | Long Term effects | Construction effects | Short term effects | Long Term effects | |
| (verandah house) | | | | | | front windows of dwelling which view directly towards the site. | advanced grade planting | establishment of proposed screening | |
| 76 Settlement Road | 270m | Oblique views from north and east windows towards site | Very Low | Very Low | Nil | Low adverse, due to oblique nature of view and distance | Low adverse | Very Low adverse | |
| 90 Settlement Road | 300m | Oblique views from north and east windows towards site | Very Low | Very Low | Nil | Low adverse, due to oblique nature of view and distance | Low adverse | Very Low adverse | |
| 96 Settlement Road (black house) | Approx 100m | Open, oblique views from dwelling towards site. | Low | Low | Very Low | Moderate adverse, due to near distance, oblique views from front windows of dwelling | Low-Moderate adverse, with screening provided by advanced grade planting | Low adverse, once planting has fully established | |
| 97 Settlement Road (white house) | 370m | Oblique, but open views from dwelling toward site | Low | Low | Nil | Low-Moderate adverse, due to open nature of oblique views towards site | Low adverse, with screening provided by advanced grade planting | Very Low adverse, once planting has fully established | |

Conclusion

In conclusion, I consider the landscape effects of the proposal to be moderate adverse due to the scale of change in the existing landscape pattern of the area and the introduction of built electricity infrastructure into a currently open pastoral landscape.

I consider that the visual effects for private dwellings at 489 Moroa Road, the corner of Settlement/ Battersea Roads and 286 Moroa Road to be Low-moderate adverse, decreasing to low adverse once planting has established.

The properties at 56 and 96 Settlement Road have the most open, near views towards the site and I consider the effects on these dwellings to be moderate adverse during construction, gradually decreasing to low-moderate adverse once planting starts to become established, with low adverse effects once this planting has established.

Emma McRae

Associate Principal, NZILA Registered Landscape Architect

Boffa Miskell Ltd.


Annexure 4

| No | Name | Address | Opposes / Supports | Wishes to be heard? | Summary of Submission | Key themes | Link to submission | Conditions / Actions Sought |
|----|------------------|---|--------------------|------------------------|---|--|--------------------|--|
| 1 | Andrew Heaton | 62b Cross Line, Greytown | Opposes | Yes | Proposal is not with keeping with the established rural amenity and character of the region. The proposed structures will dominate the landscape. The proposal poses a fire risk, risks to floral and fauna of the region, environmental risks from natural hazards and contamination risks to water and soil. There are no standards in New Zealand that require minimum setbacks for solar farms and the Applicant does not provide any risk mitigation for risks posed by the application | Fire risk, Ecological impacts, Landscape and visual effects, Groundwater effects, Natural hazard risks | | |
| 2 | Anne McGee | 64 Cross Line, Greytown | Opposes | Yes | The proposal will result in pollution to nearby water sources, from the panels themselves and the maintenance procedures. The proposed solar farm is also in an unsuitable location due to the region's vulnerability to earthquakes. More information is also needed on the fire risk posed by the proposal. | Fire risk, Natural hazard risks, Groundwater effects | | |
| 3 | Dayandra Hettige | 459 Bidwills Cutting Road, Greytown | Opposes | Yes | Concerned about the utility scale power generating plant and its proximity to the Greytown township. Concerned about chemicals leaching from the panels, from fire and also over them into the aquifers. Application does not provide sufficient information to assess effects. 3D rendering of the structures should of been provided. No assessment of the potential effects on the receiving environment in the event the solar farm catches on fire. In the event of a major fire at the facility, this would result in the closure of State Highway 2 and Bidwills Cutting Road. The Applicant has provided no detail regarding the fire mitigation and management plan. The Applicant should also provide details of the inverters and what substances they contain in order to understand the risk of pollution to the receiving environment. There is no information provided regarding noise emissions. The Applicant has also not provided any information regarding end of life recycling or assurance that the site will be fully reinstated. | Fire risk, Landscape and visual effects, Groundwater effects, Natural hazard risks, Decommissioning, Noise | | Fire Risk Management Plan : Decommissioning Plan, Details on inverters and noise pollution |
| 4 | Gail Isaac | 47 Cross Line Morrison's Bush, Greytown | Opposes | Yes (joint submission) | The proposal is an industrial activity on farmland that will threaten the natural environment. New Zealand has never experienced such a large power plant being located close to human settlement. | Groundwater effects, Ecological impacts | | |
| 5 | Jacqui Southey | 5 Colville Street, Masterton | Opposes | Yes (joint submission) | The proposal will affect property values in the area, due to adverse landscape and visual effects. There is a risk of noise pollution from the proposed solar farm, which has not been sufficiently addressed by the Applicant. | Property values, Landscape and visual effects, Noise | | |

This is the annexure marked " 4 " referred to in the affidavit of Laila Alkamil affirmed at Auckland this 12 day of October 2023 before me:

DINO MONTEPARA
Barrister & Solicitor
Auckland

Signature.....
A Solicitor of the High Court of New Zealand



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|---|--|--------------------------------------|------------------|------------------------|---|---|--|---|
| 6 | Lawrence Stephenson and Laura Pilgrim | 273A Bidwills Cutting Road, Greytown | Supports in part | Yes (joint submission) | Supports renewable energy however does not consider that visual and landscape effects have been sufficiently addressed in the application. Also notes there is inconsistency throughout the application regarding differences in dimensions between drawings and a lack of information regarding effects on highly productive soils. There also appears to be a lack of consultation undertaken with FENZ, iwi and the Wairarapa Dark Skies Reserve Committee. The application also does not address how construction effects will be managed. | Landscape and visual effects, Loss of productive soils, Lack of consultation, Construction traffic impacts | | Further mitigation needed to address visual effects. This should include native plants 3 m in front of the screening as proposed. 25 m setback from the road reserve should be provided for and 10 m setback from the screening. Applicant should also contribute to a community asset such as a cycleway. No lights should be used; either only infrared cameras or a Lighting Management Plan to be provided for approval by the Wairarapa Dark Sky Reserve Committee within 3 months of works commencing |
| 7 | Jo Woodcock and Aaron Woodcock | 2128 State Highway 2, Greytown | Opposes | Yes | Concerned about the Wairarapa Fault Line which runs directly under the site and how this might affect the land stability. There is also an adjacent grass runway next to the proposed solar farm, concerned about glint and glare affecting flight safety. Also concerned about panels leaching toxic chemicals into the ground / aquifer, given the proximity of the Moroa Water Race. Fire risk is also raised as a matter of concern. Compensation is also required for the loss of income that will be experienced by rural accommodation providers due to the construction of the solar farm nearby. It is also noted that there is no national best practice guideline for solar farm construction. The proposal will damage the cultural identity of the Greytown district. It is also being built on prime agricultural land, which should be preserved for farming activities. There is a lack of detail regarding decommissioning of the farm at the end of the consent. Environmental impacts are also expected due to the habitat loss from the heat generation from the solar mirrors and beam of concentrated sunlight. | Fire risk, Decommissioning, Landscape and visual effects, Ecological impacts, Glint and glare effects, Cultural values effects, Social impacts, Construction traffic impacts, Loss of productive soils, Natural hazard risks | | Glint and glare study to be provided. Fire Risk Management Plan to be provided. |
| 8 | Frank Van Steensel and Josje Neerinx (on behalf of Wairarapa Eco Farm) | 260 Moroa Road, Greytown | Opposes | Yes | Concerned about electromagnetic radiation on wildlife, particularly, Concerned about electromagnetic radiation on wildlife, particularly on bees. Also concerned about visual impacts for building tiny homes on their property if the solar farm development goes ahead. Main concerns are the scale of the project, distance of it from the property boundaries and business, known and unknown adverse effects and a lack of national regulation for this activity. Also concerned about wind effects destabilising the solar arrays, glare effects, fire hazard, noise and vibration effects and contamination of soil. | Ecological impacts, Glint and glare effects, Landscape and visual effects, Fire risk, Loss of productive soils, Heat Island Effects, Construction traffic impacts, Operational traffic impacts, Noise, Decommissioning, Electromagnetic Radiation | | |



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|----|-----------------------|-------------------------------------|---------|------------------------|---|--|---|
| 9 | Rodney and Judith Jay | 80 Battersea Road, Greytown | Opposes | Yes (joint submission) | <p>The proposal will fundamentally alter the land purpose from agricultural to industrial, resulting in a loss of amenity values. The application does not sufficiently consider the loss of amenity values on local residents and the district. The site has previously flooded and is expected to experience more extreme weather events with climate change - on that basis, the proposal is not a suitable activity for the site. The Applicant has not adequately considered the effects of climate change and how this will affect the solar farm operations.</p> | Landscape and visual effects, Natural hazard risks | <p>1. Reduce the site of the proposal to the north of Moroa Road to reduce the number of impacted visual receptors., 1. Reduce the site of the proposal to the north of Moroa Road to reduce the number of impacted visual receptors. 2. Require the shelter belts to be planted and maintained prior to construction. 3. Ensure the site remains dark at night. 4. Impose conditions on noise limits. 5. Impose conditions to restrict building to summer months only to avoid waterlogged soils</p> |
| 10 | Elizabeth Creevey | 144 Bidwills Cutting Road, Greytown | Opposes | Yes | <p>The proposal will result in a significant change to the entire district. The activity should be defined as an Industrial Network Utility activity and therefore it is not an appropriate activity in the rural zone. There are inconsistencies in the application regarding the height of the panels, number of substations and distance between the panels. Unclear from the application whether insecticide spraying will be undertaken and what decommissioning plans are in place. Submitter does not consider this site to be the best practicable option. Considers the proposal to be completely inappropriate for the rural zone and believes it will result in significant adverse effects on the receiving environment. Concerned about construction and operational noise effects from the proposal, glint and glare and effects on prime soils. The proposal will result in a significant change to the entire district. The activity should be defined as an Industrial Network Utility activity and therefore it is not an appropriate activity in the rural zone. There are inconsistencies in the application regarding the height of the panels, number of substations and distance between the panels. Unclear from the application whether insecticide spraying will be undertaken and what decommissioning plans are in place. Submitter does not consider this site to be the best practicable option. Considers the proposal to be completely inappropriate for the rural zone and believes it will result in significant adverse effects on the receiving environment. Concerned about construction and operational noise effects from the proposal, glint and glare and effects on prime soils. Also states that no information is provided in the</p> | Decommissioning, Fire risk, Ecological impacts, Property values, Landscape and visual effects, Glint and glare effects, Heat Island Effects, Natural hazard risks, Groundwater Radiation, Loss of productive soils | |

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|----|--|--------------------------------------|---------|-----|--|--|--|--|
| 11 | Rachel Hughes | 56 Settlement Road, Greytown | Opposes | Yes | <p>Proposal will result in a significant impact on the amenity values of the district. There was a lack of consultation with the immediate adjacent neighbours by the Applicant. Concerned about the risk of ambient noise (higher than what is usually expected in a rural environment) and risk of environmental damage. Cumulative effects of other solar farm developments. This application would set a precedent for other solar farm developments. Also concerned about effects of lighting on the dark sky reserve, heat island effects, wind damage and toxins leaching into the aquifer / water race. No detail is provided regarding decommissioning and how the proposal will adversely impact property values.</p> | <p>Decommissioning, Fire risk, Ecological impacts, Property values, Landscape and visual effects, Glint and glare effects, Natural hazard risks, Effects on the dark sky reserve, Heat island Effects, Lack of consultation, Groundwater effects, Operational traffic impacts, Construction traffic impacts, Noise</p> | | |
| 12 | Andrienne Nunns | 415 Moroa Road, Greytown | Opposes | Yes | <p>The proposal is for an industrial energy generation facility, which is incompatible with the site's rural zoning. The proposal is of a significant scale and will result in a more than minor adverse effects on landscape and amenity values. Concerned about property values being adversely affected. Proposal should be considered under Rule 2.1.1.24 in relation to Network Utilities and Energy Generation Activities. This proposal does not align with the intent of the District Plan in terms of preserving the rural character of the area. Although the site is not classed as highly productive, it is used for farming practices and should be retained for this use. The site regularly floods and needs to be considered by the Applicant. The proposal will result in adverse effects associated with the construction and operation. This includes noise, dust, glint and glare, pesticide / chemicals used to clean the panels, electromagnetic radiation and will result in groundwater contamination.</p> | <p>Landscape and visual effects, Property values, Glint and glare effects, Noise, Electromagnetic Radiation, Loss of productive soils, Groundwater effects, Decommissioning</p> | | |
| 13 | Warren Woodgyer | 20 Cotter Street, Greytown | Opposes | Yes | <p>Concerned that this proposal will set a precedent for other solar farm developments in the area. Cumulative effects of numerous solar farms in the district need to be considered. The proposal will result in the loss of valuable agricultural land - disagrees with the land being classed as LUC 4. Concerned about the social impact from the construction of solar farms and associated adverse effects, particularly on the landscape and amenity values of the district.</p> | <p>Ecological impacts, Landscape and visual effects, Social impacts, Social impacts</p> | | |
| 14 | Peter Isaac (on behalf of South Wairapa Whenua Advisory Group) | 47 Cross Line Morison Bush, Greytown | Opposes | Yes | <p>Presence of electrical equipment in proximity to the water poses an environmental threat to human safety. Proposal has not taken into account effects of climate change, particularly flood risk.</p> | <p>Natural hazard risks</p> | | |

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| 15 | Gaylene O'Connor | 122 Cross Line, Greytown | Opposes | Yes (joint submission) | Proposal is a threat to the environmental quality and character of Greytown. It will dominate the landscape and is not appropriate for a rural zone. The Applicants are seeking an unlimited consent duration which will permanently alter the site from primary production to a solar farm, which is a land use change. No explanation provided in the application why the setback from the roads cannot be achieved. Solar farms cannot be compared to glasshouses in terms of density on the site. Effects on natural character will be more than minor, particularly when the screen planting is maturing. Noise effects from the construction and operation of the solar farm have been overlooked. The proposal will in itself create a HAL site due the presence of inverters / substations. No information provided on the recommissioning of the solar panel or how materials will be recycled. | Decommissioning, Ecological impacts, Landscape and visual effects, Glint and glare effects, Noise, Loss of productive soils | |
| 16 | Louise Brown (On behalf of the Greytown Community Board) | PO BOX 6, Martimborough | Opposes | Yes | Recognises the importance of renewable energy, however considers that there has been insufficient public consultation regarding the proposal. Resource consent should not be granted until meaningful engagement has been undertaken with the Greytown community. | Lack of consultation | |
| 17 | John Walsh and Anne Clark | 38A Abbott Street, Ngaio | Opposes | No | Purchased a property on the corner of Moroa Road and Battersea Road. The proposal will significantly alter the landscape of the rural zone. The Applicant does not seem to be aware of the two residential properties which are to be built soon adjacent to the corner of Battersea and Moroa Roads. Concerned that mitigation plans have been developed without taking into account of this future development. Panels are described as being 4.5 m in height on the Site Plan, therefore the proposed screening should at least match this height. Lack of mitigation measures provided to address fire risk on site. | Landscape and visual effects, Lack of consultation, Fire risk | Screen planting need to be improved (increase height to over 4 m if height of panels is 4.5 m). |
| 18 | Peter Ratner and Carol Walters | 15 Ludy Street, Greytown | Supports in whole | Yes | Supports the proposal subject to conditions | | Applicant to provide a Stormwater Assessment. A bond should be in place to ensure the site is fully reinstated. An Independent Soil Report should be prepared. A requirement that the Applicant recycles all solar panels / materials. This should be in the form of a bond held by a third part |

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|----|---------------------|--|---------|-----|--|--|---|
| 19 | James Field | 268 Bidwills Cutting Road, Greytown | Opposes | Yes | <p>Professional aviator. Owns farms immediately bounding the north and east borders of the subject site. The proposal contravenes the strategic direction and intent of the District Plan (Strategic Objectives RE-O2, O3 and CCR-O3). The proposal will have significant landscape and visual effects, will affect the productive capability of the land and will result in toxic chemicals leaching into waterways as a result of natural disasters. Proposal will also result in flight safety risks, due to the proximity of the proposal to the grass runway near the site. Concerned about a lack of detail regarding recycling and decommissioning.</p> | <p>Landscape and visual effects, Groundwater effects, Decommissioning, Natural hazard risks, Loss of productive soils, Glint and glare effects</p> | |
| 20 | Danielle Genty-Nott | 273C Bidwills Cutting Road, Morison Bush | Opposes | No | <p>Concerned about impacts on soil from the panels. Also concerned that security lighting will be used which will impact the Dark Sky Reserve. Concerned about impacts on Moroa Road from construction and operational traffic - wants the Applicant to pay for the road to be sealed and maintained for the duration of their lease. Concerned about the use of non-native planting and the staging of planting to ensure trees are mature by the time panels are erected. Consideration needs to be given to the water requirements for irrigation. Also concerned about fire risk.</p> | <p>Fire risk, Operational traffic impacts, Construction traffic impacts, Effects on the dark sky reserve, Loss of productive soils</p> | <p>Applicant to provide funding to the Fire Brigade to assist with specific training / response to the proposed solar farm as a condition of consent.</p> |
| 21 | Richard Schofield | 149 Bidwills Cutting Road, Greytown | Opposes | Yes | <p>Overall, the application does not include an adequate assessment of environmental effects. The effects assessment on users of Moroa Road is incorrect and underestimates the extent and scale of adverse effects on landscape and visual effects. The proposal will result in the removal of shelter belts which will have an adverse effect on animal and plant life. The operation of the solar farm will also adversely affect birdlife. The application uses an unreasonable baseline comparing the proposal to the development of glasshouses. No assessment is provided for noise and further detail regarding noise levels from inverters, panel adjusters and other noise generating activities is required. There is no impact on the wind impacts from the removal of shelterbelts. The application also does not consider Heat Island Effects, Radio Frequency Interference impacts on cell coverage / internet, fire risk management, decommissioning planning and pest control required. The application also does not consider flood or earthquake risks and there has been comment on how the proposal may adversely impact local tourism.</p> | <p>Impacts on birds, Decommissioning, Fire risk, Electromagnetic Radiation, Natural hazard risks, Ecological impacts, Noise</p> | <p>Noise assessment needs to be provided. Bond needs to be in place to ensure site is reinstated at the end of the consent.</p> |

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|----|--------------------|------------------------------|------------------|------------------------|---|--|---|
| 22 | Denise Clements | 96 Settlement Road, Greytown | Opposes | Yes | <p>Site is not zoned for an industrial use such as a solar farm. Unsuitable location due to the proximity of the site to housing and sensitive activities. The proposal will result in the site becoming a HAIL site. Trees will be insufficient to screen the site. Significant water use required for irrigation may result in the bore drying up. More details is required regarding the proposed site lighting. Concern about proposed stormwater runoff from impermeable surfaces being erected. Also raises concern regarding increased truck movements along unsealed roads. States that power will go to Auckland and the district will have to experience the adverse effects from the operation. Application deliberately understates the adverse effects and alternatives need to be sought. Requests information on the potential heat generation and thermal convection of the proposed solar farm and a fire risk review.</p> | <p>Fire risk, Ecological impacts, Landscape and visual effects, Glint and glare effects, Cultural values effects, Construction traffic impacts, Operational traffic impacts, Heat Island Effects</p> | <p>Provide a glint and glare assessment, acoustic assessment, heat island effects assessment. Approach Iwi and seek a Cultural Impact Assessment.</p> |
| 23 | Dr Stephen Hartley | 6 Matai Grove, Greytown | Supports in part | Yes (joint submission) | <p>Supports the principles of moving to renewable electricity. Main concern is regarding the removal of large trees that are not being adequately offset and that the project is not increasing biodiversity on the site. A polyculture hedge of native trees and shrub could achieve greater biodiversity outcomes compared to the proposed Japanese cedar.</p> | | <p>Replace the proposed screening with a diverse polyculture hedge of native trees.</p> |
| 24 | Matthew Bell | 57 Cross Line, Greytown | Opposes | No | <p>Incompatible industrial use in the rural zone. The proposal will result in a precedent for industrial activities in the rural zone to be developed in the future. The proposal involves 4.5 m structures close to the road boundary. It will take several years for the proposed plantings to be mature to allow for sufficient screening, resulting in a more than minor adverse effects on the landscape and amenity values of the zone. Alternative sites should be considered with fewer visual receptors that would be affected.</p> | <p>Landscape and visual effects</p> | <p>Proposed screening should be at least 4 m in height.</p> |
| 25 | Shane Wraatt | 96 Settlement Road, Greytown | Opposes | Yes | <p>Unsuitable site due to its proximity to residential dwellings. The proposal's industrial nature makes it incongruent with the rural zoning. The activity will result in the site becoming a HAIL site. The site also experiences flooding, meaning a higher risk of contaminants entering surface waterbodies from the panels. Concerned about stormwater runoff from impermeable surfaces. No local benefit from the proposal. Insufficient consideration of alternatives given. Activity is not consistent with the provisions of the District Plan. The proposal will result in significant adverse effects on the rural character of the district. No detailed planting plans in the application or suggested provisions to ensure planting is maintained. Concerned about increased vehicle movements along Moroa Road.</p> | <p>Landscape and visual effects, Natural hazard risks, Construction traffic impacts, Operational traffic impacts</p> | |

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|----|--|--------------------------------------|-----------------|------------------------|--|--|--|---|
| 26 | Ainsley Kelly | 96 Settlement Road, Greytown | Opposes | Yes | Unsuitable site due to its proximity to residential dwellings. The proposal's industrial nature makes it incongruent with the rural zoning. The activity will result in the site becoming a HAIL site. The site also experiences flooding, meaning a higher risk of contaminants entering surface waterbodies from the panels. Concerned about stormwater runoff from impermeable surfaces. No local benefit from the proposal. Insufficient consideration of alternatives given. Activity is not consistent with the provisions of the District Plan. The proposal will result in significant adverse effects on the rural character of the district. No detailed planting plans in the application or suggested provisions to ensure planting is maintained. Concerned about increased vehicle movements along Moroa Road. | Landscape and visual effects, Natural hazard risks, Construction traffic impacts, Operational traffic impacts | | |
| 27 | Saane van Steenseel | 168 Main Street, Greytown | Opposes | Yes (joint submission) | Concerned about living close to the proposed solar farm and potential effects from electromagnetic radiation. Concerned that batteries will leach into groundwater and pollute drinking water. Lack of detail regarding decommissioning and recycling of the solar panels. Monoculture farming like solar is not beneficial. Concerned that the proposal will result in people moving around from the district due to landscape and visual effects. | Landscape and visual effects, Decommissioning, Electromagnetic Radiation, Natural hazard risks, Loss of productive soils, Social impacts | | |
| 28 | Mark Crawford | 273b Bidwills Cutting Road, Greytown | Opposes | No | Proposal is inconsistent with other rural activities provided for in the zone. No detail provided regarding the chemicals that may be used during construction and operation. Existing site access from Bidwills Cutting Road is not shown on the site plan provided with the application. | Landscape and visual effects | | |
| 29 | Liat Gush | 21 Hupenui Road, Greytown | Opposes | No | Concerned about the scale of the project and its proximity to residential dwellings and farms. The proposal should be treated as an industrial activity and will become a precedent for other large scale solar farms to be developed. | Landscape and visual effects, Electromagnetic Radiation | | |
| 30 | Maria Berry | Po Box 122 Featherston | Opposes | Yes (joint submission) | Concerned about the decommissioning of the solar farm at the end of the consent. Significant impact on the rural character and amenity values of the site. Concerned about noise impact and adverse effects from electromagnetic radiation. | Landscape and visual effects, Noise, Electromagnetic Radiation | | |
| 31 | Gerry and Jenny Van Dalen | 112 Wards Line, Greytown | Opposes | Not stated | Adverse effects on the rural character. Also concerned about potential health effects from living close to the solar panels. | Landscape and visual effects, Electromagnetic Radiation | | |
| 32 | Andy Eccleshall (on behalf of Transpower NZ Ltd) | Po Box 21154, Edgeware | Opposes in part | Yes | Seeks that NZECP requirements are adhered to and that protection is afforded National Grid infrastructure on site. | | | NZECP Conditions provided by Transpower to be imposed on any consent. |
| 33 | Abe Southey | 125 Battersea Road, Greytown | Oppose | Yes (joint submission) | [Blank] | | | |

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|----|---|--|-----------------|------------------------|--|--|--|--|
| 34 | Anna Whitehead | 169 Underhill Road, Greytown | Support | Yes | Renewable electricity will benefit Waipara | | | |
| 35 | Anna McGee | 64 Cross Line, Greytown | Oppose | Yes (joint submission) | Too close to housing and arterial roads. Chemical pollution and fire risk a concern. | Fire risk | | |
| 36 | Avis Stansly | 34 Hollis Road, Paraparaumu | Oppose | No | Landscape and visual effects on the town and impacts on tourism. | Landscape and visual effects | | |
| 37 | Ben Burger | 84 Bettersea Road, Greytown | Oppose | Yes | Landscape and visual effects and effects on the productive potential / soil of the site. | Landscape and visual effects, Loss of productive soils | | |
| 38 | Chris and Roz Geany | 415 Moroa Road, Greytown | Oppose | Yes (joint submission) | Change in character / use, contamination and fire risks. Lack of clarity in the application. | Fire risk, Landscape and visual effects | | |
| 39 | Dauida McDonald | 56 Settlement Road, Greytown | Oppose | Yes (joint submission) | Landscape and visual effects affecting the overall enjoyment of the district, noise effects are not addressed and a lack of sufficient consultation with affected landowners. | Landscape and visual effects, Lack of consultation, Noise | | |
| 40 | Folkert Burger | 13 Wilford Street, Wallaceville Upper Hutt | Oppose | Yes | Concerned about health risks associated with EMF. Also concerned about the scale of the project and noise pollution and stormwater runoff. | Landscape and visual effects, Electromagnetic Radiation, Noise | | |
| 41 | Ingrid Ward | 42 Reading Street, Greytown | Oppose | No | Endores the submission of Elizabeth Creavey | | | |
| 42 | Jeannie Hancock | 255 Bidwills Cutting Road, Greytown | Oppose | Yes (joint submission) | Concerned about visual effects and impacts on wildlife. Construction effects, noise pollution and impacts on tourism., Concerned about visual effects and impacts on wildlife. Construction effects, noise pollution and impacts on tourism. | Ecological impacts, Landscape and visual effects, Noise | | |
| 43 | Josh Kenneally (on behalf of Waka Kotahi) | | Support in part | Yes | Glare effects on SHW. Landscaping extension. | Glint and glare effects | Conditions provided., Extension of the 2m high planting along the north and north-eastern boundary of 'PLOT 3' would adequately mitigate any glint/glare effects resulting from this proposal. | |
| 44 | Lucyvarna Fowles | 13 Wilford Street, Wallaceville Upper Hutt | Oppose | Yes (joint submission) | Concerned about health risks associated with EMF. Also concerned about the scale of the project and noise pollution and stormwater runoff. | Landscape and visual effects, Electromagnetic Radiation, Noise | | |
| 45 | Nicole Kolvenbag | 84 Bettersea Road, Greytown | Oppose | Yes | Incompatible industrial use in the rural zone. Will impact tourism | Landscape and visual effects | | |
| 46 | Robyn Ramsden | 3 Farrier Grove, Featherston | Support | Yes | Will benefit the district by providing renewable electricity | | | |

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|---------------------------------|
| Decomissioning |
| Fire risk |
| Impacts on birds |
| Ecological impacts |
| Property values |
| Landscape and visual effects |
| Glint and glare effects |
| Cultural values effects |
| Social impacts |
| Construction traffic impacts |
| Operational traffic impacts |
| Groundwater effects |
| Lack of consultation |
| Heat Island Effects |
| Loss of productive soils |
| Natural hazard risks |
| Noise |
| Electromagnetic Radiation |
| Effects on the dark sky reserve |



27 June 2023

This is the annexure marked " 5 " referred to in the affidavit of Laila Alkamil affirmed at Auckland this 2 day of October 2023 before me:

Far North Solar Farm Limited
c/o Williamson Water and Land Advisory
Unit 10 1 Putaki Drive
Kumeu
Auckland 0841

Signature.....
A Solicitor of the High Court of New Zealand

DINO MONTEPARA
Barrister & Solicitor
Auckland

Attention: Laila Alkamil
Email: Laila.Alkamil@wwla.kiwi

Dear Laila

**APPLICATION FOR RESOURCE CONSENT – SOLAR FARM IN RURAL ZONE,
MOROA ROAD, GREYTOWN
PLANNING APPLICATION NO 220103**

Further information request – following the close of submissions

You will be aware that submissions on your application closed on 6 June 2023. I understand we have both received copies of all the submissions, where 46 submissions have been received to date. Please call me on 021 424 175 or email me if you think this is not the case.

Submitters raised a number of issues about the proposal which are of particular interest to us. Following my review of the submissions I am requesting the following further information from you. This is to help me better understand your proposed activity, its effect on the environment, and the ways any adverse effects on the environment might be mitigated.

Requested information

1. Effects on electricity transmission lines (Transpower assets)

Submitters have raised concerns regarding the access to transmission lines, the heights of shelter belts, the safe separation of mechanical plan during the construction phase and other construction effects. It is noted that a submitter (Transpower) has recommended conditions be imposed on this application. The limitations set out in those conditions on shelterbelts may be incompatible with the landscape mitigation strategy. The outcome of any consultation with Transpower, including any agreed and offered conditions should be provided. Please provide information on how these effects on transmission lines can be managed.

Note: The AEE does not include an assessment of the proposal against the National Policy Statement on Electricity Transmission (principally the objective and Policy 10), please provide this.

2. Glint and glare on State Highway 2 users

Submitters have identified that the proposed grade of planting for the shelterbelts intended to screen views of the solar farm from State Highway 2 will allow drivers to view the solar panels in the short term, and until the *Cryptomeria japonica* shelterbelt, attains a suitable height. This will have an effect on users of the SH2 network through glint/glare during this time. Please provide information on how these effects can be managed.

3. Effect on aircraft operations

Submitters have identified that the panels pose a risk to aircraft use on nearby sites as a climb out obstruction and through glint and glare creating sun strike for aircraft pilots. Whilst the report entitled ‘*Glint and Glare Considerations for FNSF Solar Farms*’ prepared by Renewable Energy Group addresses aircraft briefly in the summary noting that “The panels have been re-orientated to minimise the effect.” This appears to be a generic comment and it is unclear whether this has been factored into the design and layout of the solar farm. Please provide information on how the effects on aircraft use including potential obstructions and glint and glare can be managed.

4. End of life

Submitters have raised concerns regarding the end of life disposal of the panels. The AEE notes:

The panels themselves are warranted for 30 years with an expected lifespan in excess of the consent duration. At the end of the consented period, the solar farm is decommissioned and all materials are removed for recycling.

Please provide more information regarding the process of decommissioning and what protocols can be adopted to ensure that actual and potential effects of discharges of contaminated material can be suitably managed.

Note: at section 1.4 the AEE notes that an ‘unlimited duration’ is sought as the application is for a land use consent under section 9 of the Resource Management Act 1991. This is not consistent with section 3.7 that implies a ‘consented period’ and that this is less than 30 years. Please clarify whether a specified duration is sought.

5. Soil and water contamination from panel run-off and breakdown

Submitters have raised concern that over time the panels will breakdown and discharge contaminated material to land and water. Submissions also identify risk associated with panel damage releasing contaminated material. Please provide information on how, if any, adverse effects can be managed.

6. Noise effects during construction and operational phase

A number of submitters have raised concerns regarding the noise effects that may be generated during the construction phase and within the operational phase of the solar farm. It is noted that the AEE asserts that: “The proposed construction works will comply with the New Zealand Standard NZS 6803:1999...” and ‘Operational noise effects are minimal and will not be noticeable from the boundary of the site...Average maximum sound pressure at 1m distance was measured at 62dBA.’ Noting the permitted standard which excludes mobile sources associated with primary production at the notional boundary is:

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|-----------|-----------------|-----------|
| Daytime | 7.00am – 7.00pm | 55dBA L10 |
| Nighttime | 7.00pm – 7.00am | 45dBA L10 |
| | 9.00pm – 7.00am | 75dBA L10 |



Please provide an acoustic assessment, prepared by a suitably qualified person to confirm that both during the construction and operational phase of the activity adverse noise effects will be managed to within acceptable limits, with reference to the permitted standards. Submissions have noted that there are already other noise generating activities that may contribute to noise effects, and the proposal may generate a cumulative effect or exacerbated noise effects on amenity by the introduction of the panels themselves.

7. Heating effects

Submitters have raised concerns that panels will generate localised changes to temperature as a 'heat island'. Please provide information on how, if any, adverse heating effects can be managed.

8. Highly Productive Land

Submitters have raised concerns that the solar farm will diminish the productive capacity of the land by establishing a use on the land that is not 'land-based primary production'¹ and 'primary production'² activities. It is noted that essential parts of the solar farm proposal being the substation and switchyard and also part of the 'Extended Plot Area' are located on land identified as LUC 2 on the soil maps. An assessment in respect of the National Policy Statement for Highly Productive Land 2022 has been included in the AEE that states that there are 'functional and operational requirements for it to be located on the subject site'. Please provide further details on this functional and operational need assessment.

Providing the information

Three upcoming points in the consent process are important in relation to this information request. I understand that you have made a request for the application to be processed on a direct referral pathway, this request has not been determined at this time. The below is framed on a standard processing pathway and would need to change if direct referral is confirmed.

Planner's report to the hearing commissioners (section 42A report)

First, I will need to make a full assessment of your proposal in my report to the hearing commissioners.³ The purpose of the report is to help them make a decision on your application. Without complete information about your proposal, I may not be able to support it. The question of whether requested information has been made available is also a matter that the commissioners are required to have regard to when they make their decision, and they can refuse consent in cases where there is inadequate information.⁴

My report must be completed and made available to you, to all submitters who wish to be heard, and the commissioners on or 15 working days before the scheduled date for the hearing. If you intend to provide the requested information, I will need to receive it in sufficient time to act on it in my report.

Deadline for the provision of information before the hearing

¹ 'land-based primary production' refer National Policy Statement for Highly Productive Land 2022 – where this term is defined and 'means production, from agricultural, pastoral, horticultural, or forestry activities, that is reliant on the soil resource of the land.'

² 'primary production' refer Wairarapa Combined District Plan 2011 – where this term is defined to mean 'the use of land and accessory buildings (e.g. greenhouses) for the raising, growing and breeding of animals or vegetative matter and crops, including horticulture, plantation forestry, agriculture, viticulture, floriculture, racing stables, and outdoor (extensive) pig farming, as well as winemaking, flower packing, and other primary processing activities, but excludes top soil stripping, intensive farming activities, and mineral extraction and processing.'

³ Section 42A of the RMA

⁴ Section 104(6) and (7) of the RMA



Second, the Resource Management Act 1991 (the RMA) requires that any information requested of applicants be made available to us no later than 10 days before the hearing.⁵

Deadline for circulation of evidence before the hearing

Third, you will be required to make all your evidence available to us, so we can make it available to submitters and the hearings panel / commissioners, 10 days before the hearing.⁶

Requesting more time

We will not be suspending your application or waiving or extending our processing timeframes while you prepare and supply this information.

However, if you decide that you will require more time, you can suspend the processing at any time within the 130 working days.⁷ As a consequence of suspending processing, the dates for the hearing and prior exchange of evidence will most likely be delayed. If you consider it will be helpful to suspend the process, please make a request to me in writing.

Next steps

Once you have provided the further information, I will review what you have provided to make sure it adequately addresses all of the points of my request.

As you will be aware, the hearing for your application has not been scheduled at this time.

Timeframes that will need to be met by both you and Council leading up to the hearing are:

- At least 15 working days before the hearing we will send you a copy of the planning officer's recommendation report, as well as any other expert evidence.
- At least 10 working days before the hearing you must provide us with all the briefs of evidence, including legal submissions, that you intend to present to support your application at the hearing.
- At least five working days before the hearing submitters must provide to us briefs of any expert evidence they are calling.

If you have any queries, please contact me on 021 424 175 and quote the application number above.

Yours sincerely,



Nick Pollard
Consultant Planner

⁵ Section 92(3A) of the RMA

⁶ Section 103B of the RMA

⁷ Section 91A of the RMA



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Annexure 6

South Wairarapa District Council

Attention: Nick Pollard
Nick.Pollard@boffamiskell.co.nz

This is the annexure marked " 6 " referred to in the affidavit of Laila Alkamil affirmed at Auckland this 12 day of October 2023 before me:

Signature.....
A Solicitor of the High Court of New Zealand

11 August 2023

DINO MONTEPARA
Barrister & Solicitor
Auckland

WWLA0589

Dear Nick

Resource Consent Application 415 Moroa Road, Greytown (Planning Application No. 220103) – Response to Further Information Request Following the Close of Submissions

This letter provides a response to your letter dated 27 June 2023 which requested further information following the close of submissions on this application. The requests are presented in *blue italics*, followed by our responses.

1. *Effects on Electricity Transmission Lines (Transpower assets) Assessment of Effects on the Environment*

Submitters have raised concerns regarding the access to transmission lines, the heights of shelterbelts, the safe separation of mechanical plan during the construction phase and other construction effects. It is noted that a submitter (Transpower) has recommended conditions be imposed on this application. The limitations set out in those conditions on shelterbelts may be incompatible with the landscape mitigation strategy. The outcome of any consultation with Transpower, including any agreed and offered conditions should be provided. Please provide information on how these effects on transmission lines can be managed.

Note: The AEE does not include an assessment of the proposal against the National Policy Statement on Electricity Transmission (principally the objective and Policy 10), please provide this.

The Applicant has consulted with Transpower following the receipt of their submission. As a result of these discussions, the Applicant accepts the recommended conditions put forward by Transpower as set out in **Attachment 1**.

The conditions put forward by Transpower will ensure the appropriate setbacks and work practices set out under the NZECP:34 Regulations are adhered to for the duration of the project.

The proposed conditions require vegetation within 12 m of the centreline of the transmission lines and support structures to not exceed 2 m in height and to ensure, for any vegetation outside of these setbacks, that they cannot fall within 4 m of the transmission lines. All vegetation planted will comply with the Electricity (Hazards from Trees) Regulations 2003. This will not impact on the proposed screen planting, as this vegetation is focused around the site boundary and not within 12 m of transmission lines or support structures.

There are no plants to plant screening trees within the site, and at along the site boundary all proposed screening will be maintained to comply with the Electricity (Hazards from Trees) Regulations 2003.

2. *Glint and Glare on State Highway 2 Users*

Submitters have identified that the proposed grade of planting for the shelterbelts intended to screen views of the solar farm from State Highway 2 will allow drivers to view

the solar panels in the short term, and until the Cryptomeria japonica shelterbelt, attains a suitable height. This will have an effect on users of the SH2 network through glint/glare during this time. Please provide information on how these effects can be managed.

Refer to the Glint and Glare Assessment provided in **Attachment 2**. The assessment notes that up to 3 minutes of green glare between 5-6am from late January to early February and up to 3 minutes of green glare between 4:30 am and 5:30 am from late October to mid-November on State Highway 2 users can be expected. Overall, the impact of this is assessed as being very low (negligible) and no mitigation is required.

3. Effect on Aircraft Operations

Submitters have identified that the panels pose a risk to aircraft use on nearby sites as a climb out obstruction and through glint and glare creating sun strike for aircraft pilots. Whilst the report entitled 'Glint and Glare Considerations for FNSF Solar Farms' prepared by Renewable Energy Group addresses aircraft briefly in the summary noting that "The panels have been re-orientated to minimise the effect." This appears to be a generic comment and it is unclear whether this has been factored into the design and layout of the solar farm. Please provide information on how the effects on aircraft use including potential obstructions and glint and glare can be managed.

Please see the Glint and Glare Assessment in **Attachment 2**.

With regards to the airfield immediately east of the site, this does not appear to be a registered aerodrome according to the Civil Aviation Authority New Zealand's list of Aerodrome Coordinates. On that basis, this has been excluded from the Glint and Glare Assessment.

4. End of Life

Submitters have raised concerns regarding the end of the life disposal of the panels. The AEE notes:

The panels themselves are warranted for 30 years with an expected lifespan in excess of the consent duration. At the end of the consented period, the solar farm is decommissioned and all materials are removed for recycling.

Please provide more information regarding the process of decommissioning and what protocols can be adopted to ensure that actual and potential effects of discharges of contaminated material can be suitably managed.

Note: at section 1.4 the AEE notes that an 'unlimited duration' is sought as the application is for a land use consent under section 9 of the Resource Management Act 1991. This is not consistent with section 3.7 that implies a 'consented period' and that this is less than 30 years. Please clarify whether a specified duration is sought.

With regards to decommissioning, all site reinstatement is assured in the lease agreement with the property owner which includes a decommissioning bond. At the end of the solar farm operation, the Applicant will removal all energy facility, structures and equipment including subsurface wires and footings. Any access tracks within the site will be removed and re-planted with vegetation and grassland species, as appropriate. The solar panels and all other equipment removed from the project site, unless being reused or repurposed for another project, shall be recycled in accordance with all applicable policies and procedures in effect at the time of decommissioning.

In addition to this, the Applicant would accept a condition of consent that would require a Decommissioning Plan to be prepared and implemented.

With regards to the consent duration, it is noted an unlimited consent was sought in the application. However, the Applicant would like to amend this to a consent duration of 35 years which will be in line with the decommissioning plan for the solar farm.

5. Soil and Water Contamination from Panel Run-Off and Breakdown

Submitters have raised concern that over time the panels will breakdown and discharge contaminated material to land and water. Submissions also identify risk associated with panel damage releasing contaminated material. Please provide information on how, if any, adverse effects can be managed.

The panels are warranted for a duration of 35 years, with an expected lifespan in excess of the duration of the consent. The panels are designed to weather the elements for this period of time and there is no expected leachate of contaminants over the consent duration.

During the operation of the solar farm, the panels will be regularly checked and repaired (as required). At the end of the consented period, the panels will be decommissioned and all material and associated materials (i.e. cabling) will be removed off-site for recycling.

6. Noise Effects During Construction and Operational Phase

A number of submitters have raised concerns regarding the noise effects that may be generated during the construction phase and within the operational phase of the solar farm. It is noted that the AEE asserts that: "The proposed construction works will comply with the New Zealand Standard NZS 6803:1999..." and 'Operational noise effects are minimal and will not be noticeable from the boundary of the site...Average maximum sound pressure at 1m distance was measured at 62dBA'. Noting the permitted standard which excludes mobile sources associated with primary production at the notional boundary is:

| | | |
|-----------|-----------------|-----------|
| Daytime | 7.00am – 7.00pm | 55dBA L10 |
| Nighttime | 7.00pm – 7.00am | 45dBA L10 |
| | 9.00pm – 7.00am | 75dBA L10 |

Please provide an acoustic assessment, prepared by a suitably qualified person to confirm that both during the construction and operational phase of the activity adverse noise effects will be managed to within acceptable limits, with reference to the permitted standards. Submissions have noted that there are already other noise generating activities that may contribute to noise effects, and the proposal may generate a cumulative effect or exacerbated noise effects on amenity by the introduction of the panels themselves.

Please see the Acoustic Assessment in **Attachment 3**.

With regards to construction noise, the assessment notes that the majority of dwellings are well beyond 100 m from the piling and therefore compliance with the Wairarapa Combined District Plan construction noise rules will be complied with at most dwellings. However, there are some dwellings that will be closer to the piles than this. These are identified as:

- 489 Moroa Road;
- 56 Settlement Road; and
- 312 Bidwills Road.

Mitigation measures are proposed to ensure compliance with the NZS 6803:1999 noise limits at all dwelling facades. This includes limiting the use of unattenuated Vermeer or drop hammer piling occurring in close proximity to dwellings. In the event that a Vermeer-type or drop hammer piling rig was used, that a suitable dolly or shroud (or similarly effective method) is used to mitigate noise from the piling.



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To address this, a Noise Management Plan (NMP) is proposed to be prepared as part of the resource consent conditions. The key matter that the NMP will address are maps that will illustrate the “pilling zones” where noise levels may be above the NZS 6803:1999 noise limit without attenuation. For the wording of the proposed conditions, please refer to Section 9 of the Acoustic Assessment.

The operational noise limits have been found to comply with the permitted daytime limits as set out in the Wairarapa Combined District Plan.

7. Heating Effects

Submitters have also raised concerns that panels will generate localised changes to temperature as a ‘heat island’. Please provide information on how, if any, adverse heating effects can be managed.

Most of the world’s largest solar farms, and therefore a large proportion of solar farm studies, are located in savannah or desert environments (Aman et al., 2015; Barron-Gafford et al., 2016; Fthenakis and Yu, 2013; Montag et al., 2016; Nordberg et al., 2021; Taylor et al., 2019; Turney and Fthenakis, 2011). In these systems, PV panels are typically placed directly on bare ground. One such solar farm observed that temperatures were 3 to 4°C higher 2.5 metres above the ground compared to a natural desert control site. This was likely due to the combined effects of a lack of vegetation at the site, little room for convective cooling beneath the panels, and the low albedo of solar panels, as well as potential effects from the desert environment (Barron-Gafford et al., 2016). It is difficult to apply these findings to the proposed Greytown site as these panels will be 2-2.5 metres above pasture and the site has a very different climate from the Barron-Gafford study.

Agrivoltaic systems - wherein solar energy collection is undertaken on the same land as agricultural activities - affect temperature and soil moisture in very different ways than PV systems where panels are placed directly on bare ground. In a study of 18 soybean farms, areas shaded by panels were up to 10°C cooler than sun-exposed areas due to the combined effects of the lower albedo of crops, evapotranspiration from crops, and convective cooling under the raised panels (Williams et al., 2023). Similar results, showing lower ground temperatures and higher relative humidity and soil moisture, were also found by Dutch (Vervloesem et al., 2022) and American (Adeh et al., 2018) studies. Of particular relevance to the proposed Greytown site, sheep grazing in agrivoltaic systems in Oregon showed a 90% increase in late-season pasture productivity and 328% increased water efficiency compared to pastures without solar panels (Adeh et al., 2018).

Based on the combined results from several studies in more extreme environments than the proposed Greytown solar farm site, no evidence was found to indicate that a Heat Island Effect would be produced by raised solar panels installed over grazed pasture in the Wairarapa.

8. Highly Productive Land

Submitters have raised concerns that the solar farm will diminish the productive capacity of the land by establishing a use on the land that is not ‘land-based primary production’ and ‘primary production’ activities. It is noted that essential parts of the solar farm proposal being the substation and switchyard and also part of the ‘Extended Plot Area’ are located on land identified as LUC2 on the soil maps. An assessment in respect of the National Policy Statement for Highly Productive Land 2022 has been included in the AEE that states that there are ‘functional and operational requirements for it to be located on the subject site’. Please provide further details on this functional and operational need assessment.

The functional and operational need to locate the proposed solar farm in this specific location relates to the proximity of the grid connection point that is provided by the Transpower’s substation on the corner of Moroa Road and Bidwills Cutting Road. This enables the solar farm to



connect to the National Grid with minimal cabling / connection works required, which avoids electricity losses.

Furthermore, the site is of a suitable topography (i.e. relatively flat), not in prominent view of sensitive visual receptors and receives well-above average sunlight hours / irradiance, making it suitable for solar panels to be erected.

In addition to this, the Soil Assessment (**Attachment 4**) confirms the proposal will not adversely impact the productive potential of the site's soil and will actually be potentially more beneficial to soil structure and long-term potential productivity than many farming operations.

Conclusion

We trust that there is now sufficient information available for you to continue processing the application. Please do not hesitate to contact Laila Alkamil on 027 266 8405 if you require further clarification of any aspects of this letter.

Yours sincerely,



Laila Alkamil
Planner | 027 266 8405
Laila.Alkamil@wwla.kiwi | www.wwla.kiwi



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References

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Attachment 1: Transpower Conditions

A handwritten signature in blue ink, consisting of a large, stylized 'R' followed by the letters 'LA'.

General

1. The consent holder shall provide Transpower NZ Ltd 10 working days notice in writing prior to commencing the proposed works. Note: notification can be sent to transmission.corridor@transpower.co.nz

Building and Structures

2. No buildings or structures (except non-conductive fencing) shall be located within 12m of the centreline of the MST-UHT A National Grid transmission lines.
3. No buildings or structures shall be located within 12m of any outer visible edge of the foundation of National Grid support structures MST-UHT-A0192 to 0199; except for non-conductive fencing, which can be located 6m from any outer visible edge of the support structure foundation.

NZECF Compliance

4. All land use activities, including the construction of new buildings/structures, earthworks, fences, any operation of mobile plant and/or persons working near exposed line parts shall comply with the New Zealand Electrical Code of Practice for Electrical Safe Distances (NZECF 34:2001) or any subsequent revision of the code.

Access

5. All buildings, structures and vegetation must be located to ensure vehicle access is maintained to the MST-UHT A National Grid transmission lines, and support structures MST-UHT-A0192 to 0199, for maintenance at all reasonable times, and emergency works at all times.

Advice note: Transpower NZ Ltd has a right to access its existing assets under s23 of the Electricity Act 1992. Any development on must not preclude or obstruct this right of access. It is an offence under s163D of the Electricity Act 1992 to intentionally obstruct any person in the performance of any duty or in doing any work that the person has the lawful authority to do under s23 of the Electricity Act 1992.

Mobile Plant

6. All machinery and mobile plant operated in association with the works shall maintain a minimum clearance distance of 4 metres from the live overhead conductors (wires) of the MST-UHT A National Grid transmission lines at all times to avoid the potential of machinery striking the lines.
7. To ensure safe separation distances to the conductors (wires) of the National Grid transmission lines are maintained, all machinery, mobile plant and vehicles operating within 12m of the



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transmission lines, and traversing beneath the lines, shall be limited to a maximum reach height of 2.1 metres. This includes any loads being lifted or transported underneath the line.

Vegetation

8. Any proposed new trees or vegetation within 12 metres either side of the centreline of the MST-UHT A National Grid transmission line must not exceed 2 metres in height at full maturity and must comply with the Electricity (Hazards from Trees) Regulations 2003, or any subsequent revision of the regulations.
9. Any proposed new trees or vegetation outside of 12 metres either side of the centreline of the MST-UHT A National Grid transmission lines must be setback sufficiently to ensure the tree cannot fall within 4 metres of the National Grid transmission lines and must comply with the Electricity (Hazards from Trees) Regulations 2003, or any subsequent revision of the regulations.

Construction Management Plan

10. Prior to the commencement of the solar farm works, the consent holder shall prepare and submit to the Council for approval a Construction Management Plan (CMP) to ensure the protection of the MST– UHT A National Grid transmission lines and support structures. The CMP must be given to Transpower NZ Ltd for its certification at least 20 working days prior to being submitted to the Council.

Note: The CMP should be sent to Transpower via PATAI Form 5: <https://transpower.patai.co.nz/new-enquiry>

11. The CMP must include the following (but is not limited to):
 - a) The name, experience and qualifications of the person/s nominated by the consent holder to supervise the implementation of, and adherence to, the CMP.
 - b) Construction drawings, plans, procedures, methods and measures to demonstrate that all construction activities undertaken on the site will meet the safe distances within the New Zealand Electrical Code of Practice for Electrical Safe Distances 2001 (NZECP 34: 2001) or any subsequent revision of the code; including (but not limited to) those relating to:
 - i. Excavation and Construction near Towers (Section 2);
 - ii. Building to conductor clearances (Section 3);
 - iii. Ground to conductor clearances (Section 4);
 - iv. Mobile Plant to conductor clearances (Section 5); and
 - v. People to conductor clearances (Section 9).
 - c) Details of any areas that are “out of bounds” during construction and/or areas within which additional management measures are required, such as fencing off, entry and exit hurdles, maximum height limits, or where a safety observer may be required (a safety observer will be at the consent holder’s cost.
 - d) Demonstrate how the existing transmission lines and support structures will remain accessible during and after construction activities;



- e) Demonstrate how the effects of dust (including any other material potentially resulting from construction activities able to cause material damage beyond normal wear and tear) on the transmission lines will be managed;
- f) Demonstrate how changes to the drainage patterns, runoff characteristics and stormwater will avoid adverse effects on the foundations of any support structure;
- g) Demonstrate how construction activities that could result in ground vibrations and/or ground instability will be managed to avoid causing damage to the transmission lines, including support structures.
- h) Details of proposed contractor training for those working near the transmission lines.

12. All activities are to be undertaken in accordance with the approved CMP.



Attachment 2: Glint and Glare Assessment

A handwritten signature in blue ink, appearing to be the initials "PQ", is located in the bottom right corner of the page.

CA



Greytown Solar Farm Glint and glare study

Final Report

Revision 03
August 2023

ENGINEERING | STRATEGY | ANALYTICS | CONSTRUCTION





DOCUMENT CONTROL

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| Report Title | Greytown Solar Farm – Glint and glare study | | | | |
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| Client | Far North Solar Farm | Client Contact | John Andrews | | |
| Rev | Date | Status | Author/s | Reviewed By | Approved |
| 1 | 6/07/2023 | Draft | N Logan | I Chawla | N Logan |
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Project No. 23070 – Greytown Solar Farm August 2023 Revision 03





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Our regular clients include governments, energy utilities, financial institutions, international development donor agencies, project developers and investors, the R&D community, and private firms.

ABOUT THIS REPORT

This report assesses the glint and glare impact of the proposed Greytown Solar Farm near Greytown, New Zealand. It was commissioned by Far North Solar Farm Limited.



ABBREVIATIONS

| | |
|-------|---|
| AC | Alternating current |
| CAA | Civil Aviation Authority |
| DC | Direct current |
| FAA | Federal Aviation Administration (United States) |
| FNSF | Far North Solar Farm Limited |
| ha | Hectare |
| ITP | ITP Renewables |
| MW | Megawatt, unit of power (1 million Watts) |
| MWp | Megawatt-peak, unit of power at standard test conditions; used to indicate PV system capacity |
| OP | Observation point |
| PV | Photovoltaic |
| SGHAT | Solar Glare Hazard Analysis Tool |

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1 INTRODUCTION

1.1 Overview

Far North Solar Farm Limited (FNSF) has requested a glint and glare assessment for a proposed solar photovoltaic (PV) installation near Greytown, New Zealand. This assessment will be submitted as part of the consent process for the project. It includes:

- Identification of potential receptors of glint and glare from the proposed solar farm
- Assessment of the glint and glare hazard using the Solar Glare Hazard Analysis Tool (SGHAT) GlareGauge analysis

1.2 Glint and glare

The United States Federal Aviation Administration (FAA) defines glint and glare as follows:¹

- **Glint** is a momentary flash of bright light
- **Glare** is a continuous source of excessive brightness relative to ambient lighting.

Glint and glare can occur when light reflected off a surface (reflector) is viewed by a person (receptor). Glint typically occurs when either the receptor or the reflector is moving, while glare typically occurs when the reflector and receptor are completely, or nearly, stationary. For a transparent material (e.g., glass, water) the quantity of light reflected depends on the surface itself (i.e., material and texture), and the angle at which the light intercepts it (angle of incidence). A higher angle of incidence will result in a higher proportion of light being reflected, as shown in Figure 1.

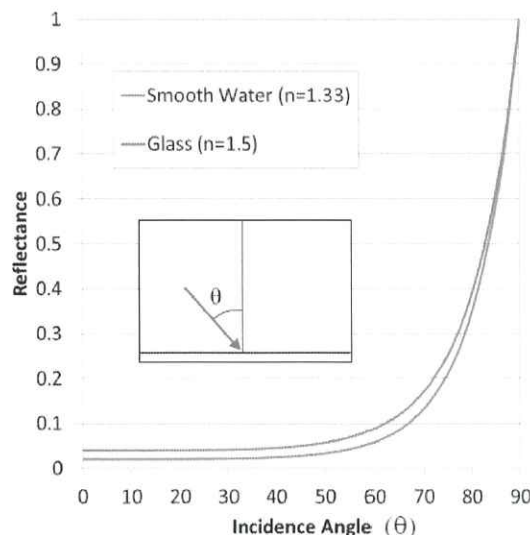


Figure 1: Angles of incidence and increased levels of reflected light

¹ Federal Aviation Administration [FAA], 2018

Potential visual impacts from glint and glare include distraction and temporary afterimage; at its worst, it can cause retinal burn. The ocular hazard caused by glint or glare is a function of:

1. The intensity of the glare upon the eye (retinal irradiance)
2. The subtended angle of the glare source (i.e., the extent to which the glare occupies the receptor's field of vision; dependent on size and distance of the reflector).

The severity of the ocular hazard can be divided into three levels, as shown in Figure 2:

- **Green glare**, which has low potential to cause temporary afterimage
- **Yellow glare**, which has potential to cause temporary afterimage
- **Red glare**, which can cause retinal burn and is not expected for PV.

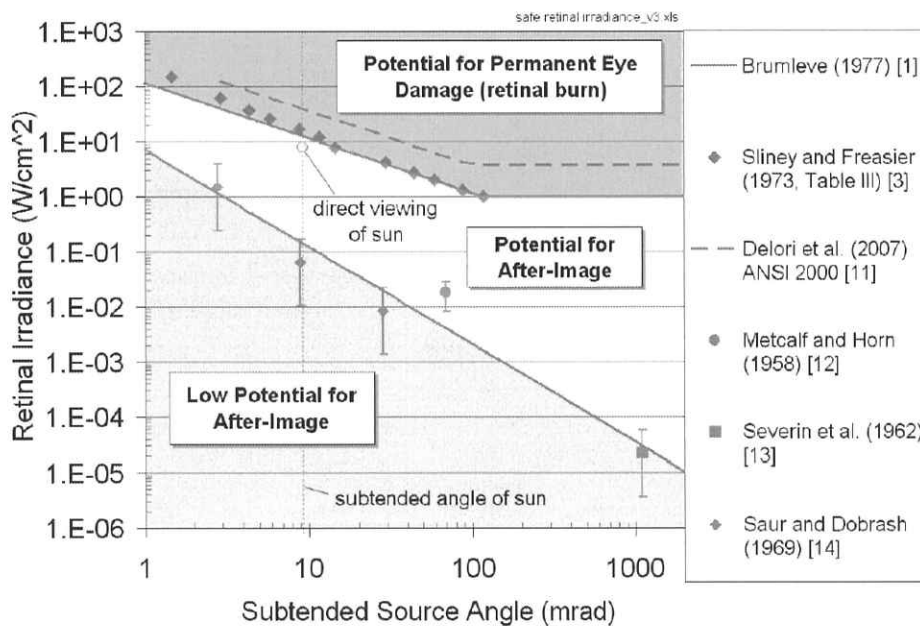


Figure 2: Classification of glare based on severity of ocular effects

1.3 Glare from solar PV

Solar photovoltaic (PV) cells are designed to absorb as much light as possible to maximise efficiency (generally around 98% of the light received). To limit reflection, solar cells are constructed from dark, light-absorbing material and are treated with an anti-reflective coating. PV modules generate less glare than many other surfaces, as shown in Figure 3.

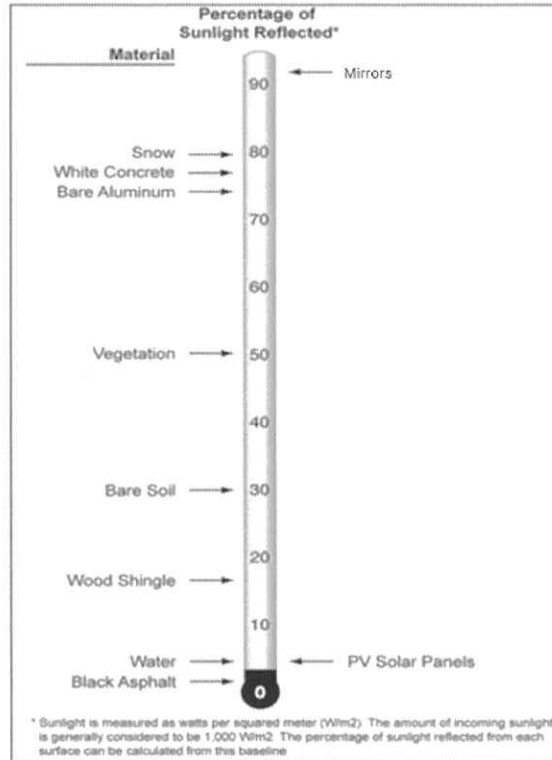


Figure 3: Typical percentage of sunlight reflected from different surfaces (Source: Adapted from Journal of Airport Management, 2014)

The small percentage of light reflected from PV modules varies depending on the angle of incidence. Figure 4 shows an example of this with a solar module. A larger angle of incidence will result in a higher percentage of reflected light.

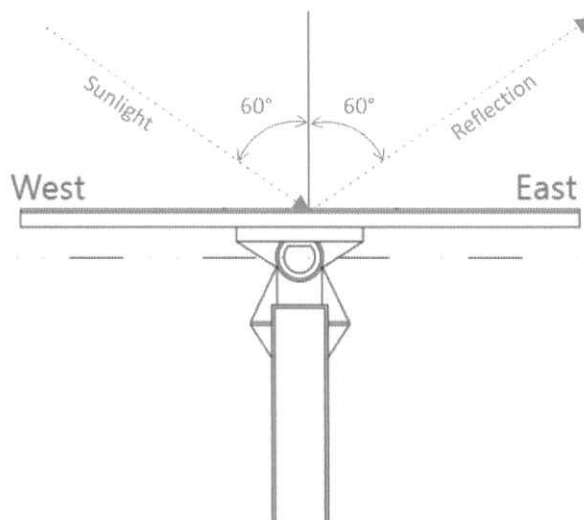


Figure 4: Typical sunlight reflection off the surface of a solar module

The two most common PV mounting structures are fixed tilt and single axis tracking. Fixed tilt arrays are stationary, while single axis tracking arrays rotate the receiving surface of the modules from east to west throughout the day as the sun moves across the sky.

In a fixed tilt PV array, since the sun is moving but the modules are stationary, the angle of incidence varies as the sun moves across the sky. It is smallest around noon when the sun is overhead and largest in the early morning and late afternoon when the sun is near the horizon. There is therefore a higher potential for glare at these times.

The angle of incidence for a single axis tracking system varies less as the reflective surface of the modules rotates on a horizontal axis to follow the sun. Single axis tracking arrays therefore generate less glare than fixed tilt arrays. The tracking varies throughout the year to match seasonal changes in the sun's path (see Figure 5).

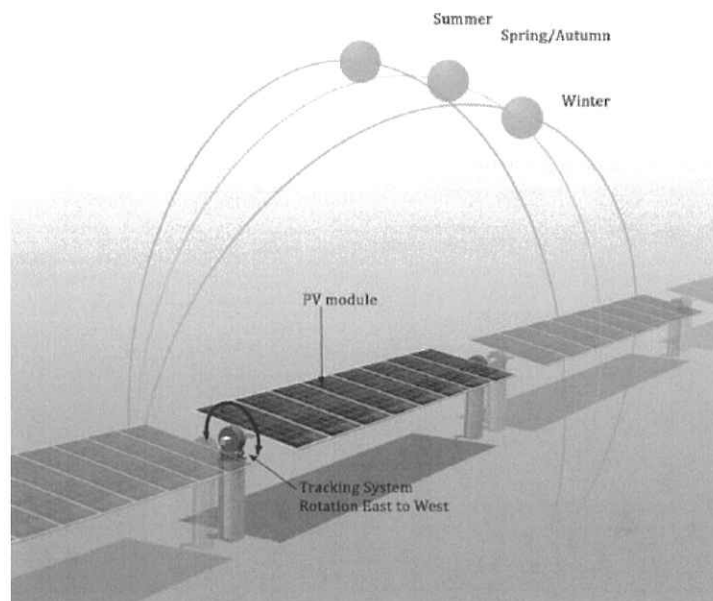


Figure 5: Sun position relative to PV modules on a horizontal single-axis tracking system

2 PROJECT DESCRIPTION

2.1 Site overview

FNSF is proposing a solar farm at the location described in Table 1 and shown in Figure 6. The site is located approximately 4 km south-west of Greytown. An indicative layout is displayed in Figure 7, Figure 8, and Figure 9.

Table 1: Site Information

| Parameter | Description |
|--------------|--|
| Parcels | Lot 10 DP 3106; Lots 5, 6, & 7 DP 8803; Lot 1 DP 76478; Part Section 122 Moroa DIST; Section 27 Moroa SETT; Lot 1 DP 52574 |
| Address | Moroa Rd |
| Council | South Wairarapa District Council |
| Project area | 220 ha |

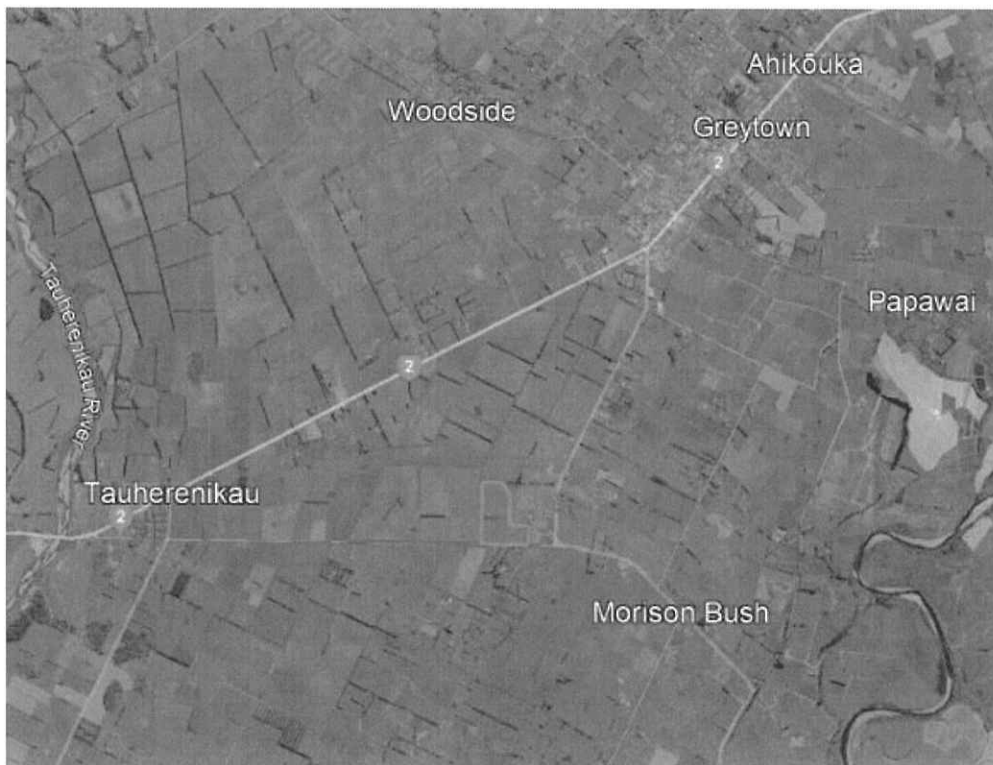


Figure 6: Greytown Solar Farm indicative location and PV layout



Figure 7: Array layout view 1



Figure 8: Array layout detail view 2



Figure 9: Array layout detail view 3

2.2 Solar farm details

Table 2 summarises the details of the proposed solar farm.

Table 2: Solar farm information

| Parameter | Description |
|-----------------|----------------------|
| Solar farm name | Greytown Solar Farm |
| Capacity | 175 MWp |
| Mounting system | Single-axis tracking |

FNSF is proposing to construct a solar farm with a DC capacity of 175 MWp on an approximately 220 ha site. There will be approximately 300,000 solar modules installed in 6,000 single-axis tracking tables (each table approximately 30 m long) running north-east to south-west. There is approximately 10.5 m spacing between each row and the maximum height of each table is approximately 4 m. The mounting system is constructed on piles that are driven into the ground. The solar farm will include 20 medium voltage (MV) power

stations. Each power station incorporates high/medium voltage switchgear, transformers, and inverters. The solar farm will be surrounded by a vegetation screen with a maximum height of 4 m.



Figure 10: Solar farm model layout showing arrays (yellow) surround by proposed screening (green)

3 ANALYSIS

3.1 Overview

The Solar Glare Hazard Analysis Tool (SGHAT) was developed by Sandia National Laboratories to evaluate glare resulting from solar farms at different viewpoints, based on the location, orientation, and specifications of the PV modules. This tool was required by the United States FAA for glare hazard analysis near airports until 2021 and is also recognised by the Australian Government Civil Aviation Safety Authority (CASA).

The GlareGauge software uses SGHAT to provide an indication of the type of glare expected at each potential receptor. It runs with a simulation timestep of one minute. Glint lasting for less than one minute is unlikely to occur from the sun on PV modules due to their slow movement.

Table 3 details the parameters used in the SGHAT model. GlareGauge default settings were adopted for the analysis time interval, direct normal irradiance, observer eye characteristics and slope error. The height of the observation points for road and rail users was assumed to be 1.5 m for a car driver. The height for a person standing was assumed to be 1.65 m.

The solar farm comprises three separate arrays. Each array was modelled separately, and the largest was further divided into five parts to improve the accuracy of the results. The vegetation screening was modelled as an opaque obstruction with a height of 4 m. The division of the array, and the proposed screening is shown in Figure 10.

Table 3: SGHAT specification inputs

| Parameters | Input |
|--------------------------------|---|
| Time zone | UTC+12:00 |
| Module surface material | Smooth glass with ARC (anti-reflective coating) |
| Module tracking | Single-axis tracking with backtracking |
| Backtracking algorithm | Shade |
| Maximum tilt angle | ±55° |
| Module axis orientation | 0° |
| Resting angle | 0° |
| Height of modules above ground | 2.25 m (height from the ground to the table centre) |
| Obstruction height | 4 m |

3.2 Potential receptors

This assessment considers potential visual receptors (e.g., residences and road users) within 2 km of the site. There is no formal guidance on the maximum distance for glint and glare assessments; however, the significance of a reflection decreases with distance for two main reasons:

1. The solar farm appears smaller (smaller subtended angle), and glare has less impact
2. Visual obstructions (e.g., terrain, vegetation) may block the view of the solar farm

Glint and glare impacts beyond 2 km are highly unlikely. This choice of distance is conservative and is based on existing studies and assessment experience.

Seventy-seven observation points and fourteen road routes were identified as potential visual receptors, as shown in Figure 11. Other observation points were excluded from the study due to intervening vegetation and other barriers which block line-of-site to the arrays.



Figure 11: Potential visual receptors within 2 km of the site

The client requested that ITP consider including a potential private airstrip immediately east of the array as shown in Figure 12. The location of the airstrip was difficult to identify, and it does not appear to be a registered aerodrome according to the Civil Aviation Authority New Zealand’s list of Aerodrome Coordinates.² Hence, ITP has excluded it from this study. The nearest listed aerodrome is Papawai Airfield, approximately 5.5 km northeast of the site.



Figure 12: Runway satellite imagery (Source: Google Maps, 2023)

3.3 Assumptions

The visual impact of solar farms depends on the scale and type of infrastructure, the prominence and topography of the site relative to the surrounding environment, and any proposed screening measures to reduce visibility of the site. ITP modelled a line of tall trees adjacent to NZ State Hwy 2 and the horizon line. Other minor screening was not assessed in detail. The GlareGauge analysis results are therefore considered conservative as the model assumes there is no screening.

² Civil Aviation Authority of New Zealand, 2023, Aeronautical Services: NZANR – Aerodrome Coordinates, https://www.aip.net.nz/assets/AIP/Air-Navigation-Register/5-Aerodromes/NZANR-Aerodrome_Coordinates.pdf

The line of tall trees adjacent to NZ State Hwy 2 was modelled using an obstruction object with a height of 5 m as shown in Figure 13.



Figure 13: Obstruction used to model roadside vegetation on NZ State Hwy 2

The horizon line was sourced from the National Institute of Water Atmospheric Research (NIWA) Solarview tool. The horizon line is shown in Figure 14. The line of hills to the north-west of the site introduces a horizon of between 1° and 3° in the afternoon. The horizon limit was modelled by running two ForgeSolar models, one with a minimum sun angle of 0° and the other with a minimum sun angle of 2.5° . For receptors where all glare occurred between May and August, the results from the 2.5° horizon model were substituted for the results from the 0° horizon model as the sun will be below the horizon at these times.

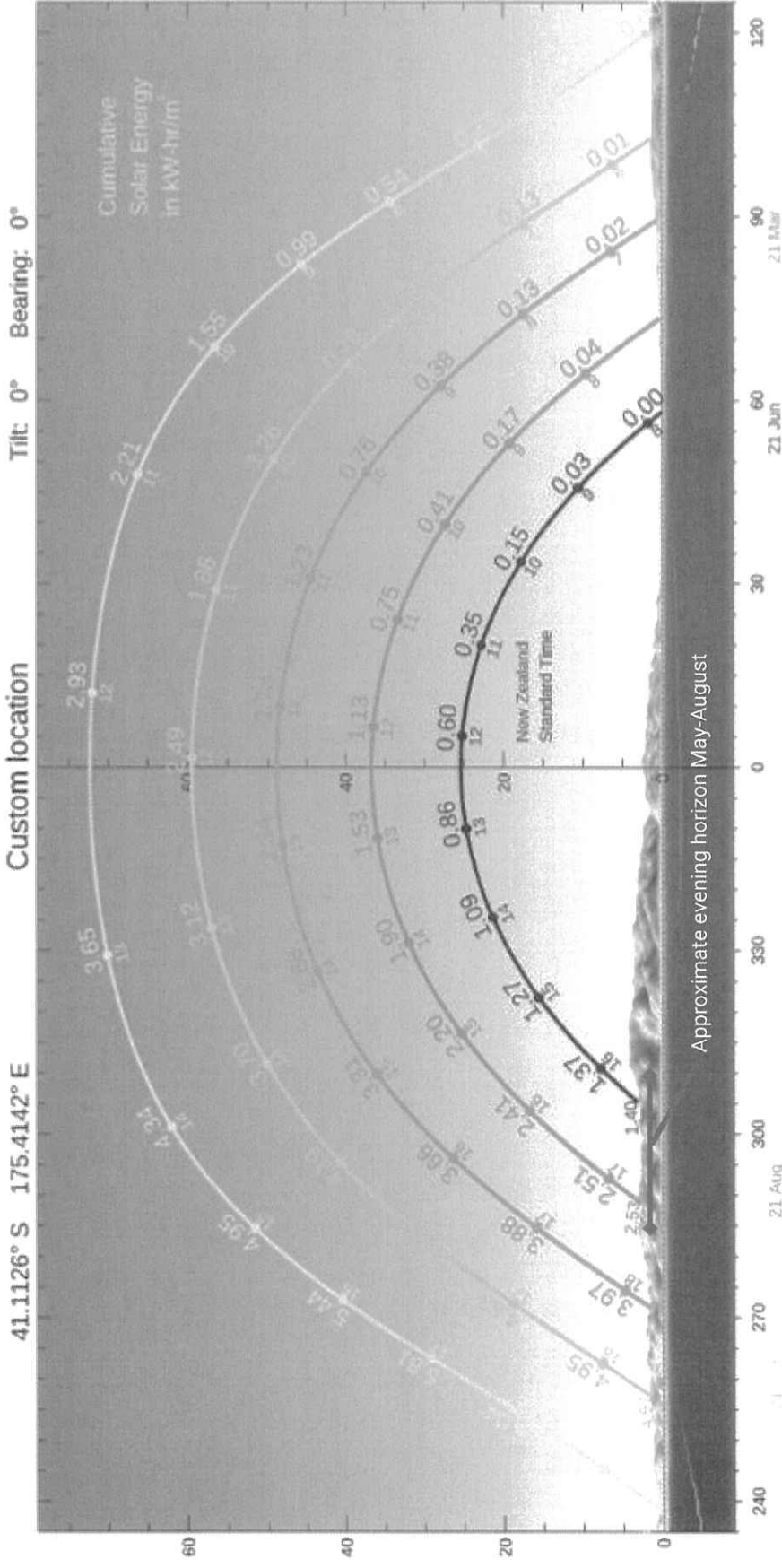


Figure 14: Horizon line at Greytown at different times of year (source: NIWA Solarview)

Atmospheric conditions such as cloud cover will also influence light reflection and the resulting impact on visual receptors. GlareGauge does not model varying atmospheric conditions. The GlareGauge analysis assumes clear sky conditions, with a peak direct normal irradiance (DNI) of 1,000 W/m² which varies throughout the day. This is a conservative assumption.

3.4 Results

The results of the GlareGauge analysis are summarised in Table 4. These results count only unique minutes of glare received from any source; they do not detail which of the eight PV areas the glare came from. For observation points where some glare occurred, the impact is described qualitatively. In general, most glare occurred in the early mornings or late evenings when backtracking is active.

The analysis identified 1,373 minutes (23 hours) of cumulative green glare spread across three observation points and three road routes. All other receptors (74 observation points and eleven road routes) received no glare at any time. No observation points or routes received more than 6 minutes of glare in any single day.

The 2.5° horizon model was used for seven observation points and one road route where all glare from the 0° horizon model occurred between May and August. In these cases, the sun will be below the horizon when glare would be expected otherwise. The effected receptors are:

- OPs 40, 41, 42, 43, 44, and 45
- OP 71
- Moroa Rd.

These receptors are highlighted in Table 4. The full results for both horizon models are included in Appendix A.



Table 4: Glare potential at each receptor

| Receptor | Location | Horizon model | Green (min/yr) | Yellow (min/yr) | Daily glare potential | Impact | Further mitigation required |
|----------|------------------|---------------|----------------|-----------------|--|----------|-----------------------------|
| OP 1 | -41.111, 175.390 | 0° | 125 | 0 | Up to 3 minutes of green glare between 4:30 am and 5:30 am from late November to late January. | Very low | No |
| OP 2 | -41.123, 175.433 | 0° | 0 | 0 | None | None | No |
| OP 3 | -41.124, 175.430 | 0° | 0 | 0 | None | None | No |
| OP 4 | -41.125, 175.429 | 0° | 0 | 0 | None | None | No |
| OP 5 | -41.109, 175.412 | 0° | 0 | 0 | None | None | No |
| OP 6 | -41.126, 175.427 | 0° | 0 | 0 | None | None | No |
| OP 7 | -41.127, 175.426 | 0° | 0 | 0 | None | None | No |
| OP 8 | -41.127, 175.424 | 0° | 0 | 0 | None | None | No |
| OP 9 | -41.125, 175.423 | 0° | 0 | 0 | None | None | No |
| OP 10 | -41.124, 175.422 | 0° | 0 | 0 | None | None | No |
| OP 11 | -41.125, 175.420 | 0° | 0 | 0 | None | None | No |
| OP 12 | -41.120, 175.412 | 0° | 0 | 0 | None | None | No |
| OP 13 | -41.112, 175.398 | 0° | 0 | 0 | None | None | No |
| OP 14 | -41.111, 175.402 | 0° | 0 | 0 | None | None | No |
| OP 15 | -41.106, 175.411 | 0° | 0 | 0 | None | None | No |
| OP 16 | -41.105, 175.413 | 0° | 0 | 0 | None | None | No |

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| Receptor | Location | Horizon model | Green (min/yr) | Yellow (min/yr) | Daily glare potential | Impact | Further mitigation required |
|----------|------------------|---------------|----------------|-----------------|-----------------------|--------|-----------------------------|
| OP 17 | -41.103, 175.408 | 0° | 0 | 0 | None | None | No |
| OP 18 | -41.100, 175.415 | 0° | 0 | 0 | None | None | No |
| OP 19 | -41.101, 175.419 | 0° | 0 | 0 | None | None | No |
| OP 20 | -41.099, 175.419 | 0° | 0 | 0 | None | None | No |
| OP 21 | -41.097, 175.418 | 0° | 0 | 0 | None | None | No |
| OP 22 | -41.100, 175.421 | 0° | 0 | 0 | None | None | No |
| OP 23 | -41.101, 175.422 | 0° | 0 | 0 | None | None | No |
| OP 24 | -41.099, 175.424 | 0° | 0 | 0 | None | None | No |
| OP 25 | -41.098, 175.425 | 0° | 0 | 0 | None | None | No |
| OP 26 | -41.098, 175.426 | 0° | 0 | 0 | None | None | No |
| OP 27 | -41.093, 175.432 | 0° | 0 | 0 | None | None | No |
| OP 28 | -41.116, 175.435 | 0° | 0 | 0 | None | None | No |
| OP 29 | -41.115, 175.439 | 0° | 0 | 0 | None | None | No |
| OP 30 | -41.113, 175.439 | 0° | 0 | 0 | None | None | No |
| OP 31 | -41.112, 175.437 | 0° | 0 | 0 | None | None | No |
| OP 32 | -41.112, 175.439 | 0° | 0 | 0 | None | None | No |
| OP 33 | -41.112, 175.440 | 0° | 0 | 0 | None | None | No |

4



| Receptor | Location | Horizon model | Green (min/yr) | Yellow (min/yr) | Daily glare potential | Impact | Further mitigation required |
|----------|------------------|---------------|----------------|-----------------|--|----------|-----------------------------|
| OP 34 | -41.109, 175.440 | 0° | 0 | 0 | None | None | No |
| OP 35 | -41.109, 175.442 | 0° | 0 | 0 | None | None | No |
| OP 36 | -41.112, 175.455 | 0° | 0 | 0 | None | None | No |
| OP 37 | -41.123, 175.451 | 0° | 0 | 0 | None | None | No |
| OP 38 | -41.123, 175.453 | 0° | 0 | 0 | None | None | No |
| OP 39 | -41.124, 175.453 | 0° | 0 | 0 | None | None | No |
| OP 40 | -41.126, 175.453 | 2.5° | 226 | 0 | Up to 6 minutes of green glare between 4 pm and 5:30 pm from early May to early August. | Very low | No |
| OP 41 | -41.127, 175.453 | 2.5° | 0 | 0 | None | None | No |
| OP 42 | -41.127, 175.457 | 2.5° | 0 | 0 | None | None | No |
| OP 43 | -41.128, 175.455 | 2.5° | 0 | 0 | None | None | No |
| OP 44 | -41.129, 175.453 | 2.5° | 0 | 0 | None | None | No |
| OP 45 | -41.130, 175.452 | 2.5° | 0 | 0 | None | None | No |
| OP 46 | -41.134, 175.448 | 0° | 0 | 0 | None | None | No |
| OP 47 | -41.142, 175.420 | 0° | 0 | 0 | None | None | No |
| OP 48 | -41.142, 175.420 | 0° | 0 | 0 | None | None | No |
| OP 49 | -41.112, 175.388 | 0° | 227 | 0 | Up to 4 minutes of green glare between 4:30 am and 6 am from mid-November to early February. | Very low | No |





| Receptor | Location | Horizon model | Green (min/yr) | Yellow (min/yr) | Daily glare potential | Impact | Further mitigation required |
|----------|------------------|---------------|----------------|-----------------|-----------------------|--------|-----------------------------|
| OP 50 | -41.141, 175.424 | 0° | 0 | 0 | None | None | No |
| OP 51 | -41.140, 175.422 | 0° | 0 | 0 | None | None | No |
| OP 52 | -41.138, 175.423 | 0° | 0 | 0 | None | None | No |
| OP 53 | -41.139, 175.421 | 0° | 0 | 0 | None | None | No |
| OP 54 | -41.137, 175.422 | 0° | 0 | 0 | None | None | No |
| OP 55 | -41.143, 175.414 | 0° | 0 | 0 | None | None | No |
| OP 56 | -41.143, 175.411 | 0° | 0 | 0 | None | None | No |
| OP 57 | -41.143, 175.409 | 0° | 0 | 0 | None | None | No |
| OP 58 | -41.141, 175.406 | 0° | 0 | 0 | None | None | No |
| OP 59 | -41.119, 175.388 | 0° | 0 | 0 | None | None | No |
| OP 60 | -41.133, 175.420 | 0° | 0 | 0 | None | None | No |
| OP 61 | -41.134, 175.426 | 0° | 0 | 0 | None | None | No |
| OP 62 | -41.132, 175.426 | 0° | 0 | 0 | None | None | No |
| OP 63 | -41.129, 175.427 | 0° | 0 | 0 | None | None | No |
| OP 64 | -41.130, 175.428 | 0° | 0 | 0 | None | None | No |
| OP 65 | -41.128, 175.425 | 0° | 0 | 0 | None | None | No |
| OP 66 | -41.121, 175.444 | 0° | 0 | 0 | None | None | No |





| Receptor | Location | Horizon model | Green (min/yr) | Yellow (min/yr) | Daily glare potential | Impact | Further mitigation required |
|---------------|---------------------|---------------|----------------|-----------------|--|----------|-----------------------------|
| OP 67 | -41.122, 175.448 | 0° | 0 | 0 | None | None | No |
| OP 68 | -41.142, 175.396 | 0° | 0 | 0 | None | None | No |
| OP 69 | -41.142, 175.391 | 0° | 0 | 0 | None | None | No |
| OP 70 | -41.144, 175.392 | 0° | 0 | 0 | None | None | No |
| OP 71 | -41.128, 175.451 | 2.5° | 0 | 0 | None | None | No |
| OP 72 | -41.140, 175.387 | 0° | 0 | 0 | None | None | No |
| OP 73 | -41.140, 175.384 | 0° | 0 | 0 | None | None | No |
| OP 74 | -41.138, 175.382 | 0° | 0 | 0 | None | None | No |
| OP 75 | -41.132, 175.386 | 0° | 0 | 0 | None | None | No |
| OP 76 | -41.120, 175.388 | 0° | 0 | 0 | None | None | No |
| OP 77 | -41.104, 175.445 | 0° | 0 | 0 | None | None | No |
| Route 1 | Bidwills Cutting Rd | 0° | 616 | 0 | Up to 1 minutes of green glare between 4 pm and 5:30 pm from late April to mid-August. | Very low | No |
| Route 2 (car) | NZ State Hwy 2 | 0° | 44 | 0 | Up to 3 minutes of green glare between 5 am and 6 am from late January to early February. Up to 3 minutes of green glare between 4:30 am and 5:30 am from late October to mid-November. | Very low | No |





| Receptor | Location | Horizon model | Green (min/yr) | Yellow (min/yr) | Daily glare potential | Impact | Further mitigation required |
|-----------------|---|---------------|----------------|-----------------|---|----------|-----------------------------|
| Route 2 (truck) | | 0° | 84 | 0 | Up to 3 minutes of green glare between 5 am and 6:30 am from late January to mid-March. Up to 3 minutes of green glare between 4:30 am and 6 am from late September to mid-November. | Very low | No |
| Route 3 | No 1 Line | 0° | 0 | 0 | None | None | No |
| Route 4 | Moroa Rd | 2.5° | 0 | 0 | None | None | No |
| Route 5 | Moroa & Bidwills Cutting tee-intersection | 0° | 0 | 0 | None | None | No |
| Route 6 | Battersea Rd | 0° | 0 | 0 | None | None | No |
| Route 7 | Phillips Line | 0° | 0 | 0 | None | None | No |
| Route 8 | Settlement Rd | 0° | 0 | 0 | None | None | No |
| Route 9 | Unnamed Rd 1 (off No 1 Line) | 0° | 0 | 0 | None | None | No |
| Route 10 | Pharazyns Rd | 0° | 0 | 0 | None | None | No |
| Route 11 | Tauherenikau-Racecourse Rd | 0° | 0 | 0 | None | None | No |
| Route 12 | Unnamed Rd 2 (off Taherenikau) | 0° | 0 | 0 | None | None | No |



| Receptor | Location | Horizon model | Green (min/yr) | Yellow (min/yr) | Daily glare potential | Impact | Further mitigation required |
|--------------|------------|---------------|----------------|-----------------|---|----------|-----------------------------|
| Route 13 | Cross Line | 0° | 51 | 0 | Up to 2 minutes of green glare between 7 pm and 7:30 pm in February. Up to 2 minutes of green glare between 6:30 pm and 7 pm from mid-October to early November. | Very low | No |
| Route 14 | Wards Line | 0° | 0 | 0 | None | None | No |
| Total | | | 1,373 | 0 | | | |

GA

4 SUMMARY

The results of the GlareGauge analysis indicated that three observation points and three road routes received green glare, which has low potential to cause afterimage. In general, most of the glare occurred during early mornings and late evenings when backtracking is active. No observation points or routes received more than 6 minutes of glare in any single day.

The 2.5° horizon model was used for seven observation points and one road route where all glare from the 0° horizon model occurred between May and August. In these cases, the sun will be below the horizon when glare would be expected otherwise.

The proposed vegetation screen provides effective mitigation of the glare expected from the solar farm. The residual glare is very low impact and does not require further mitigation. These results are conservative as existing roadside vegetation, and other intervening vegetation and structures were not modelled explicitly and will further reduce the glare impact.

5 REFERENCES

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Barrett, S., Devita, P., Ho, C. and Miller, B., 2014. Energy technologies' compatibility with airports and airspace: Guidance for aviation and energy planners. *Journal of Airport Management*, 8(4), pp.318-326.

APPENDIX A. FORGESOLAR ANALYSIS REPORTS

The following are provided as an attachment.

1. **23070 – ForgeSolar Analysis Report A 0 deg horizon.pdf:** including results for OP 1 to 40 and all road routes with the minimum sun angle set to 0°.
2. **23070 – ForgeSolar Analysis Report B 0 deg horizon.pdf:** including results for OP 41 to OP 77 with the minimum sun angle set to 0°.
3. **23070 – ForgeSolar Analysis Report A 2.5 deg horizon.pdf:** including results for OP 1 to 40 and all road routes with the minimum sun angle set to 2.5°.
4. **23070 – ForgeSolar Analysis Report B 2.5 deg horizon.pdf:** including results for OP 41 to OP 77 with the minimum sun angle set to 2.5°.



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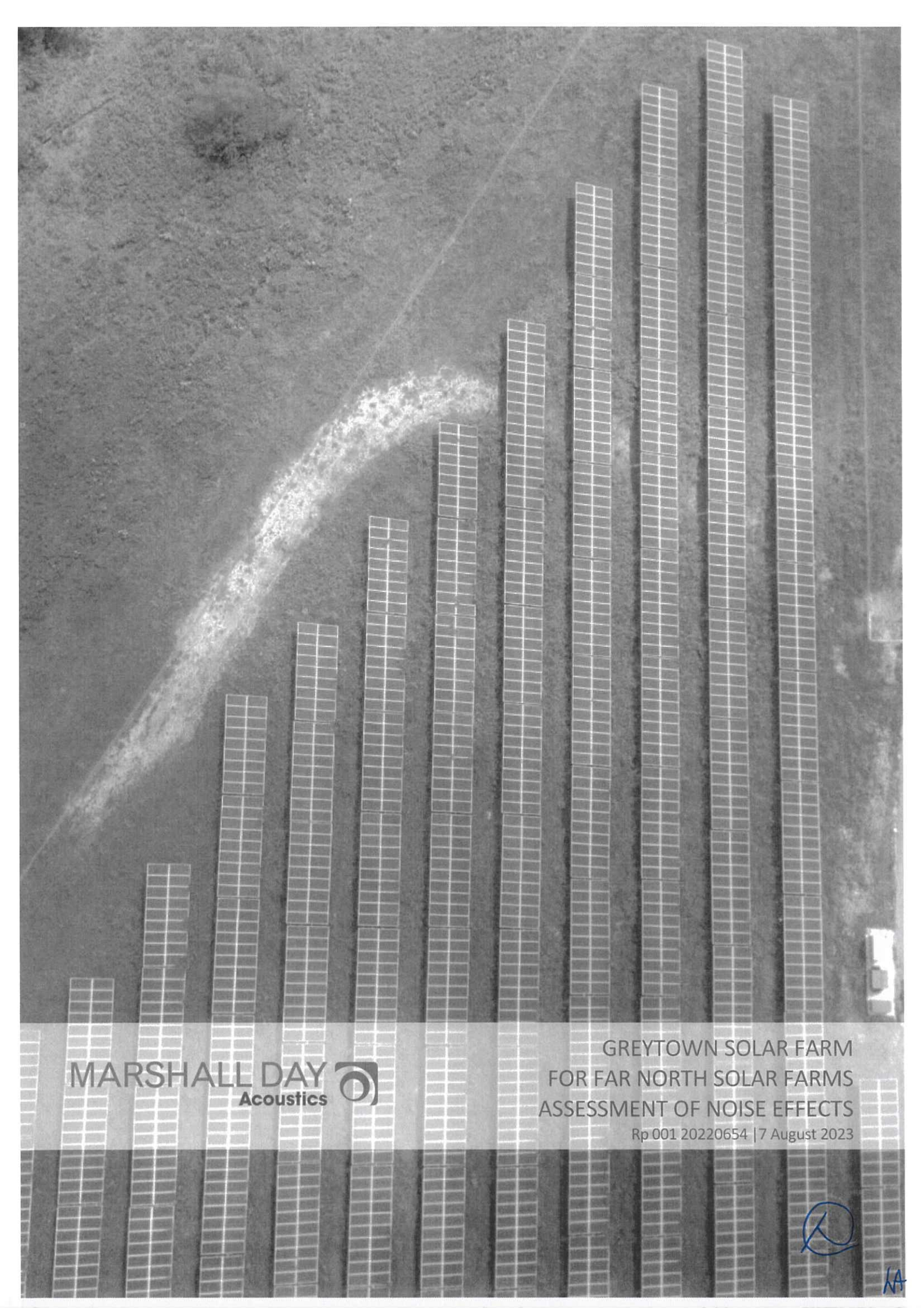




Attachment 3: Acoustic Assessment

Q

LA



MARSHALL DAY
Acoustics 

GREYTOWN SOLAR FARM
FOR FAR NORTH SOLAR FARMS
ASSESSMENT OF NOISE EFFECTS

Rp 001 20220654 | 7 August 2023



NA

Project: **GREYTOWN SOLAR FARM**

Prepared for: **Far North Solar Farms
Level 1
65 Main Road
Kumeu 0810
New Zealand**

Attention: **John Andrews and Richard Homewood**

Report No.: **Rp 001 20230481**

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| Status: | Rev: | Comments | Date: | Author: | Reviewer: |
|----------------|-------------|---|--------------|----------------|------------------|
| Approved | - | - | 31 July 2023 | Peter Ibbotson | Mat Cottle |
| Reissue | 01 | Changes to require compliance with NZS6803 at all times | 7 Aug 2023 | Peter Ibbotson | External |



IA

SUMMARY

Marshall Day Acoustics has been engaged by Far North Solar Farms to undertake a noise assessment for the operation and construction of a proposed solar farm.

The proposed generation only 145 MW solar farm would be located at Bidwills Cutting Road, Greytown on the southern side of the township. The proposed solar farm is in three “blocks”: one large block north of Moroa Road and two smaller blocks south of Moroa Road. The combined area of the blocks is approximately 240 hectares.

The proposed solar farm is in a rural area. The surrounding land is used for rural farming and rural lifestyle purposes. Greytown and the surrounding hinterland is flat – there is no significant ground undulation that would result in any appreciable acoustic screening.

The generation facility would include 39 inverters (mostly in pairs). These would be distributed over the farm. The solar panel arrays would include 6,034 motors.

This assessment has drawn the following conclusions:

- The proposed solar farm would readily comply with the Wairarapa Combined District Plan daytime noise rule of 55 dB L_{A10} . Even in the worst-case “100%” scenario, noise levels would be significantly (at least 16 decibels) below the daytime noise rule.
- Evening operation of the proposed solar farm would readily comply with the Wairarapa Combined District Plan nighttime noise rule of 45 dB L_{A10} . Even in the worst-case “100%” scenario, noise levels would be significantly (at least 6 decibels) below the noise rule.
- The proposed solar farm would also comply with the noise rules in the Draft Wairarapa Combined District Plan.
- For dwellings near State Highway 2 and Bidwills Cutting Road, solar farm generated noise levels are expected to be quieter than the existing ambient (L_{A10}) and background (L_{A90}) noise (during the typical hours of solar generation). Solar farm noise levels at dwellings near SH2 would be in the order of 24 to 34 dB L_{A10} , whereas State Highway traffic would generate background and ambient noise levels that are typically higher than this during daylight hours.
- Solar farm noise levels at dwellings on Moroa Road, Settlement Road and Battersea Road would be in the order of 27 to 39 dB L_{A10} at times of solar generation. As the Moroa, Settlement and Battersea Road area is further removed from State Highway 2, it is subject to generally lower noise levels (noting that background noise levels in this area vary depending on local activity). Noise from the solar farm generation is expected to be above the existing background (L_{A90}) noise level at times, but generally similar to or quieter than the existing ambient (L_{A10}) noise level. In this area on settled weather days, the solar farm would be audible at times as a low-level constant noise source.
- The NZS 6803:1999 construction noise guidelines will be complied with at all times. This is likely to require noise mitigation to Vermeer-type or any other drop hammer piling works, such as shrouds, dollies or use of alternative methods at piling locations that are within 100 metres of dwellings. A noise management plan is recommended.

Overall the location of the solar farm is well chosen from a noise perspective. The fairly large distances between the sources of noise and the nearest receivers would result in noise from the solar farm being fairly low overall and well below the District Plan noise limits.



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1.0 INTRODUCTION

Marshall Day Acoustics has been engaged by Far North Solar Farms to undertake a noise assessment for the operation and construction of a proposed solar farm.

This report addresses noise from the proposed operation and from construction. This report is intended to form part of an application for resource consent.

A glossary of terminology is included in Appendix A.

2.0 APPLICATION SITE

The proposed generation only 145 MW solar farm is located at Bidwills Cutting Road, Greytown. The site is comprised of three “blocks”: one large block north of Moroa Road and two smaller blocks south of Moroa Road. The combined area of the blocks is approximately 240 hectares and is located on the southern side of Greytown.

The proposed solar farm is in a rural area. The surrounding land is used for rural farming and rural lifestyle purposes. Greytown and the surrounding hinterland is flat – there is no significant ground undulation that would result in any appreciable acoustic screening.

The proposed solar farm is fairly well removed from the nearest rural dwelling receivers. The nearest inverter pair is around 350 metres from the nearest dwelling, though most inverters are around 500 metres or more distant.

Surrounding receivers are listed in Table 1 and depicted in Figure 1.

Table 1: Surrounding Receivers

| Receiver Location | Details | Typical Use ¹ | Approx distance of closest dwelling notional boundary (m) ¹ | |
|---|---|---------------------------|--|---------------------|
| | | | To solar farm boundary | To nearest inverter |
| Settlement and Battersea Road dwellings | The area to the south and south-east of the south-east solar farm “block” includes several dwellings on 1-to-12-hectare sections | Rural lifestyle | 100m | 370m |
| Moroa Road dwellings (west) | There are few dwellings on Moroa Road. There are two larger allotments adjacent to the southwest solar farm “block”. One of these allotments is understood to have worker accommodation on the site in several detached buildings across the site | Rural | Adjacent | 350m |
| Moroa Road dwelling (east) | A dwelling is located to the south-east of the solar farm site, adjacent to the existing substation | Rural lifestyle | Adjacent | 480m |
| Bidwills Cutting Road dwellings | There are many dwellings along Bidwills Cutting Road, though these are typically well removed from the proposed solar farm site. | Rural and Rural Lifestyle | 250m ⁽²⁾ | 600m ⁽²⁾ |
| State Highway 2 | There are many dwellings along SH2, though these are typically well removed from the proposed solar farm site. The closest dwelling is some 300m from the solar farm boundary | Rural and Rural lifestyle | 50m | 550m |

Note 1: Existing land use and distances have predominantly been determined from aerial photography and are indicative. The noise model uses specific distances between source and receiver.

Note 2: Excluding 312 Bidwills Road which is the farm owner from whom the land will be leased




Figure 1: Site and Surrounds



3.0 PROPOSAL

We understand that most of the approx. 240-hectare (total) site would be used for the solar farm arrays. The proposed farm location in relation to the surrounding area is given in Figure 1. A site layout plan is given in Appendix B.

The proposed farm would be divided into three blocks, the majority of which would be located to the north of Moroa Road. In this assessment, these blocks are referred to as follows:

- **Main north block:** the largest block (c. 170 Ha), to the north of Moroa Road and west of Bidwills Cutting Rd
- **South-east block:** the block (c. 25 Ha) nearest Battersea and Settlement Roads, south of Moroa Rd.
- **South-west block:** the block (c. 45 Ha) to the south-west of Moroa Road, towards SH2

3.1 Facility Description

Solar panels would be installed in rows spaced apart to allow access by agricultural machinery and grazing animals. Access to the site would be off Moroa Road.

An existing substation is located to the east of the main north solar farm block. A switchyard is proposed to be located adjacent to the substation which will switch the generated power as required to the substation.

The total generation power rating of the farm would be around 135 MW¹.

The key operational noise sources would be from the following plant:

- **39 central inverters.** An inverter turns Direct Current (DC) created by the photovoltaic cells to alternating current (AC) current used in the electricity grid². These central inverters would be distributed throughout the farm and would be used in the generation of power from the solar arrays. The inverters would generally be arranged in pairs of two as shown in Appendix B.
- **Around 6,034 tracker motors** would be associated with the solar panel arrays. Each solar panel array table would be attached to a tracker motor³.
- **A switchyard adjacent to the existing substation.** We understand that two 33/100kV transformers will be located in this switchyard.

Power generation at the solar farm would occur during daylight/sunshine hours. In summer, operating daylight hours could begin earlier and extend later than the prescribed⁴ daytime period of 7am to 7pm. In particular, generation is still likely to be appreciable after 7pm during the longer days of summer. We have allowed for full load on the inverters when solar load is high.

¹ This is the alternating current generation power. The power of each inverter is nominally 4,200 kVA.

² No specific inverter supplier has been selected at this stage of the project. There are two major manufacturers of inverters that are used on most solar projects, although other manufacturers may be considered.

³ Trackers consist of many solar panels on a frame that tilts vertically to align the panels to the sun throughout the day. The trackers are rotated around a central horizontal axis by a small DC motor (approximately 300 watts running at 24V DC). The motor is the main noise source associated with each tracker. The tracker motors are understood to operate intermittently during daylight hours and only for a short period as they are only required to make small incremental adjustments to the trackers. DC motors are quiet, even under continuous load and operation, and the collective sound power level of even a large number of tracker motors is not normally significant when considered over the normally large solar farm sites.

⁴ Refer to Section 5 for discussion of the District Plan noise rules and statutory timeframes.




3.2 Written Approvals

The owner of 312 Bidwills Cutting Road is the lessor of the land that the solar farm would be constructed on. Written approval is understood to have been obtained from this party. The noise effects on this property can be disregarded⁵.

3.3 Acoustic Mitigation

Some inverter manufacturers have shrouds / lined bends that can be provided to the inverter intake and discharge ventilation openings. These result in around 3 to 5 decibels of attenuation per source.

As shown later in this report, acoustic mitigation such as enclosure or attenuation of the inverters is not considered necessary on this project to meet the relevant noise limits or to provide a reasonable level of acoustic amenity based on the inverters expected to be used. The final determination of inverter selection can inform if any further noise mitigation package is required. We would not expect it to be required for most inverter units we have reviewed.

4.0 EXISTING NOISE ENVIRONMENT

Site visits were carried out to measure noise in the area over a period of two days of attended measurements and to deploy a noise logger over a longer period. Noise measurements were conducted at various locations on the site and in the adjacent area as follows:

- The attended noise measurements were carried out at intervals over the period 18:00 hrs 16 July to 17:40 hrs on 17 July 2023.
- A site visit to install a noise logger was carried out on the morning of 22 July 2023. The logger data used in this analysis comprises the period 11:45 hrs, 22 July to 06:00 hrs, 31 July 2023.

The purpose of the measurements was to establish ambient noise levels representative of the site and surrounding sites. The area was observed to have a background and ambient noise character that was typically dominated by human-made noises over the daytime, such as traffic on the state highway and local roads. Natural noises such as bird calls were audible at times. There was little insect noise audible generally during the period of winter monitoring, although insect noise may be more present over the warmer months.

Attended and unattended noise measurements results are summarised in the following sections.

⁵ Council must not, when considering the application, have regard to any effect on a person who has given their written approval to the application (Section 104 (3) of the Resource Management Act 1991).

4.1 Logger Data

The logger measurement position was located at the north-west corner of the site (MP15, refer Figure 1). This location was approximately 760 metres south-east of State Highway 2.

The logger results obtained provides an indication of the variation in traffic noise over the day, evening and night periods at the logger location. Dwellings adjacent to the State Highway will receive higher levels of traffic noise, and dwellings further from the State Highway (e.g., Moroa, Battersea, Settlement Roads) will receive lower levels of traffic noise. However, all will receive a similar *diurnal variation* in noise from distant state highway traffic⁶.

As the solar farm may operate outside the prescribed daytime period, logged data has been analysed for the prescribed daytime, evening and night-time periods⁷.

Refer to Appendix C for the noise level variation over the logging period. Meteorological conditions referenced on this graph were those measured at a NIWA weather station in Masterton and confirmed with the landowner's observations.

The following table summarises noise levels at the logger position.

Table 2: Measured Ambient Noise Levels (logged)

| Date | Overall Measured Level (dB) ¹ | | | | | | Likely meteorological conditions |
|--------|--|------------------|------------------|------------------|------------------|------------------|--|
| | Daytime hours ² | | Evening hours | | Night hours | | |
| | L _{A10} | L _{A90} | L _{A10} | L _{A90} | L _{A10} | L _{A90} | |
| 22-Jul | 49 | 44 | 43 | 35 | 37 | 28 | Potentially day winds > 5m/s |
| 23-Jul | 46 | 39 | 38 | 28 | 38 | 28 | Lighter winds, generally < 5m/s |
| 24-Jul | 49 | 45 | 38 | 38 | 42 | 34 | Potentially day/night winds > 5m/s, rain |
| 25-Jul | 44 | 38 | 43 | 35 | 49 | 40 | Light daytime winds, night winds >5m/s |
| 26-Jul | 53 | 43 | 45 | 35 | 42 | 30 | Potentially day winds > 5m/s, rain, light wind night |
| 27-Jul | 49 | 40 | 45 | 34 | 52 | 45 | Potentially day/night winds > 5m/s, some rain |
| 28-Jul | 46 | 39 | 45 | 35 | 39 | 26 | Light winds, no rain |
| 29-Jul | 43 | 38 | 46 | 40 | 39 | 28 | Light winds, no rain |
| 30-Jul | 44 | 37 | 44 | 34 | 39 | 28 | Light winds, no rain |

Notes to Table 2:

- (1) An explanation of technical terms is provided in Appendix A
- (2) Daytime is given as 07:00 to 19:00 hours in this table

The logger data shows that average daytime noise levels are relatively high: between 43 - 53 dB L_{A10} even at 760 metres from State Highway 2. Average background noise levels during this time vary from 37 - 45 dB L_{A90} at this distance. Background noise levels are a little lower in lower wind conditions.

⁶ As an approximate guide, dwellings located closer to the State Highway (those around 300 to 400m from the highway) would receive L_{Aeq} and L_{A10} noise levels around 3 decibels higher than those measured at the logger position. Dwellings on Settlement, Battersea and the southern part of Bidwills Crossing Roads will receive noise levels of around 5 decibels lower than measured at the logger position. This is approximate only, and will depend on the meteorological conditions, ground conditions and actual distance between receiver and the State Highway.

⁷ Prescribed daytime hours are: 7am to 7pm. Prescribed night-time hours are: 7pm to 7am.



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The logger data shows that noise levels in this area reduce through the evening. This appears to typically occur from around 19:00hrs during weekdays (sunset in July is around 17:00 hrs, so this reduction in noise level currently occurs well after dark). During weekends, the data suggests that ambient noise levels begin to reduce a little later, typically from around 20:30hrs. The reduction in noise level at these times is likely due to reducing traffic on the State Highway.

The average evening ambient noise levels varied from 38 to 46 dB L_{A10} with background noise levels between 28 to 40 dB L_{A90} . Note that the evening period currently occurs in the hours of darkness – it is probable that in the warmer months when days are longer that evening noise levels will be higher (due to birds, insects and potentially different traffic patterns).

The logger data shows that morning ambient noise levels are typically elevated by 05:30 to 06:00 hours on weekdays and around 07:00 hours on weekends.

4.2 Attended Measurements

Attended measurements were carried out on and off site to establish the existing level of environmental noise in the area and to identify the main sources of noise that occur at all surrounding dwellings. Table 3 summarises the attended measurement results.

Table 3: Measured Ambient Noise Levels (attended)

| Measurement Position | Measurement | | Measured Level (dB) ¹ | | | | Noise Source ² |
|--|---------------------|------------------|----------------------------------|-----------|-----------|-------------|--|
| | Date Start (hh:mm) | Duration min:sec | L_{Aeq} | L_{A10} | L_{A90} | L_{AFmax} | |
| MP3: At cemetery on SH2 (evening), around 65 m from SH2, representative SH2 dwellings | 16/07/2023 18:08 | 15:14 | 55 | 59 | 43 | 70 | Cars are frequent and there are few lulls between vehicles of any significance. During lulls, levels fall away to 45 dB L_{AF} but any lulls are brief and there is always some distant traffic. |
| MP14: At southern end of proposed Solar Farm (day), near 489 Moroa Rd | 17/07/2023 10:39 | 10:05 | 48 | 50 | 42 | 63 | Traffic on Bidwells Cutting and Moroa Road. Transformer hum at 100Hz. Regular bird calls. Possible distant SH2 noise |
| MP15: At north-west end of proposed solar farm (day), somewhat representative of SH2 dwellings that are closest to farm (noting measured levels are somewhat lower than dwellings will receive) | 17/07/2023 11:18 | 10:06 | 37 | 39 | 34 | 50 | Distant SH2 traffic, birds (magpies), Possible distant constant noise from industry, but likely distant traffic. Noted absence of insects. Environment noted to consist of predominantly manmade noise |
| MP16: At south-west corner of proposed solar farm main block (north Moroa Road), representative of Moroa Road dwellings (day) | 17/07/2023 11:43 | 08:01 | 35 | 38 | 31 | 56 | Distant SH2 traffic and magpies. Similar but quieter than MP15 |



| Measurement Position | Measurement | | Measured Level (dB) ¹ | | | | Noise Source ² |
|---|---------------------|------------------|----------------------------------|------------------|------------------|--------------------|---|
| | Date Start (hh:mm) | Duration min:sec | L _{Aeq} | L _{A10} | L _{A90} | L _{AFmax} | |
| MP17: At south-west end of south-east "block". Representative of dwellings on Settlement Road and Battersea Road (day) | 17/07/2023 12:05 | 10:01 | 34 | 36 | 30 | 49 | Distant traffic on Bidwills Cutting Road. Distant dog barks and cattle lows. Birds. Two vehicle movements on Battersea Road. Background broadly set by distant traffic. |
| MP18: At cemetery on SH2 (day), representative of SH2 dwellings | 17/07/2023 16:13 | 15:01 | 56 | 59 | 46 | 69 | Traffic on SH2 is regular, birds also audible |
| MP20: Kemptons Line, near intersection of Bidwills Cutting Road. Representative of dwelling façades on Bidwills Cutting Road | 17/07/2023 16:44 | 10:18 | 53 | 56 | 43 | 74 | Traffic and birds, traffic is regular but some regular gaps in traffic. |
| MP21: Bidwills Cutting Road near 273 Bidwills Cutting subdivision | 17/07/2023 17:02 | 10:01 | 72 | 75 | 44 | 88 | Frequent traffic on Bidwills Cutting Road (note that measurement location is closer to road carriageway than dwelling façades, therefore raised L _{Aeq} and L _{A10}) |
| MP22: Settlement Road and Battersea Road Intersection | 17/07/2023 17:24 | 10:04 | 46 | 49 | 34 | 62 | Distant traffic, birds, cattle, distant, people noise calling, cars at nearby house. distant loud dog bark, distant train horn. SH2 sets background noise level |

Note to Table 3:

- (1) An explanation of technical terms is provided in Appendix A.
- (2) Dominant sources are underlined.

The results show that ambient noise levels depend on the proximity to the State Highway.

Noise levels near State Highway 2 are elevated during the daytime and evening and are up to 59 dB L_{A10} at around 65 metres from the road. As there are few gaps between vehicles on SH2 during the daytime and evening, background noise levels are also elevated at between 43 to 46 dB L_{A90}.

Noise levels at dwellings to the north, west and south of the proposed solar farm (e.g., dwellings on Moroa, Settlement and Battersea Roads) vary with the time of the day and the distance of these dwellings from the busier Bidwills Cutting Road. Measurements conducted around the site during daytime hours in settled conditions show that noise levels for dwellings well removed from Bidwills Cutting Road are around 35 to 40 dB L_{A10} and 30 to 35 dB L_{A90} – although noise levels can be up to 50 dB L_{A10} at times when birds are active and there is activity at nearby dwellings.

Dwellings on Bidwills Cutting Road (at around 60 metres from the road) may receive ambient noise levels of up to 56 dB L_{A10} with background noise levels of 40 to 45 dB L_{A90} due to regular traffic on this road during the daytime.



5.0 NOISE PERFORMANCE STANDARDS AND LEGISLATION

The site is subject to the Operative Wairarapa Combined District Plan noise rules. We understand that a draft Wairarapa Combined District Plan has also been prepared.

5.1 Operative District Plan

5.1.1 Zoning

The application site is situated on land zoned *Rural Primary* Production in the Operative Wairarapa Combined District Plan. Surrounding sites are also zoned *Rural Primary*.

5.1.2 Operative Noise Rules

Section 4.5 of the Wairarapa Combined District Plan sets out the noise rules for the Rural Zone. Rule 4.5.2(f) sets out the noise limits for the zone as follows:

(f) **Noise Limits**

(i) *The sound level from activities within any site, excluding mobile sources associated with primary production (e.g. tractors, harvesters), shall not exceed the following limits within any measurement time interval in the stated time-frames, when assessed at any point within the notional boundary of any dwelling on any site within the Rural Zone but excluding any dwelling on the property where the sound levels are generated, and at any point within the boundary of any site within the Residential Zone:*

| | | |
|------------|------------------|-------------------|
| Daytime | 7:00am to 7:00pm | 55 dB L_{A10} |
| Night-time | 7:00pm to 7:00pm | 45 dB L_{A10} |
| | 9:00pm to 7:00pm | 75 dB L_{AFmax} |

(ii) *All sound levels shall be measured in accordance with NZS 6801:1999 "Acoustics – Measurement of Environmental Sound", and assessed in accordance with NZS 6802:1991 "Assessment of Environmental Sound".*

The above noise rules are fairly typical of Rural zones throughout New Zealand. However it is noted that the statutory daytime in this District is between 7am to 7pm and the statutory night-time therefore begins somewhat earlier than is typical for many rural zones around New Zealand. As there will be times during summer when there is still strong sunshine after 7pm, this means that the solar farm will need to comply with 45 dB L_{A10} when operating at peak generation.

5.1.3 Construction Noise Rules

The Operative District Plan contains the following noise rule (Rule 21.1.13(c))

(c) **Construction Noise**

(i) *Construction noise shall be measured and assessed in accordance with NZS6803:1999 "Acoustics – Construction Noise" and shall not exceed the noise limits set out in Table 2 of that Standard for the timeframes stated.*

(ii) *Provided that the provisions of the standard related to the duration of construction events and the more or less stringent noise limits applicable in such circumstances shall apply.*



5.2 Draft District Plan

5.2.1 Zoning

In the Draft District Plan, the site is zoned *General Rural Zone*. All adjacent sites would also be zoned *General Rural Zone*. There would be some more distant sites closer to Greytown that would be zoned *General Industrial Zone* and *Mixed Use Zone*.

5.3 Draft Noise Rules

The draft District Plan sets out noise rules in NOISE-R1. This rule requires that activities comply with noise rules NOISE-S1, S2, S3 and S4. Of these, only parts of S1 and S2 are relevant to the proposed solar farm operation. These are given as follows:

NOISE-S1 Maximum Noise Levels in Zones

Rural Zones and Future Urban Zone

3. *Noise emitted from any activity within a Rural Zone or Future Urban Zone shall not exceed the following noise limits at any point within the notional boundary of any noise sensitive activity on any other site within a Rural Zone or Future Urban Zone, or at any point within the boundary of any other site within a Residential Zone or Māori Purpose Zone:*

- a. *Daytime (7.00am to 7.00pm): 55 dB $L_{Aeq(15min)}$;*
- b. *Evening: (7.00pm to 10.00pm): 50 dB $L_{Aeq(15min)}$;*
- c. *Night time: (10.00pm to 7.00am): 45 dB $L_{Aeq(15min)}$; and*
- d. *Night time: (10.00pm to 7.00am): 70 dB L_{Amax} .*

All Zones

All sound levels shall be measured in accordance with NZS 6801:1999 Acoustics Measurement of Environmental Sound and assessed in accordance with NZS 6802:1991 Assessment of Environmental Sound.

NOISE-S2 Maximum noise levels for specified activities

Construction

1. *Construction noise shall be measured, assessed, managed, and controlled in accordance with the requirements of New Zealand Standard NZS 6803:1999 Acoustics Construction Noise.*

5.4 Discussion of Operative and Draft Rules

We do not expect that the draft rules will yet have statutory effect. Regardless it is noted that the Draft District Plan noise rules are likely to be somewhat less restrictive than the Operative District Plan rules, given that the Draft District Plan introduces an evening shoulder period noise limit that is less restrictive than the Operative District Plan noise rule. Compliance with the Operative District Plan noise rules would also result in compliance with the Draft District Plan noise rules⁸.

Both versions of the Plan require construction noise to be measured and assessed using NZS6803:1999. This is a standard approach in most Districts.

Both the operative and draft District Plans require sound levels to be measured in accordance with NZS 6801 and assessed in accordance with NZS 6802. However, the versions of the standards referenced in both plans are the older 1999/1991 versions, rather than the current 2008 versions. We expect that this is an error in the Draft Plan, as the referenced standards do not accord with the National Planning Standards.

⁸ Note that solar farm noise emissions will be typically at a constant level and thus the L_{Aeq} and L_{A10} noise levels are likely to be quite similar.



We consider the best approach is for the assessment to be carried out using the most recent versions of these standards: while there are some differences between the current and superseded versions, the outcome of using the most updated version will not be materially different to superseded versions. We have retained the use of the L_{A10} parameter as it is the assessment metric used in the Operative District Plan.

5.5 Resource Management Act

Under the provisions of the Resource Management Act (RMA) there is a duty to adopt the best practicable option to ensure that noise (including vibration⁹) from any development does not exceed a reasonable level. Specifically, Sections 16 and 17 reference noise effects as follows.

Section 16 states that "every occupier of land (including any premises and any coastal marine area), and every person carrying out an activity in, on, or under a water body or the coastal marine area, shall adopt the best practicable option to ensure that the emission of noise from that land or water does not exceed a reasonable level".

Section 17(1) states that "every person has a duty to avoid, remedy, or mitigate any adverse effect on the environment arising from an activity carried on by or on behalf of the person, whether or not the activity is in accordance with –

(a) Any of sections 10, 10A, 10B and 20A; or

(b) A national environmental standard, a rule, a resource consent, or a designation".

6.0 OPERATIONAL NOISE LEVELS

6.1 Noise Sources and Modelling Methodology

The main noise sources from the proposed solar farm would be the central generation inverters. Tracker motors also generate noise, but to a lesser degree than unattenuated inverters. Some noise is generated by transformers, although modern transformers typically have a low sound power level.

We have prepared a noise model using SoundPLAN® environmental noise modelling which considers factors such as the terrain, screening by buildings, and ground effect. Calculations have been carried out using ISO 9613-2:1996 "Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation". Noise levels have been calculated under meteorological conditions that are favourable to sound propagation¹⁰ and represent the typical 'worst case' propagation situation¹¹.

The following sound power data has been used in the preparation of this noise model. Data has relied on advice given by the manufacturers or from previous measurements we have carried out. We recommend suppliers confirm that the final equipment selected can operate accordingly.

Solar farm inverters may have tonal characteristics at various frequencies. The assessment of environmental noise effects for resource consent allows for inverters to have some tones and the relevant penalties have been applied¹².

⁹ RMA 1991 Part 1 Section 2 Interpretation: Noise includes vibration

¹⁰ These are set out in ISO9613-2 and represent downwind or temperature inversion conditions.

¹¹ Under most daytime metrological conditions, noise levels will be lower than calculated. This is because when the solar farm is operating at full generation, it will be during periods of high solar gain (typically during the middle part of the day). In general, high solar gain conditions correspond with conditions that are not favourable to sound propagation, as sound will refract upward when air temperatures reduce with increasing altitude (temperature lapse). In temperature lapse conditions, noise levels are expected to be around five decibels lower than calculated for the temperature inversion condition.

¹² Tonality would typically be expected to occur at higher frequencies. Higher frequencies are attenuated with distance due to air and ground absorption, as well as topographical screening. Given the distances involved, tonality may not be audibly present at the



We understand that inverter noise levels will reduce at low loads. A reduction in sound power level of four decibels has been allowed for at 10% inverter power output¹³. Available data shows that tonal character is eliminated at low loads.

Table 4: Sound Power Levels

| Noise Source | Sound Power Level dBA re 10 ⁻¹² Watts | Number of Units | Directivity | Operation time |
|-----------------------------|---|----------------------|-------------|---|
| Generation Inverters | | | | |
| DC / AC inverter | 93 dB L _{WA} (AC end) | 39 | Included | Operation during sunshine hours (therefore within the statutory night period on Sunday) |
| 4.2 MVA | 88 dB L _{WA} (DC end) | | | |
| Tracker modules | 74 dB L _{WA} (emission when moving) = 100 dB L _{WA} (total L _w for all trackers across total farm ¹⁴) | 6,034 | None | 68 seconds per 15 minutes – sunshine hours |
| Transformer | 79 dB L _{WA} | 2 (in switchyard) | None | Sunshine hours |
| TOTAL SOURCES | | 41 + Trackers | | |

6.2 Noise Level Calculations

Noise levels have been calculated at the notional boundaries of the receivers surrounding the farm.

Inverter units will likely have appreciable directivity. We have allowed for each inverter pair to have the AC end facing in different directions, and broadly as shown on the plans. Other orientations may result in a slight reduction in noise level, although this will depend on the orientation of the air intake on the final units selected.

The calculations have been carried out based on the following assumptions:

- Inverter source heights at around 4 metres above ground. Inverters distributed across the site as shown in the site drawings. Inverter plant has been allowed to operate at 100% load at times.
- Transformers with 3m source height
- Tracker motors below the table rotational axis at 3m above ground level.

Calculations have applied a broad special audible character¹⁵ correction in accordance with NZS 6802:2008. As the solar farm could potentially operate for more than 80% of the prescribed daytime period (particularly during summer), no duration correction has been applied. Furthermore, as the solar farm can generate during part of the statutory night period (after 7pm), no duration correction is possible at that time.

receiver as any tones may be below the background level. Nonetheless we have conservatively allowed for tonality to be potentially present at low levels.

¹³ Our analysis has allowed for inverter ventilation fans to operate at 100% even during times of low power generation. This is likely a conservative assumption where fans are variable speed.

¹⁴ Recent data from manufacturers suggests a sound power level of 74 dB L_{WA} for solar farm 24V DC-type motors at all ranges of torque loads.

¹⁵ Spectral data from some inverter manufacturers shows the potential for tones therefore, a five-decibel special audible character penalty has been applied to the overall noise level from this solar farm. It is possible that tonality will not occur and rating noise levels could be lower – data shows this will occur at lower inverter loads.

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6.3 Calculated Noise Levels from Proposed Solar Farm

The following table summarises the results of our calculations. Calculations include a+5 dBA special audible characteristics correction for tonality. No duration correction applied.

Table 5: Calculated Noise levels

| Receiver Location | Noise Limits [daytime / night] (dB LA10) | Calculated Rating Noise Level (dB LA) | |
|--|--|--|-------------|
| | | 100% LOAD | 10% LOAD |
| Battersea Road, Morison Bush 100 | 55 / 45 | 31 | 27 |
| Battersea Road, Morison Bush 100A | 55 / 45 | 30 | 26 |
| Battersea Road, Morison Bush 101 | 55 / 45 | 28 | 24 |
| Battersea Road, Morison Bush 28 | 55 / 45 | 36 | 32 |
| Battersea Road, Morison Bush 35 | 55 / 45 | 31 | 27 |
| Battersea Road, Morison Bush 50 | 55 / 45 | 34 | 30 |
| Battersea Road, Morison Bush 72 | 55 / 45 | 34 | 30 |
| Battersea Road, Morison Bush 80 | 55 / 45 | 32 | 28 |
| Battersea Road, Morison Bush 84 | 55 / 45 | 32 | 28 |
| Bidwills Cutting Road, Morison Bush 179 | 55 / 45 | 21 | 17 |
| Bidwills Cutting Road, Morison Bush 193 | 55 / 45 | 22 | 18 |
| Bidwills Cutting Road, Morison Bush 217 | 55 / 45 | 25 | 21 |
| Bidwills Cutting Road, Morison Bush 224 [east] | 55 / 45 | 27 | 23 |
| Bidwills Cutting Road, Morison Bush 224[west] | 55 / 45 | 29 | 25 |
| Bidwills Cutting Road, Morison Bush 247 | 55 / 45 | 28 | 24 |
| Bidwills Cutting Road, Morison Bush 255 | 55 / 45 | 29 | 25 |
| Bidwills Cutting Road, Morison Bush 263 | 55 / 45 | 30 | 26 |
| Bidwills Cutting Road, Morison Bush 268 | 55 / 45 | 31 | 27 |
| Bidwills Cutting Road, Morison Bush 269 | 55 / 45 | 29 | 25 |
| Bidwills Cutting Road, Morison Bush 273A | 55 / 45 | 30 | 26 |
| Bidwills Cutting Road, Morison Bush 273B | 55 / 45 | 27 | 23 |
| Bidwills Cutting Road, Morison Bush 273D | 55 / 45 | 27 | 23 |
| Bidwills Cutting Road, Morison Bush 273E | 55 / 45 | 28 | 24 |
| Bidwills Cutting Road, Morison Bush 299 | 55 / 45 | 32 | 28 |
| Bidwills Cutting Road, Morison Bush 381 | 55 / 45 | 26 | 22 |
| Bidwills Cutting Road, Morison Bush 388 | 55 / 45 | 26 | 22 |
| Moroa Road, Morison Bush 489 | 55 / 45 | 36 | 32 |
| Moroa Road, Tauherenikau 169 | 55 / 45 | 28 | 24 |
| Moroa Road, Tauherenikau 260 | 55 / 45 | 38 | 34 |
| Moroa Road, Tauherenikau 260_1 | 55 / 45 | 39 | 35 |
| Moroa Road, Tauherenikau 260_2 | 55 / 45 | 32 | 28 |
| Moroa Road, Tauherenikau 260_3 | 55 / 45 | 31 | 27 |
| Moroa Road, Tauherenikau 286 | 55 / 45 | 33 | 29 |
| Settlement Road, Morison Bush 23 | 55 / 45 | 29 | 25 |
| Settlement Road, Morison Bush 26 | 55 / 45 | 31 | 27 |
| Settlement Road, Morison Bush 38 | 55 / 45 | 29 | 25 |
| Settlement Road, Morison Bush 45 | 55 / 45 | 29 | 25 |



LA

| Receiver Location | Noise Limits [daytime / night] (dB LA10) | Calculated Rating Noise Level (dB LR) | |
|--|--|--|-------------|
| | | 100% LOAD | 10% LOAD |
| Settlement Road, Morison Bush 51 | 55 / 45 | 27 | 23 |
| Settlement Road, Morison Bush 51 | 55 / 45 | 27 | 23 |
| Settlement Road, Morison Bush 53 | 55 / 45 | 29 | 25 |
| Settlement Road, Morison Bush 54 | 55 / 45 | 34 | 30 |
| Settlement Road, Morison Bush 56 | 55 / 45 | 38 | 34 |
| Settlement Road, Morison Bush 73 | 55 / 45 | 30 | 26 |
| Settlement Road, Morison Bush 74 | 55 / 45 | 30 | 26 |
| Settlement Road, Morison Bush 74A | 55 / 45 | 32 | 28 |
| Settlement Road, Morison Bush 76 | 55 / 45 | 32 | 28 |
| Settlement Road, Morison Bush 90 | 55 / 45 | 32 | 28 |
| Settlement Road, Morison Bush 96 | 55 / 45 | 34 | 30 |
| Settlement Road, Morison Bush 97 | 55 / 45 | 33 | 29 |
| State Highway 2, Tauherenikau 1688 | 55 / 45 | 26 | 22 |
| State Highway 2, Tauherenikau 1690 | 55 / 45 | 25 | 21 |
| State Highway 2, Tauherenikau 1704 | 55 / 45 | 26 | 22 |
| State Highway 2, Tauherenikau 1724 | 55 / 45 | 24 | 20 |
| State Highway 2, Tauherenikau 1746 | 55 / 45 | 26 | 22 |
| State Highway 2, Tauherenikau 1746A | 55 / 45 | 26 | 22 |
| State Highway 2, Tauherenikau 1746B | 55 / 45 | 27 | 23 |
| State Highway 2, Tauherenikau 1776 | 55 / 45 | 27 | 23 |
| State Highway 2, Tauherenikau 1776A | 55 / 45 | 26 | 22 |
| State Highway 2, Tauherenikau 1787 | 55 / 45 | 24 | 20 |
| State Highway 2, Tauherenikau 1800 | 55 / 45 | 29 | 25 |
| State Highway 2, Tauherenikau 1800A | 55 / 45 | 26 | 22 |
| State Highway 2, Tauherenikau 1800B | 55 / 45 | 27 | 23 |
| State Highway 2, Tauherenikau 1808 | 55 / 45 | 29 | 25 |
| State Highway 2, Tauherenikau 1808a | 55 / 45 | 32 | 28 |
| State Highway 2, Tauherenikau 1832A | 55 / 45 | 29 | 25 |
| State Highway 2, Tauherenikau 1832B | 55 / 45 | 33 | 29 |
| State Highway 2, Tauherenikau 1923 | 55 / 45 | 27 | 23 |
| State Highway 2, Tauherenikau 1925A | 55 / 45 | 28 | 24 |
| State Highway 2, Tauherenikau 1931 | 55 / 45 | 25 | 21 |
| State Highway 2, Tauherenikau 1937 | 55 / 45 | 27 | 23 |
| State Highway 2, Tauherenikau 1942 | 55 / 45 | 28 | 24 |
| State Highway 2, Tauherenikau 1963 | 55 / 45 | 25 | 21 |
| State Highway 2, Tauherenikau 1975A | 55 / 45 | 23 | 19 |
| Bidwills Cutting Road 312 (Written Approval) | 55 / 45 | 40 | 36 |
| Gunclub: 170 Moroa Road, Tauherenikau | 55 / 45 | 32 | 28 |




6.4 Results Summary

Our calculations show that for the compliance receivers that have not given written approval:

- The proposed solar farm would readily comply with the Wairarapa Combined District Plan daytime noise rule of 55 dB L_{A10} . Even in the worst-case “100%” scenario, noise levels would be significantly (at least 16 decibels) below the daytime noise rule.
- Evening operation of the proposed solar farm would readily comply with the Wairarapa Combined District Plan night-time noise rule of 45 dB L_{A10} . Even in the worst-case “100%” scenario, noise levels would be significantly (at least 6 decibels) below the night-time noise rule,
- The proposed solar farm would also comply with the noise rules in the Draft Wairarapa Combined District Plan.
- For dwellings near State Highway 2 and Bidwills Cutting Road, solar farm generated noise levels are expected to be quieter than the existing ambient (L_{A10}) and background (L_{A90}) noise (during the typical hours of solar generation). Solar farm noise levels at dwellings near SH2 would be in the order of 24 to 34 dB L_{A10} , whereas State Highway traffic would generate background and ambient noise levels that are typically higher than this during daylight hours.
- Solar farm noise levels at dwellings on Moroa Road, Settlement Road and Battersea Road would be in the order of 27 to 39 dB L_{A10} at times of solar generation. As the Moroa, Settlement and Battersea Road area is further removed from State Highway 2, it is subject to generally lower noise levels (noting that background noise levels in this area vary depending on local activity). Noise from the solar farm generation is expected to be above the existing background (L_{A90}) noise level at times, but generally similar to or quieter than the existing ambient (L_{A10}) noise level. In this area on settled weather days, the solar farm would be audible at times as a low-level constant noise source.

6.5 Operational Traffic

Operational traffic has been assessed for the project. We understand the farm would only require around two staff on site which we expect could generate perhaps 4 to 12 vehicle movements per day. During the initial period of commissioning, we understand that there may be more staff on site and a higher number of traffic movements may result. Operation of the solar farm would only require very occasional heavy vehicle movements, which are not expected to occur during the evening and night periods.

The locations of the vehicle entry points are generally well removed from most dwellings and we therefore expect noise from on-site movements to be very low, typically below the existing background noise level at most dwellings at most times.

Based on our observations, the above number of vehicles would not significantly increase traffic on SH2 or Bidwills Cutting Road. We would not expect traffic noise levels from these roads to appreciably increase. Traffic on Moroa Road may increase markedly over the commissioning period as it currently has few movements per day on it. However the number of overall movements would still remain low. We understand all roads surrounding the proposed solar farm are public roads, and the District Plan rules do not apply to any traffic using these roads.

Overall, we consider that operational traffic noise is likely to be largely insignificant in comparison to existing (non-site) noise traffic noise levels in the area.



7.0 SUMMARY OF OPERATIONAL NOISE EFFECTS

- The location of the solar farm is well chosen from a noise perspective. The significant distances between the sources of noise and the nearest receivers would result in noise from the solar farm being fairly low overall.
- For most dwellings to the north, west and east of the site, noise generated by the solar farm will typically be below the existing ambient and background noise levels. For some dwellings south of the site, solar farm noise may be above the existing background (L_{A90}) noise level at times, but generally similar to or quieter than the existing ambient (L_{A10}) noise level. In this area, the solar farm would be audible on days with settled weather as a low-level constant noise source.
- Compliance with the District Plan noise limits would readily occur for the proposed operation.

8.0 CONSTRUCTION NOISE LEVELS

8.1 On-site construction

Construction of the solar farm is likely to involve the following:

- Delivery of panels, inverters and other infrastructure, requiring trucks and small cranes. Around three trucks per day are expected.
- Earthworks would occur using trucks, loaders and excavators
- A 'Vermeer PD10 Pile Driver' to impact drive the support piles into the ground.

Solar farm construction typically takes place over a period of less than 20-weeks and between the hours 7:30 to 18:00, Monday to Saturday. Therefore, the 'typical duration' construction noise limits: 75 dB L_{Aeq} and 90 dB L_{AFmax} would apply. The proposed Greytown Solar Farm is relatively large, and the total duration of piling could be longer than 20 weeks, however the activity will not be stationary during this time and piling in any one location will occur for much shorter than 20 weeks. Based on section c7.2.1 of NZS 6803:1999, the appropriate NZS 6803 noise limit is 75 dB L_{Aeq} .

All significant equipment likely to be used on the project is listed in Table 6. The sound levels given are based on measurements we have made of similar plant or from BS 5228-1:2009 *Code of practice for noise and vibration control on construction and open sites* Part 1: Noise.

Table 6: Activity Specific Noise Levels at 1m from a building façade (without screening)

| Item/Activity | Operating Sound Power Level (dB L_{WA}) | Noise Level (dB L_{Aeq}) | | | | 75dBA Limit Setback (m) |
|---|--|-----------------------------|------|------|------|-------------------------|
| | | 100m | 250m | 500m | 750m | |
| Large Trucks (operating within the site) | 108 | 60 | 50 | 43 | 38 | 25m |
| Excavators and other earthmoving plant | 103 | 55 | 45 | 38 | 33 | 14m |
| Vermeer PD10 Pile Driver (unattenuated impact piling noise level) | 123 | 75 | 65 | 58 | 53 | 100m |
| Impact piling (with casing and dolly) | 114 | 66 | 58 | 49 | 44 | 44m |
| Concrete truck & pump | 103 | 55 | 45 | 38 | 33 | 14m |
| Truck idling | 91 | 43 | 33 | 26 | 21 | 4m |

The majority of dwellings would be well beyond 100 metres from the piling and thus compliance with the District Plan construction noise rules will be complied with at most dwellings. However there are some dwellings that will be closer to the closest piles than this. We have identified these dwellings as:

- Potential worker accommodation on 260 Moroa Road



- 489 Moroa Road
- 56 Settlement Road
- 312 Bidwills Road (written approval from lessor)

The applicant has advised that they will take all required mitigation measures to ensure compliance with the NZS 6803:1999 noise limits at all dwelling façades. In some piling locations close to dwellings, that may mean that unattenuated Vermeer or drop hammer piling may not be able to occur. The applicant would ensure that if a Vermeer-type or drop hammer piling rig was used, that a suitable dolly or shroud (or similarly effective method) is used to mitigate noise from the piling. If the piling contractor advises that that method is impractical for the Vermeer-type rig, the applicant may need to use an alternative method (potentially screw, auger or bored piling) for piles within around 100m of dwellings.

We recommend that a noise management plan is prepared by the piling contractor to show the “zones” where Vermeer-type or drop hammer piling cannot occur. These zones are expected to be relatively small, nonetheless piling in these areas will need to be restricted to attenuated or quieter methods.

The key matter that the noise management plan should show are maps that illustrate the “piling zones” where noise levels may be above the NZS 6803:1999 noise limit without attenuation. Other matters should be addressed in the construction noise management plan as generally required in NZS 6803 and as part of typical best-practice.

There would be no perceptible vibration from the above construction activity.

8.2 Construction vehicles on public roads

Truck and construction passenger vehicle movements will occur on Moroa Road during construction. These are public roads and the construction noise and vibration limits do not technically apply to activities on these roads, although we note that vehicles using these roads would likely generate noise levels that comply with NZS 6803 guidelines regardless.

9.0 RECOMMENDED NOISE CONDITIONS

It is recommended that the following noise conditions are imposed on any consent granted.

1. The noise level from operation of the solar farm shall meet the following noise limits at the notional boundary of dwellings existing at the time of consent on any other site (excluding those where written approval has been obtained):

| | | |
|------------|------------------|---------------------------------------|
| Daytime | 7:00am to 7:00pm | 55 dB L _{A10} |
| Night-time | 7:00pm to 7:00pm | 45 dB L _{A10} |
| | 9:00pm to 7:00pm | 75 dB L _A F _{max} |

Noise levels shall be measured and assessed in accordance with NZS 6801:2008 *Acoustics – Measurement of Environmental Sound* and NZS 6802:2008 *Acoustics – Environmental Noise*.

2. Noise from construction activities shall not exceed the typical duration limits recommended in, and shall be measured and assessed in accordance with, New Zealand Standard NZS 6803: 1999 “*Acoustics – Construction Noise*”.
3. A Construction Noise Management Plan (CNMP) shall be prepared and submitted to Council. The CNMP shall identify any areas of piling on maps that are likely to breach the consented construction noise limits without further attenuation. The CNMP shall identify suitable methods of noise attenuation that should be used by the contractor to comply with the noise limits when piling within these zones and/or any procedures that should be carried out to identify these methods of noise attenuation prior to work beginning in these areas.



APPENDIX A GLOSSARY OF TERMINOLOGY

| | |
|--|---|
| Ambient Noise | Ambient Noise is the all-encompassing noise associated with any given environment and is usually a composite of sounds from many sources near and far. |
| dBA | A measurement of sound level which has its frequency characteristics modified by a filter (A-weighted) so as to more closely approximate the frequency bias of the human ear. |
| L_{eq} | The time averaged sound level (on a logarithmic/energy basis) over the measurement period (normally A-weighted). |
| L₉₀ | The sound level which is equalled or exceeded for 90% of the measurement period. L ₉₀ is an indicator of the mean minimum noise level and is used in New Zealand as the descriptor for background noise (normally A-weighted). |
| L₁₀ | The sound level which is equalled or exceeded for 10% of the measurement period. L ₁₀ is an indicator of the mean maximum noise level and is used in New Zealand as the descriptor for intrusive noise (normally A-weighted). |
| L_{AFmax} | The maximum sound level recorded during the measurement period (normally A-weighted). |
| NZS 6801:2008 | New Zealand Standard NZS 6801:2008 <i>Acoustics – Measurement of environmental sound</i> |
| NZS 6802:2008 | New Zealand Standard NZS 6802:2008 <i>Acoustics - Environmental Noise</i> |
| NZS 6803:1999 | New Zealand Standard NZS 6803:1999 “ <i>Acoustics – Construction Noise</i> ” |
| Prescribed time frame | ‘Daytime’, night-time’, ‘evening’, or any other relevant period specified in any rule or national environmental standard or in accordance with 8.3.2 in NZS 6802:2008. |
| Rating level | A derived level used for comparison with a noise limit. Considers any and all corrections described in NZS 6801 and NZS 6802, e.g. duration, special audible character, residual sound etc. This definition is from NZS 6802:2008. |
| Special audible characteristics | Distinctive characteristics of a sound that make it more likely to cause annoyance or disturbance. A penalty of up to 5 decibels can be applied when assessing sounds with SAC Examples are tonality – a hum or a whine) and impulsiveness – bangs or thumps. |

APPENDIX B SITE LAYOUT PLAN



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PRELIMINARY DESIGN

GENERAL NOTES

1. ALL DIMENSIONS ARE UNLESS OTHERWISE SPECIFIED.
 2. ALL DIMENSIONS ARE TO FACE UNLESS OTHERWISE SPECIFIED.

- LEGEND**
- 1. 10% TYPICAL SPACING (ON STRIP)
 - 2. 20% TYPICAL SPACING (ON STRIP)
 - 3. 30% TYPICAL SPACING (ON STRIP)
 - 4. 40% TYPICAL SPACING (ON STRIP)
 - 5. 50% TYPICAL SPACING (ON STRIP)
 - 6. 60% TYPICAL SPACING (ON STRIP)
 - 7. 70% TYPICAL SPACING (ON STRIP)
 - 8. 80% TYPICAL SPACING (ON STRIP)
 - 9. 90% TYPICAL SPACING (ON STRIP)
 - 10. 100% TYPICAL SPACING (ON STRIP)
 - 11. 110% TYPICAL SPACING (ON STRIP)
 - 12. 120% TYPICAL SPACING (ON STRIP)
 - 13. 130% TYPICAL SPACING (ON STRIP)
 - 14. 140% TYPICAL SPACING (ON STRIP)
 - 15. 150% TYPICAL SPACING (ON STRIP)
 - 16. 160% TYPICAL SPACING (ON STRIP)
 - 17. 170% TYPICAL SPACING (ON STRIP)
 - 18. 180% TYPICAL SPACING (ON STRIP)
 - 19. 190% TYPICAL SPACING (ON STRIP)
 - 20. 200% TYPICAL SPACING (ON STRIP)

REFERENCE FRAMEWORK

1. 10% TYPICAL SPACING (ON STRIP)

| NO. | DESCRIPTION | DATE |
|-----|--------------------|------------|
| 1 | PRELIMINARY DESIGN | 2023/04/11 |
| 2 | REVISED DESIGN | 2023/04/11 |
| 3 | REVISED DESIGN | 2023/04/11 |
| 4 | REVISED DESIGN | 2023/04/11 |
| 5 | REVISED DESIGN | 2023/04/11 |
| 6 | REVISED DESIGN | 2023/04/11 |
| 7 | REVISED DESIGN | 2023/04/11 |
| 8 | REVISED DESIGN | 2023/04/11 |
| 9 | REVISED DESIGN | 2023/04/11 |
| 10 | REVISED DESIGN | 2023/04/11 |
| 11 | REVISED DESIGN | 2023/04/11 |
| 12 | REVISED DESIGN | 2023/04/11 |
| 13 | REVISED DESIGN | 2023/04/11 |
| 14 | REVISED DESIGN | 2023/04/11 |
| 15 | REVISED DESIGN | 2023/04/11 |
| 16 | REVISED DESIGN | 2023/04/11 |
| 17 | REVISED DESIGN | 2023/04/11 |
| 18 | REVISED DESIGN | 2023/04/11 |
| 19 | REVISED DESIGN | 2023/04/11 |
| 20 | REVISED DESIGN | 2023/04/11 |

CONTRACT NAME

GREYTOWN 174 MWp
 NEW ZEALAND

SUBJECT LOCATION

GREYTOWN 174 MWp
 NEW ZEALAND

PREPARED BY

ACQUANT

DATE

2023/04/11

SCALE

1:1000

PROJECT NO.

174 MWp

CLIENT

ACQUANT

PROJECT NAME

GREYTOWN 174 MWp

PV SYSTEM DETAILS

| | |
|---------------------------|--------------------------|
| SITE COORDINATES | UIC - 41 374 000 000 000 |
| MODULE TYPE | 60 CELL PER 100 Wp |
| MODULE POWER (Wp) | 300 Wp |
| MODULE VOLTAGE (V) | 30 V |
| MODULE LENGTH (M) | 1.65 M |
| MODULE WIDTH (M) | 0.9 M |
| TRACKING ANGLE | 0° |
| TRACKING TYPE | FIXED TILT |
| PITCH | 35.5° |
| TABLE ARRANGEMENT | 2x 2x 2x 1.5 |
| NO. OF MODULES PER STRING | 30 |
| ADDITIONAL POWER (Wp) | 0 Wp |
| INVERTER | SHR SUNNY CENTRAL 400 Lp |
| NO. OF INVERTERS | 4250 |
| INVERTER TYPE | 3PH |
| AC CAPACITY (MWp) | 128.7 MWp |
| AC CAPACITY (MWp) | 128.7 MWp |
| AC CAPACITY (MWp) | 128.7 MWp |



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Rp 001 R01 20230481 FNSF Greytown Solar Farm PAI Assessment of Environmental Noise Effects ISSUE PR

APPENDIX C LOGGED NOISE RESULTS (OVERLEAF)



Figure 2: Diurnal Ambient and Background Noise Levels Measured at Logger Position

