Viewpoint Location Photographs - Falston Road

Viewpoint Location Photograph 13: Located along Falston Road, north of shelterbelt located along the western side of the road. This photo illustrates the view over the top end of Lake Benmore towards the site and the surrounding mountains, with the solar farm being 1.9kms aways.

Viewpoint Location Photographs - Haldon Road

Viewpoint Location Photograph 14: Located along Haldon Road at the western end of Little Pass. This photo illustrates the first time a road user gains a view over this part of the basin when travelling along this road, with the solar farm being 9.8kms aways.

Viewpoint Location Photograph 15: Located near the intersection of Haldon Road and Haldon Arm Road. This photo illustrates the view over the dryland outwash plain towards the site and enclosing mountains, with the solar farm being 6.3kms away, on the far side of the Pukaki / Tekapo Rivers.

Viewpoint Location Photographs - Haldon Road

Viewpoint Location Photograph 16: Located along Haldon Arm Road. This photo illustrates the view over the dryland outwash plain towards the site and enclosing mountains, with the solar farm being 3.3kms away, on the far side of the Pukaki / Tekapo Rivers.

Viewpoint Location Photograph 17: Located along Haldon Arm Road, near the Tekapo River terrace edge. This photo illustrates the view over the dryland outwash plain towards the site and enclosing mountains, with the solar farm being 2.2kms away, on the far side of the Pukaki / Tekapo Rivers.

Viewpoint Location Photographs - Haldon Arm Road

Viewpoint Location Photograph 18: Located along the four-wheel drive track section of Haldon Arm Road, immediately west of Haldon Arm Campground. This photo illustrates the limited long range views gained from these four-wheel-drive tracks alongside the Pukaki and Tekapo Rivers.

Viewpoint Location Photograph 19: Located along the four-wheel drive track west Haldon Arm Road, heading towards Old Iron Bridge. This photo illustrates the limited long range views gained from these four-wheel-drive tracks alongside the Pukaki and Tekapo Rivers.

Viewpoint Location Photographs - Haldon Arm Road

Viewpoint Location Photograph 20: Located on the eastern side of Old Iron Bridge. This photo illustrates the view along the Tekapo River towards the site and the Benmore Range.

Viewpoint Location Photograph 21: Located in the middle of Old Iron Bridge. This photo illustrates the view along the Tekapo River towards the site, which cannot be seen, and the Benmore Range.

ROUGH MILNE MITCHELL
LANDSCAPE ARCHITECTS

Christchurch
Level Two, 69 Cambridge Terrace
Christchurch 8013
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Wānaka 9305
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RMM

ROUGH MILNE MITCHELL
LANDSCAPE ARCHITECTS

Proposed Solar Farm - The Point, Mackenzie Basin
Appendix 2: Visual Simulations

25 May 2023

Virtual View

Photo Simulation Methodology

VIRTUALVIEW
3D VISUALISATION SPECIALISTS

METHODOLOGY FOR THE PREPARATION OF A PHOTO SIMULATION

1. The main objective of a photo simulation is to provide an image that, as realistically as possible, conveys the modification or change of a proposed activity. The most appropriate technical methodology has been applied to ensure the accuracy of what is depicted, in terms of its relative position, elevation, scale, and appearance. Photo simulations can never replace the real experience of being at a location, but they are a useful tool to assist in the decision-making process.

2. To achieve a photo simulation, a 3D model is rendered into a series of 2-dimensional photographs.

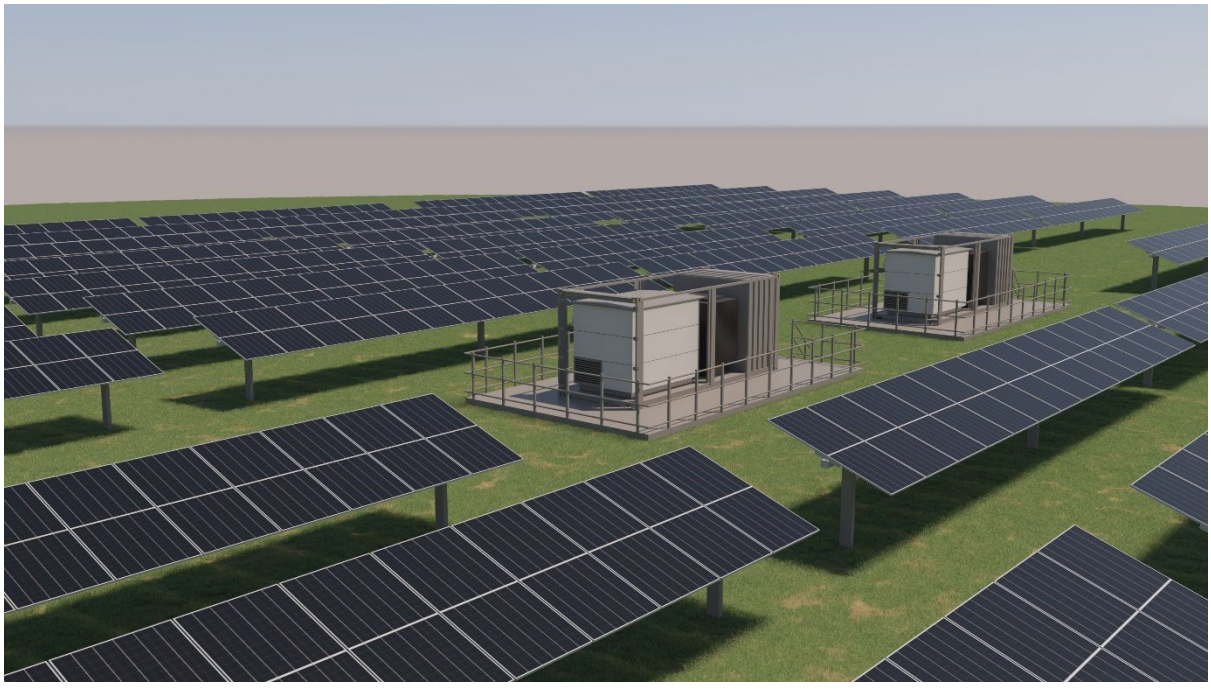
3. Viewpoint locations were chosen by Paul Smith from Rough Milne Mitchell Landscape Architects Ltd (RMM) and taken by Virtual View Ltd. A full frame Canon 5D mk2 with a 50mm lens was used to take the photo panoramas from the designated positions.

4. The photo simulation positions, and corresponding reference points were survey marked by Virtual View Ltd using a Lecia GS18 RTK Rover.

5. The photos were then colour matched to ensure consistency throughout the image and manually stitched together to form a photo panoramic.

6. To achieve a photo simulation Virtual View Ltd firstly created a digital terrain model of the existing landform. A 3D model of the solar panel system was created to supplied specifications and duplicated across the site to match the site layout plan. Landscaping was then added to the model to supplied heights and locations. Simulations 09, 12 and 25 include proposed landscaping at years 2 and 5. All other simulations only include proposed landscaping at year 5 due to it being on the southern side of the site and less visible.

Overview of 3D model showing digital terrain model with solar panel layout and landscaping.



Close-up view of 3D model solar panel layout components.

7. A series of 3D computer cameras within the simulation software are then created. They were positioned accurately to the corresponding survey marked photo position from which the photos were taken. The camera used depicts a real-world camera, including matching the focal length of the 50mm lens.

8. To duplicate the view through the real-world camera, it was necessary to match the landform data and reference points to the respective physical objects in the photo – thus ensuring an accurate horizontal and vertical alignment.

9. A sunlight system was then created which uses light in a system that follows the geographically correct angle and movement of the sun over the earth at a given location. Location, date, time, and compass orientation can be chosen. The simulations Virtual View Ltd prepared, depict the proposed development at the same, time and date as specified, and are simulated to resemble the natural lighting.

10. The solar panels have been rotated horizontally to match the sun angle and azimuth at the corresponding time of day.
    0 degrees = Parallel to the ground surface.
    Negative degrees = Facing east.
    Positive degrees = Facing west.
    Below are the angles for each viewpoint:
    - Viewpoint 03 = -40 degrees
    - Viewpoint 07 = -50 degrees
    - Viewpoint 08 = -30 degrees
    - Viewpoint 09 = -5 degrees
    - Viewpoint 12 = -20 degrees
    - Viewpoint 16 = +35 degrees
    - Viewpoint 23 = +52 degrees
    - Viewpoint 25 = 0 degrees

11. Within the 3D software, the new image was then rendered containing the accurately positioned 3D model over top of the original photograph.

12. Existing foreground vegetation was overlaid using photo-editing software and was then checked against aerial photography from the site to ensure correct placement.

13. For the resulting photo simulations, the viewing scale is 50cm from the eye when printed at full scale A3. This scale produces an image that is 240mm high and was chosen as it is a comfortable distance to hold at approximately an arm's length, to appreciate what the view would be at scale in real life. (Refer to Figure 1 below for viewing scale).

14. Viewing on screen should be done tentatively as there are numerous variables such as screen size, zoom level and the application being used, that can affect the scale of what would be seen by the naked eye.

15. All photo simulations comply with the New Zealand Institute of Landscape Architects document: Visual Simulations Best Practice Guide 10.2.

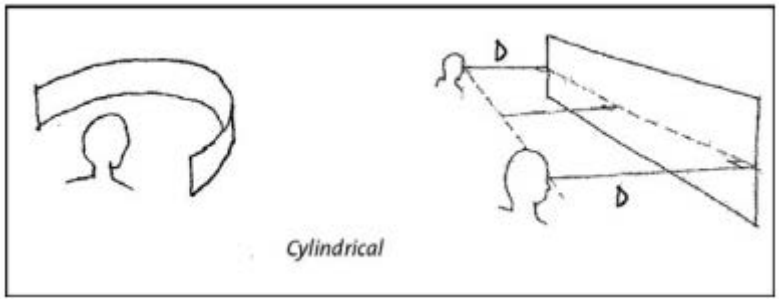
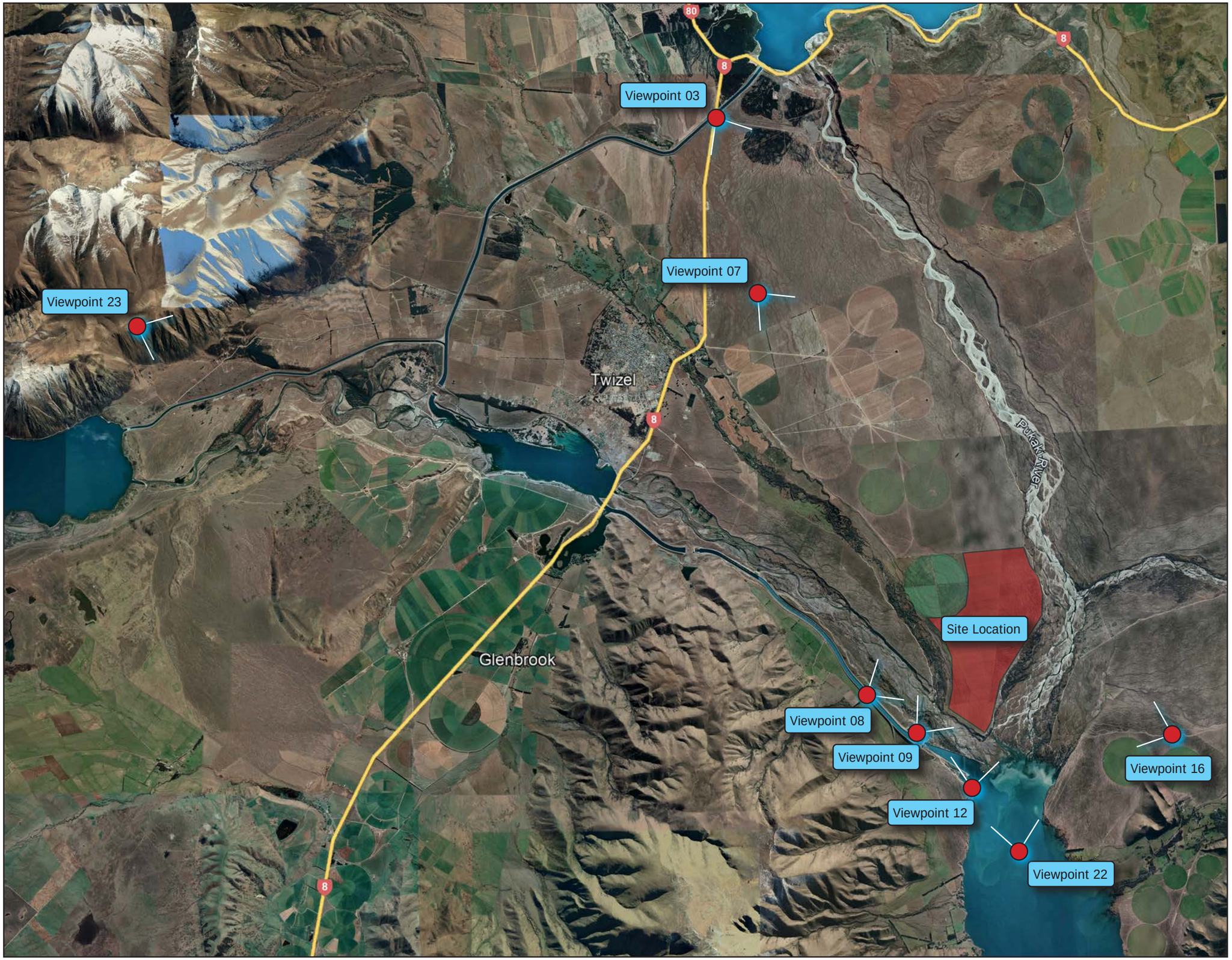


Figure 1: Viewing scale for Photo Simulations

Viewpoint Location Map



Far North Solar Farm Ltd
Ohau C

- Viewpoint 03
  Pukaki-Ohau Canal Bridge
  (E)325079.674 (N)821851.055
- Viewpoint 07
  Alps 2 Ocean Cycle Trail
  (E)326193.695 (N)817334.755
- Viewpoint 08
  McAughtries Road
  (E)328893.156 (N)807397.243
- Viewpoint 09
  McAughtries Road
  (E)330081.513 (N)806497.075
- Viewpoint 12
  Falston Road
  (E)331419.215 (N)805168.442
- Viewpoint 16
  Haldon Arm Road
  (E)336283.141 (N)806562.820
- Viewpoint 22
  Lake Benmore
  (E)332530.098 (N)803795.977
- Viewpoint 23
  Greta Track
  (E)310818.826 (N)816197.524

VIRTUALVIEW
3D VISUALISATION SPECIALISTS

Date Printed : 17-05-2023

Viewpoint 03 - Existing

Viewpoint 03 - Proposed

VIRTUALVIEW
3D VISUALISATION SPECIALISTS

Easting: 325079.674
Northing: 821851.055
Elevation : 521.628m
Height of Camera : 1.4m
Orientation of View : SE
Date of Photography : 08 Feb 2023
Time of Photography : 16:08pm

Far North Solar Farm Ltd - Ohau C

Viewpoint 03 - Pukaki-Ohau Canal Bridge

NOTES: All photos were taken by Virtual View with a Canon 5Dmk2 and a 50mm lens.
Photo positions were surveyed by Virtual View.
Dashed white line indicates cropped viewpoint portion.

Version info: 0002
Date Printed: 17-05-2023

Viewpoint 03 - Existing

IMAGE TO BE VIEWED AT 50cm FROM EYE FOR CORRECT VIEWING SCALE WHEN PRINTED AT A3

VIRTUALVIEW
3D VISUALISATION SPECIALISTS

Easting: 325079.674
Northing: 821851.055
Elevation : 521.628m
Height of Camera : 1.4m
Orientation of View : SE
Date of Photography : 08 Feb 2023
Time of Photography : 16:08pm

Far North Solar Farm Ltd - Ohau C

Viewpoint 03 - Pukaki-Ohau Canal Bridge

NOTES: All photos were taken by Virtual View with a Canon 5Dmk2 and a 50mm lens.
Photo positions were surveyed by Virtual View.

Version info: 0002
Date Printed: 17-05-2023

Viewpoint 03 - Proposed

IMAGE TO BE VIEWED AT 50cm FROM EYE FOR CORRECT VIEWING SCALE WHEN PRINTED AT A3

VIRTUALVIEW
3D VISUALISATION SPECIALISTS

Easting: 325079.674
Northing: 821851.055
Elevation : 521.628m
Height of Camera : 1.4m
Orientation of View : SE
Date of Photography : 08 Feb 2023
Time of Photography : 16:08pm

Far North Solar Farm Ltd - Ohau C

Viewpoint 03 - Pukaki-Ohau Canal Bridge

NOTES: All photos were taken by Virtual View with a Canon 5Dmk2 and a 50mm lens.
Photo positions were surveyed by Virtual View.

Version info: 0002
Date Printed: 17-05-2023

Viewpoint 07 - Existing

Viewpoint 07 - Proposed

VIRTUALVIEW
3D VISUALISATION SPECIALISTS

Easting: 326193.695
Northing: 817334.755
Elevation : 466.593m
Height of Camera : 1.4m
Orientation of View : SE
Date of Photography : 08 Feb 2023
Time of Photography : 17:11pm

Far North Solar Farm Ltd - Ohau C

Viewpoint 07 - Alps 2 Ocean Cycle Trail

NOTES: All photos were taken by Virtual View with a Canon 5Dmk2 and a 50mm lens.
Photo positions were surveyed by Virtual View.
Dashed white line indicates cropped viewpoint portion.

Version info: 0002
Date Printed: 17-05-2023

Viewpoint 07 - Existing

IMAGE TO BE VIEWED AT 50cm FROM EYE FOR CORRECT VIEWING SCALE WHEN PRINTED AT A3

VIRTUALVIEW
3D VISUALISATION SPECIALISTS

Easting: 326193.695
Northing: 817334.755
Elevation : 466.593m
Height of Camera : 1.4m
Orientation of View : SE
Date of Photography : 08 Feb 2023
Time of Photography : 17:11pm

Far North Solar Farm Ltd - Ohau C

Viewpoint 07 - Alps 2 Ocean Cycle Trail

NOTES: All photos were taken by Virtual View with a Canon 5Dmk2 and a 50mm lens.
Photo positions were surveyed by Virtual View.

Version info: 0002
Date Printed: 17-05-2023

Viewpoint 07 - Proposed

IMAGE TO BE VIEWED AT 50cm FROM EYE FOR CORRECT VIEWING SCALE WHEN PRINTED AT A3

VIRTUALVIEW
3D VISUALISATION SPECIALISTS

Easting: 326193.695
Northing: 817334.755
Elevation : 466.593m
Height of Camera : 1.4m
Orientation of View : SE
Date of Photography : 08 Feb 2023
Time of Photography : 17:11pm

Far North Solar Farm Ltd - Ohau C

Viewpoint 07 - Alps 2 Ocean Cycle Trail

NOTES: All photos were taken by Virtual View with a Canon 5Dmk2 and a 50mm lens.
Photo positions were surveyed by Virtual View.

Version info: 0002
Date Printed: 17-05-2023

Viewpoint 08 - Existing

Viewpoint 08 - Proposed

VIRTUALVIEW
3D VISUALISATION SPECIALISTS

Easting: 328893.156
Northing: 807397.243
Elevation : 411.732m
Height of Camera : 1.4m
Orientation of View : NE
Date of Photography : 08 Feb 2023
Time of Photography : 15:28pm

Far North Solar Farm Ltd - Ohau C

Viewpoint 08 - McAughtries Road

NOTES: All photos were taken by Virtual View with a Canon 5Dmk2 and a 50mm lens.
Photo positions were surveyed by Virtual View.
Dashed white line indicates cropped viewpoint portion.

Version info: 0002
Date Printed: 17-05-2023

Viewpoint 08a - Existing

IMAGE TO BE VIEWED AT 50cm FROM EYE FOR CORRECT VIEWING SCALE WHEN PRINTED AT A3

VIRTUALVIEW
3D VISUALISATION SPECIALISTS

Easting: 328893.156
Northing: 807397.243
Elevation : 411.732m
Height of Camera : 1.4m
Orientation of View : NE
Date of Photography : 08 Feb 2023
Time of Photography : 15:28pm

Far North Solar Farm Ltd - Ohau C

Viewpoint 08 - McAughtries Road

NOTES: All photos were taken by Virtual View with a Canon 5Dmk2 and a 50mm lens.
Photo positions were surveyed by Virtual View.

Version info: 0002
Date Printed: 17-05-2023

Viewpoint 08a - Proposed

IMAGE TO BE VIEWED AT 50cm FROM EYE FOR CORRECT VIEWING SCALE WHEN PRINTED AT A3

VIRTUALVIEW
3D VISUALISATION SPECIALISTS

Easting: 328893.156
Northing: 807397.243
Elevation : 411.732m
Height of Camera : 1.4m
Orientation of View : NE
Date of Photography : 08 Feb 2023
Time of Photography : 15:28pm

Far North Solar Farm Ltd - Ohau C

Viewpoint 08 - McAughtries Road

NOTES: All photos were taken by Virtual View with a Canon 5Dmk2 and a 50mm lens.
Photo positions were surveyed by Virtual View.

Version info: 0002
Date Printed: 17-05-2023

Viewpoint 08b - Existing

IMAGE TO BE VIEWED AT 50cm FROM EYE FOR CORRECT VIEWING SCALE WHEN PRINTED AT A3

VIRTUALVIEW
3D VISUALISATION SPECIALISTS

Easting: 328893.156
Northing: 807397.243
Elevation : 411.732m
Height of Camera : 1.4m
Orientation of View : NE
Date of Photography : 08 Feb 2023
Time of Photography : 15:28pm

Far North Solar Farm Ltd - Ohau C

Viewpoint 08 - McAughtries Road

NOTES: All photos were taken by Virtual View with a Canon 5Dmk2 and a 50mm lens.
Photo positions were surveyed by Virtual View.

Version info: 0002
Date Printed: 17-05-2023

Viewpoint 08b - Proposed

IMAGE TO BE VIEWED AT 50cm FROM EYE FOR CORRECT VIEWING SCALE WHEN PRINTED AT A3

VIRTUALVIEW
3D VISUALISATION SPECIALISTS

Easting: 328893.156
Northing: 807397.243
Elevation : 411.732m
Height of Camera : 1.4m
Orientation of View : NE
Date of Photography : 08 Feb 2023
Time of Photography : 15:28pm

Far North Solar Farm Ltd - Ohau C

Viewpoint 08 - McAughtries Road

NOTES: All photos were taken by Virtual View with a Canon 5Dmk2 and a 50mm lens.
Photo positions were surveyed by Virtual View.

Version info: 0002
Date Printed: 17-05-2023

Viewpoint 09 - Existing

Viewpoint 09 - Proposed - Year 02

VIRTUALVIEW
3D VISUALISATION SPECIALISTS

Easting: 330081.513
Northing: 806497.075
Elevation : 412.099m
Height of Camera : 1.4m
Orientation of View : NE
Date of Photography : 08 Feb 2023
Time of Photography : 14:00pm

Far North Solar Farm Ltd - Ohau C

Viewpoint 09 - McAughtries Road

NOTES: All photos were taken by Virtual View with a Canon 5Dmk2 and a 50mm lens.
Photo positions were surveyed by Virtual View.
Dashed white line indicates cropped viewpoint portion.

Version info: 0002
Date Printed: 17-05-2023

Viewpoint 09 - Existing

Viewpoint 09 - Proposed - Year 05

VIRTUALVIEW
3D VISUALISATION SPECIALISTS

Easting: 330081.513
Northing: 806497.075
Elevation : 412.099m
Height of Camera : 1.4m
Orientation of View : NE
Date of Photography : 08 Feb 2023
Time of Photography : 14:00pm

Far North Solar Farm Ltd - Ohau C

Viewpoint 09 - McAughtries Road

NOTES: All photos were taken by Virtual View with a Canon 5Dmk2 and a 50mm lens.
Photo positions were surveyed by Virtual View.
Dashed white line indicates cropped viewpoint portion.

Version info: 0002
Date Printed: 17-05-2023

Viewpoint 09a - Existing

IMAGE TO BE VIEWED AT 50cm FROM EYE FOR CORRECT VIEWING SCALE WHEN PRINTED AT A3

VIRTUALVIEW
3D VISUALISATION SPECIALISTS

Easting: 330081.513
Northing: 806497.075
Elevation : 412.099m
Height of Camera : 1.4m
Orientation of View : NE
Date of Photography : 08 Feb 2023
Time of Photography : 14:00pm

Far North Solar Farm Ltd - Ohau C

Viewpoint 09 - McAughtries Road

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Photo positions were surveyed by Virtual View.

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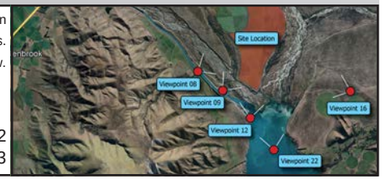


Viewpoint 09a - Proposed - Year 02

IMAGE TO BE VIEWED AT 50cm FROM EYE FOR CORRECT VIEWING SCALE WHEN PRINTED AT A3

VIRTUALVIEW
3D VISUALISATION SPECIALISTS

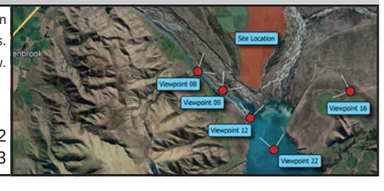
Easting: 330081.513
Northing: 806497.075
Elevation : 412.099m
Height of Camera : 1.4m
Orientation of View : NE
Date of Photography : 08 Feb 2023
Time of Photography : 14:00pm

Far North Solar Farm Ltd - Ohau C

Viewpoint 09 - McAughtries Road

NOTES: All photos were taken by Virtual View with a Canon 5Dmk2 and a 50mm lens.
Photo positions were surveyed by Virtual View.

Version info: 0002
Date Printed: 17-05-2023



Viewpoint 09a - Proposed - Year 05

IMAGE TO BE VIEWED AT 50cm FROM EYE FOR CORRECT VIEWING SCALE WHEN PRINTED AT A3

VIRTUALVIEW
3D VISUALISATION SPECIALISTS

Easting: 330081.513
Northing: 806497.075
Elevation : 412.099m
Height of Camera : 1.4m
Orientation of View : NE
Date of Photography : 08 Feb 2023
Time of Photography : 14:00pm

Far North Solar Farm Ltd - Ohau C

Viewpoint 09 - McAughtries Road

NOTES: All photos were taken by Virtual View with a Canon 5Dmk2 and a 50mm lens.
Photo positions were surveyed by Virtual View.

Version info: 0002
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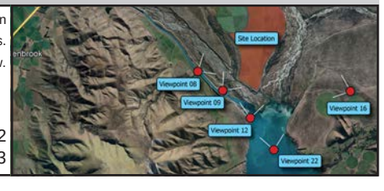

Viewpoint 09b - Existing

IMAGE TO BE VIEWED AT 50cm FROM EYE FOR CORRECT VIEWING SCALE WHEN PRINTED AT A3

VIRTUALVIEW
3D VISUALISATION SPECIALISTS

Easting: 330081.513
Northing: 806497.075
Elevation : 412.099m
Height of Camera : 1.4m
Orientation of View : NE
Date of Photography : 08 Feb 2023
Time of Photography : 14:00pm

Far North Solar Farm Ltd - Ohau C

Viewpoint 09 - McAughtries Road

NOTES: All photos were taken by Virtual View with a Canon 5Dmk2 and a 50mm lens.
Photo positions were surveyed by Virtual View.

Version info: 0002
Date Printed: 17-05-2023

Viewpoint 09b - Proposed - Year 02

IMAGE TO BE VIEWED AT 50cm FROM EYE FOR CORRECT VIEWING SCALE WHEN PRINTED AT A3

VIRTUALVIEW
3D VISUALISATION SPECIALISTS

Easting: 330081.513
Northing: 806497.075
Elevation : 412.099m
Height of Camera : 1.4m
Orientation of View : NE
Date of Photography : 08 Feb 2023
Time of Photography : 14:00pm

Far North Solar Farm Ltd - Ohau C

Viewpoint 09 - McAughtries Road

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Photo positions were surveyed by Virtual View.

Version info: 0002
Date Printed: 17-05-2023

Viewpoint 09b - Proposed - Year 05

IMAGE TO BE VIEWED AT 50cm FROM EYE FOR CORRECT VIEWING SCALE WHEN PRINTED AT A3

VIRTUALVIEW
3D VISUALISATION SPECIALISTS

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Northing: 806497.075
Elevation : 412.099m
Height of Camera : 1.4m
Orientation of View : NE
Date of Photography : 08 Feb 2023
Time of Photography : 14:00pm

Far North Solar Farm Ltd - Ohau C

Viewpoint 09 - McAughtries Road

NOTES: All photos were taken by Virtual View with a Canon 5Dmk2 and a 50mm lens.
Photo positions were surveyed by Virtual View.

Version info: 0002
Date Printed: 17-05-2023

Viewpoint 12 - Existing

Viewpoint 12 - Proposed - Year 02

VIRTUALVIEW
3D VISUALISATION SPECIALISTS

Easting: 331419.215
Northing: 805168.442
Elevation : 374.023m
Height of Camera : 1.4m
Orientation of View : N
Date of Photography : 08 Feb 2023
Time of Photography : 14:45pm

Far North Solar Farm Ltd - Ohau C

Viewpoint 12 - Falston Road

NOTES: All photos were taken by Virtual View with a Canon 5Dmk2 and a 50mm lens.
Photo positions were surveyed by Virtual View.
Dashed white line indicates cropped viewpoint portion.

Version info: 0002
Date Printed: 17-05-2023

Viewpoint 12 - Existing

Viewpoint 12 - Proposed - Year 05

VIRTUALVIEW
3D VISUALISATION SPECIALISTS

Easting: 331419.215
Northing: 805168.442
Elevation : 374.023m
Height of Camera : 1.4m
Orientation of View : N
Date of Photography : 08 Feb 2023
Time of Photography : 14:45pm

Far North Solar Farm Ltd - Ohau C

Viewpoint 12 - Falston Road

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Photo positions were surveyed by Virtual View.
Dashed white line indicates cropped viewpoint portion.

Version info: 0002
Date Printed: 17-05-2023

Viewpoint 12 - Existing

IMAGE TO BE VIEWED AT 50cm FROM EYE FOR CORRECT VIEWING SCALE WHEN PRINTED AT A3

VIRTUALVIEW
3D VISUALISATION SPECIALISTS

Easting: 331419.215
Northing: 805168.442
Elevation : 374.023m
Height of Camera : 1.4m
Orientation of View : N
Date of Photography : 08 Feb 2023
Time of Photography : 14:45pm

Far North Solar Farm Ltd - Ohau C

Viewpoint 12 - Falston Road

NOTES: All photos were taken by Virtual View with a Canon 5Dmk2 and a 50mm lens.
Photo positions were surveyed by Virtual View.

Version info: 0002
Date Printed: 17-05-2023

Viewpoint 12 - Proposed - Year 02

IMAGE TO BE VIEWED AT 50cm FROM EYE FOR CORRECT VIEWING SCALE WHEN PRINTED AT A3

VIRTUALVIEW
3D VISUALISATION SPECIALISTS

Easting: 331419.215
Northing: 805168.442
Elevation : 374.023m
Height of Camera : 1.4m
Orientation of View : N
Date of Photography : 08 Feb 2023
Time of Photography : 14:45pm

Far North Solar Farm Ltd - Ohau C

Viewpoint 12 - Falston Road

NOTES: All photos were taken by Virtual View with a Canon 5Dmk2 and a 50mm lens.
Photo positions were surveyed by Virtual View.

Version info: 0002
Date Printed: 17-05-2023

Viewpoint 12 - Proposed - Year 05

IMAGE TO BE VIEWED AT 50cm FROM EYE FOR CORRECT VIEWING SCALE WHEN PRINTED AT A3

VIRTUALVIEW
3D VISUALISATION SPECIALISTS

Easting: 331419.215
Northing: 805168.442
Elevation : 374.023m
Height of Camera : 1.4m
Orientation of View : N
Date of Photography : 08 Feb 2023
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Far North Solar Farm Ltd - Ohau C

Viewpoint 12 - Falston Road

NOTES: All photos were taken by Virtual View with a Canon 5Dmk2 and a 50mm lens.
Photo positions were surveyed by Virtual View.

Version info: 0002
Date Printed: 17-05-2023

Viewpoint 16 - Existing

Viewpoint 16 - Proposed

VIRTUALVIEW
3D VISUALISATION SPECIALISTS

Easting: 336283.141
Northing: 806562.82
Elevation : 386.23m
Height of Camera : 1.4m
Orientation of View : NW
Date of Photography : 08 Feb 2023
Time of Photography : 11:27am

Far North Solar Farm Ltd - Ohau C

Viewpoint 16 - Haldon Arm Road

NOTES: All photos were taken by Virtual View with a Canon 5Dmk2 and a 50mm lens.
Photo positions were surveyed by Virtual View.
Dashed white line indicates cropped viewpoint portion.

Version info: 0002
Date Printed: 17-05-2023

Viewpoint 16 - Existing

IMAGE TO BE VIEWED AT 50cm FROM EYE FOR CORRECT VIEWING SCALE WHEN PRINTED AT A3

VIRTUALVIEW
3D VISUALISATION SPECIALISTS

Easting: 336283.141
Northing: 806562.82
Elevation : 386.23m
Height of Camera : 1.4m
Orientation of View : NW
Date of Photography : 08 Feb 2023
Time of Photography : 11:27am

Far North Solar Farm Ltd - Ohau C

Viewpoint 16 - Haldon Arm Road

NOTES: All photos were taken by Virtual View with a Canon 5Dmk2 and a 50mm lens.
Photo positions were surveyed by Virtual View.

Version info: 0002
Date Printed: 17-05-2023

Viewpoint 16 - Proposed

IMAGE TO BE VIEWED AT 50cm FROM EYE FOR CORRECT VIEWING SCALE WHEN PRINTED AT A3

VIRTUALVIEW
3D VISUALISATION SPECIALISTS

Easting: 336283.141
Northing: 806562.82
Elevation : 386.23m
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Orientation of View : NW
Date of Photography : 08 Feb 2023
Time of Photography : 11:27am

Far North Solar Farm Ltd - Ohau C

Viewpoint 16 - Haldon Arm Road

NOTES: All photos were taken by Virtual View with a Canon 5Dmk2 and a 50mm lens.
Photo positions were surveyed by Virtual View.

Version info: 0002
Date Printed: 17-05-2023

Viewpoint 22 - Existing

Viewpoint 22 - Proposed - Year 02

VIRTUALVIEW
3D VISUALISATION SPECIALISTS

Easting: 332530.098
Northing: 803795.977
Elevation : 360.736m
Height of Camera : 1.4m
Orientation of View : NW
Date of Photography : 10 Feb 2023
Time of Photography : 13:37pm

Far North Solar Farm Ltd - Ohau C

Viewpoint 22 - Lake Benmore

NOTES: All photos were taken by Virtual View with a Canon 5Dmk2 and a 50mm lens.
Photo positions were surveyed by Virtual View.
Dashed white line indicates cropped viewpoint portion.

Version info: 0002
Date Printed: 17-05-2023

Viewpoint 22 - Existing

Viewpoint 22 - Proposed - Year 05

VIRTUALVIEW
3D VISUALISATION SPECIALISTS

Easting: 332530.098
Northing: 803795.977
Elevation : 360.736m
Height of Camera : 1.4m
Orientation of View : NW
Date of Photography : 10 Feb 2023
Time of Photography : 13:37pm

Far North Solar Farm Ltd - Ohau C

Viewpoint 22 - Lake Benmore

NOTES: All photos were taken by Virtual View with a Canon 5Dmk2 and a 50mm lens.
Photo positions were surveyed by Virtual View.
Dashed white line indicates cropped viewpoint portion.

Version info: 0002
Date Printed: 17-05-2023

Viewpoint 22 - Existing

IMAGE TO BE VIEWED AT 50cm FROM EYE FOR CORRECT VIEWING SCALE WHEN PRINTED AT A3

VIRTUALVIEW
3D VISUALISATION SPECIALISTS

Easting: 332530.098
Northing: 803795.977
Elevation : 360.736m
Height of Camera : 1.4m
Orientation of View : NW
Date of Photography : 10 Feb 2023
Time of Photography : 13:37pm

Far North Solar Farm Ltd - Ohau C

Viewpoint 22 - Lake Benmore

NOTES: All photos were taken by Virtual View with a Canon 5Dmk2 and a 50mm lens.
Photo positions were surveyed by Virtual View.

Version info: 0002
Date Printed: 17-05-2023

Viewpoint 22 - Proposed - Year 02

IMAGE TO BE VIEWED AT 50cm FROM EYE FOR CORRECT VIEWING SCALE WHEN PRINTED AT A3

VIRTUALVIEW
3D VISUALISATION SPECIALISTS

Easting: 332530.098
Northing: 803795.977
Elevation : 360.736m
Height of Camera : 1.4m
Orientation of View : NW
Date of Photography : 10 Feb 2023
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Far North Solar Farm Ltd - Ohau C

Viewpoint 22 - Lake Benmore

NOTES: All photos were taken by Virtual View with a Canon 5Dmk2 and a 50mm lens.
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Version info: 0002
Date Printed: 17-05-2023

Viewpoint 22 - Proposed - Year 05

IMAGE TO BE VIEWED AT 50cm FROM EYE FOR CORRECT VIEWING SCALE WHEN PRINTED AT A3

VIRTUALVIEW
3D VISUALISATION SPECIALISTS

Easting: 332530.098
Northing: 803795.977
Elevation : 360.736m
Height of Camera : 1.4m
Orientation of View : NW
Date of Photography : 10 Feb 2023
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Far North Solar Farm Ltd - Ohau C

Viewpoint 22 - Lake Benmore

NOTES: All photos were taken by Virtual View with a Canon 5Dmk2 and a 50mm lens.
Photo positions were surveyed by Virtual View.

Version info: 0002
Date Printed: 17-05-2023

Viewpoint 23 - Existing

Viewpoint 23 - Proposed

VIRTUALVIEW
3D VISUALISATION SPECIALISTS

Easting: 310818.826
Northing: 816197.524
Elevation : 1101.437m
Height of Camera : 1.4m
Orientation of View : SE
Date of Photography : 10 Feb 2023
Time of Photography : 9:23am

Far North Solar Farm Ltd - Ohau C

Viewpoint 23 - Greta Track

NOTES: All photos were taken by Virtual View with a Canon 5Dmk2 and a 50mm lens.
Photo positions were surveyed by Virtual View.
Dashed white line indicates cropped viewpoint portion.

Version info: 0002
Date Printed: 17-05-2023

Viewpoint 23 - Existing

IMAGE TO BE VIEWED AT 50cm FROM EYE FOR CORRECT VIEWING SCALE WHEN PRINTED AT A3

VIRTUALVIEW
3D VISUALISATION SPECIALISTS

Easting: 310818.826
Northing: 816197.524
Elevation : 1101.437m
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Orientation of View : SE
Date of Photography : 10 Feb 2023
Time of Photography : 9:23am

Far North Solar Farm Ltd - Ohau C

Viewpoint 23 - Greta Track

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Appendix D: Ecological Impact Assessment

ASSESSMENT OF ECOLOGICAL EFFECTS FOR THE PROPOSED ŌHAU C SOLAR FARM BETWEEN THE LOWER REACHES OF THE TEKAPO AND TWIZEL RIVERS, MACKENZIE DISTRICT

providing outstanding ecological services to sustain and improve our environments

Wildlands

R6621c

ASSESSMENT OF ECOLOGICAL EFFECTS FOR THE PROPOSED ŌHAU C SOLAR FARM BETWEEN THE LOWER REACHES OF THE TEKAPO AND TWIZEL RIVERS, MACKENZIE DISTRICT

A nearby induced wetland, off-site.

Contract Report No. 6621c

May 2023

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CONTENTS

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Wildland Consultants Ltd

1. INTRODUCTION

Williamson Water and Land Advisory (WWLA), on behalf of Far North Solar Farms Ltd (FNSF), are proposing to establish a new solar farm on a site near Lake Ōhau (hereafter referred to as Ōhau C) in the Mackenzie District, in South Canterbury. WWLA require an assessment of ecological effects for the proposed solar farm and advice on mitigation and ecological enhancement. WWLA also require a long-term management plan for the site.

Ōhau C is located between the Tekapo and Twizel Rivers. It is a flat site, with farmland to the north and rivers on the eastern and western boundaries. The Twizel River flows along the western side of the site and the Tekapo River flows along the eastern side. The site is approximately 10 kilometres to the southeast of Twizel township, and is currently used for farming and livestock grazing.

This report provides the findings of an ecological assessment for the proposed project. Mitigation measures, including ecological enhancement, are also provided.

2. PROPOSED WORKS

FNSF intend to install 736,866 solar panels across the site, with a four metre gap between each panel. Installation will require trenching (approximately half a metre in width) for electrical cables, which will run under the roads within the site. The panels will be installed using mounting trackers with driven piles for legs, which will minimise requirements for earthworks. The panels will be on an angle, with the highest end being 2.1 metres off the ground, and the lower end one metre off the ground. The panels will rotate approximately 45° degrees.

Forty-one six metre long inverters will be installed across the site, as well as 25 4.5 × 3.5 metre water tanks. One large control room will be built on site (dimensions to be determined).

Access roads will need to be developed for machinery for access to and around the site. Once installation is complete, solar panels will cover approximately 60% of the site.

FNSF have a strong interest in improving the local environment in addition to solar farm development. The site will have rabbit and hare-proof fencing surrounding the property. They intend to include indigenous plantings, weed control, and control of mammalian browsers in their long-term management of the site. Weed control methods around the solar panels are still being developed.

3. METHODS

3.1 Desktop assessments

Ecological Context and Databases

Desktop assessments were undertaken to determine the ecological values of the site. This included assessment of recent and historical aerial imagery and reviewing database records including Land Environments New Zealand (LENZ)[1], Land Cover Database (LCDB, v5.0)[2], the New Zealand Plant Conservation Network (NZPCN)[3], and iNaturalist (accessed December 2022)[4].

Original Vegetation

Potential natural vegetation, as mapped by Manaaki Whenua Landcare Research, has also been reviewed for the site. This describes the type of indigenous vegetation that would be expected to be present in the absence of human modifications and provides an indicator of what the pre-human ecological state may have been.

Avifauna

The eBird database[5] (maintained by Cornell University) was searched for bird records within a five-kilometre radius of the proposed site (January 2021 to January 2023) and in the surrounding area.

Lizards

The Department of Conservation Bioweb Herpetofauna database[6] (accessed May 2022) was checked for lizard records within a 20 kilometre radius of the site.

Terrestrial Invertebrates

The Global Biodiversity Information Facility[7] was searched for invertebrate records within five kilometres of the site, to see if any notable invertebrates (short-range endemics, protected species, species believed to be declining, or species listed as Threatened or At Risk) had been recorded nearby. Satellite photography was then examined to assess the likelihood of any notable invertebrate habitats being present on-site.

[1] https://www.landcareresearch.co.nz/tools-and-resources/mapping/lenz/
[2] https://ourenvironment.scinfo.org.nz/
[3] https://www.nzpcn.org.nz/
[4] https://www.inaturalist.org/
[5] https://ebird.org/atlasnz/home
[6] https://www.doc.govt.nz/our-work/reptiles-and-frogs-distribution/atlas/
[7] GBIF.org

3.2 Field assessments

3.2.1 Vegetation

Terrestrial vegetation was surveyed on 12 December 2022. Vegetation and associated habitat types were mapped and described following the structural classes of Atkinson (1985). Field mapping was digitised onto aerial imagery using ArcGIS 10.8. All vascular plant species observed are listed in Appendix 1.

3.2.2 Avifauna

An avifauna survey was undertaken on 14 December 2022. Three discrete continuous transects were walked to ensure all habitat types were visited and to maximise area coverage because of the site's large size. All bird species seen and heard were recorded, and any additional species detected while travelling between the transects were noted as incidental counts. The locations of Threatened and At Risk species were recorded with GPS waypoints.

3.2.3 Lizards

The site was visited on 13 December 2022 to determine habitats and potential species present. The walk-through lizard habitat assessment included assessing the quality of the habitat for lizards, visually surveying for active lizards, and handsearching of ground cover potential lizard habitat (e.g. rocks, pieces of wood). Weather conditions during the site visit were hot and sunny with intermittent cloud cover.

Targeted intensive surveys for lizards, using live-trapping methods, were not undertaken.

3.2.4 Invertebrates

A walk-through survey of invertebrates and their habitats was undertaken on 2 February 2023, with the primary aim of searching for notable invertebrates identified in the desktop assessment and their habitat on-site. Hand-searching involved looking on the ground and in vegetation and debris, and using a sweep-net to catch flying and jumping insects.

4. ECOLOGICAL CONTEXT

4.1 General overview

As noted in Section 1 above, the site is located between the lowest reaches of the Tekapo and Twizel Rivers. The Tekapo River discharges into the head of Lake Benmore, a human-made hydro lake, immediately adjacent to (to the east) of where the Ōhau River also discharges into the lake. The Twizel River flows into the Ōhau River about one kilometre upstream from the lake.

The site is low-lying largely flat land, *c.*400 metres above sea level, comprising the low interfluve between the Tekapo and Twizel Rivers. As such, the site is underlain by

alluvial gravels. The lower reaches of the Tekapo and Twizel Rivers are both braided systems, with a line of low eroded cliffs on the edges of the river channels.

Almost the entire site is grazed farmland and part of it is cultivated and cropped seasonally. A centre-pivot irrigator (diameter 1.5 kilometres) is present in the northwestern part of the site.

4.2 Pukaki Ecological District

The site is located in the Pukaki Ecological District and the following description is adapted from McEwen (1987).

Pukaki Ecological District is characterised by dry outwash plains between Lakes Tekapo and Benmore, mostly below 600 metres above sea level. The geology is fluvioglacial outwash deposits, with isolated greywacke and argillite hills. The climate is semi-arid to sub-humid with cold winters, warm summers and 600-1,600 mm of rainfall annually. Soils are moderately fertile but prone to drought in summer, they are easily erodible in steep areas with bare screes being common.

This Ecological District was historically typified by extensive red tussockland (*Chionochloa rubra*), replaced at altitude by snow tussock (*Chionochloa rigida*). Tussocklands had some kettlehole tarns and associated wetlands; some areas of hard tussock (*Festuca novae-zelandiae*) and scattered blue tussock (*Poa colensoi*). Some prostrate mat plants, e.g. *Coprosma petriei*, *Raoulia subsericea* as well as some scrub, including tūmatakuru/matagouri (*Discaria toumatou*) with mingimingi (*Coprosma propinqua*) were scattered throughout.

Pasture now occupies much of this Ecological District, with some tussocklands and areas of scrub (tūmatakuru, *Coprosma* spp., kōwhai (*Sophora* spp. and *Corokia*) remaining. Grazing by sheep and rabbits has significantly affected grasslands.

Braided riverbeds provide important habitat to a number of bird species, there are also several notable rare insects in the area.

4.3 Nearby protected areas

Lake Ruataniwha Conservation Area is adjacent to the proposed Ōhau C site, and it is made up of several separated sections. One of these sections primarily lies along the Twizel River, on the western side of the proposed solar farm property. The Ben Ōhau Conservation Area and adjacent Pukaki Flats Conservation Area is located seven kilometres north of the Ōhau C site. There are hard tussock (*Festuca novae-zelandiae*) grasslands to the east of Twizel. There is also the Glenbrook Conservation Area approximately eight kilometres to the southwest of Ōhau C.

4.4 Nearby sites of natural significance

The entirety of the Ōhau River has been identified as a Site of Natural Significance in the Mackenzie District Plan. It is recognised primarily for its avifauna habitat values, as well as areas of wetland. It extends along the Ōhau river from Lake Benmore into,

and including, areas of Lake Ruataniwha. This area overlaps with the north-eastern boundary of the proposed Ōhau C solar farm site.

4.5 Threatened Environment Classification

The Ōhau C site is classified entirely as a 'critically underprotected' land environment, with more than 30% indigenous vegetation left and less than 10% indigenous vegetation protected (Cieraad *et al.* 2015).

4.6 Land Cover Database (LCDB)

Two land cover types are mapped in the LCDB, with most of the site mapped as depleted grassland. An area of high producing exotic grassland is mapped where the centre pivot irrigator is located in the northwestern part of the property.

4.7 Potential natural vegetation

The site is identified as an area that would have historically been scrub, shrubland and tussock-grassland below the treeline.

4.8 Important Bird Area

The site is immediately adjacent to an Important Bird Area (IBA)[1] which includes the Ōhau, Pukaki, Twizel, and Tekapo Rivers. The site is in the wedge that forms the Ōhau-Tekapo Delta, where the Ōhau and Tekapo Rivers enter Lake Benmore. The full suite of endemic braided river birds is found in braided river habitat at the Delta, including kakī/black stilt (*Himantopus novaezelandiae*, Threatened-Nationally Critical).

This area is part of the Department of Conservation's Project River Recovery programme.

4.9 Braided rivers

Braided rivers and their associated gravel beds have been identified as a historically rare ecosystem type and are naturally uncommon on a national basis (Williams *et al.* 2007). Braided river ecosystems are therefore classified as Threatened-Endangered (Holdaway *et al.* 2012). Sixty-four percent of Aotearoa New Zealand's braided rivers occur in Canterbury. The braided rivers of the Mackenzie Basin drain into the Waitaki River and braided rivers and wetlands of the upper Waitaki Basin are under active restoration as part of "Project River Recovery" The programme is run by the Department of Conservation and funded by Meridian Energy and Genesis Energy under a compensatory agreement that recognises the impact of hydroelectric power development on these rivers and wetlands (DOC 2020).

[1] Forest & Bird 2016*:* New Zealand Seabirds - Sites on Land, Rivers, estuaries, coastal lagoons & harbours*. The Royal Forest & Bird Protection Society of New Zealand*, Wellington. 177 p.

4.10 Notable existing environmental modifications

The site has been named due to its proximity to the Ōhau C hydro power station on the Ōhau canal network, which is part of the larger Waitaki hydro scheme. This scheme comprises of five hydro-generation stations in the Upper Waitaki and three in the Lower Waitaki as well as a series of dams and canals to optimise generation potential. The Ōhau canal network runs from Lake Ōhau down through Lake Ruataniwha and into Lake Benmore. It is also fed by the Pukaki Canal, which brings water from Lakes Tekapo and Pukaki. Development of this hydro scheme has caused notable modifications to the surrounding environment through the construction of dams, formation of lakes (e.g. Lake Benmore), and diversion of water, and has drastically altered the hydrological regimes of the rivers in the Mackenzie basin.

4.11 Statutory context

4.11.1 Ecological significance

Areas of ecological significance in Canterbury are areas or habitats that meet one or more of the criteria listed in Appendix 3 of the Canterbury Regional Policy Statement (CRPS; see Appendix 2). This criteria set is provided for the evaluation of the significance of indigenous vegetation and habitat of indigenous fauna against 10 criteria within four categories:

- Representativeness
- Rarity or distinctive features
- Diversity and pattern
- Ecological context

The Mackenzie District Plan (MDP) defers to the CRPS for assessments of ecological significance. Each vegetation and habitat type at the site was assessed against these criteria.

4.11.2 Mackenzie District Plan

Relevant rules and definitions provided in the operative Mackenzie District Plan which relate to indigenous vegetation and vegetation clearance are summarised in Appendix 3. Vegetation and habitat types present at the site were assessed against the definition of indigenous vegetation and the definition of improved pasture, to assess whether they are subject to vegetation clearance rules. The Mackenzie District Plan also stipulates limits on activities adjacent to wetlands. The site was also assessed in relation to these rules.

Various Mackenzie District Plan provisions apply to the site:

- This site is zoned as Rural Zone.
- Mackenzie Basin Subzone applies across the entire site. This identifies the site as an Outstanding Natural Landscape.
- Sites of Natural Significance have been identified in proximity to the site, around the margins of Lake Benmore, and including the braided beds of Tekapo and Ōhau Rivers.

- The entire site is located within an area identified as being of High Visual Vulnerability[1].
- A hydro-electricity inundation hazard area has been identified along the river braid plains on both the eastern and western sides of the site, merging in the south where the rivers flow into Lake Benmore.

4.11.3 Wildlife Act 1953

All indigenous lizards and birds, and some indigenous invertebrates, are protected under the Wildlife Act (1953). It is an offence to disturb or destroy protected wildlife without a Wildlife Act Authorisation (WAA; also known as a wildlife permit) from the Department of Conservation. A permit must be obtained from the Department of Conservation before any protected wildlife (and/or their habitats) can be disturbed, handled, translocated or killed. Also, if an activity is likely to disturb or kill protected avifauna or their eggs, then a Wildlife Act Authority (permit) is needed from the Department of Conservation.

4.11.4 Natural wetlands

Natural wetlands were assessed using definitions in the Resource Management Act (RMA; 1991) and the National Policy Statement for Freshwater Management (NPS-FM; 2020). The RMA defines wetlands as "permanently or intermittently wet areas, shallow water, and land/water margins that support a natural ecosystem of plants and animals that are adapted to wet conditions". The NPS-FM excludes the following situations from the RMA definition:

- A wetland constructed by artificial means (unless it was constructed to offset impacts on, or restore, an existing or former natural wetland); or
- A geothermal wetland; or
- Any area of improved pasture that, at the commencement date, is dominated by (that is more than 50% of) exotic pasture species and is subject to temporary rain derived water pooling.

Rule 8 of the Mackenzie District Councils Vegetation Clearance Rules specifies that clearance may not occur within 100 metres of an ecologically significant wetland or with 50 metres of all other wetlands. Vegetation and habitats on the site and within 100 metres of its boundaries were evaluated for wetland status.

[1] Landscape features and views sensitive to change and how their visual quality can be compromised by the individual or cumulative effects of land use and development activities which are not in harmony with the natural appearance of the landscape.

4.12 Vegetation and habitats

Vegetation cover at the Ōhau C site is predominantly grazed exotic grassland and cropland, with some small remnants of indigenous dryland and shrubland communities around the margins. There are no wetlands on the site, but there are a number of wetlands within 100 metres of the site boundary (Figure 1). Including the off-site wetlands, six vegetation and habitat types were identified:

1. Sweet briar-matagouri shrubland.
2. Cocksfoot grassland.
3. Brassica cropland.
4. Brome-hawkweed-sheep's sorrel grassland/herbfield.
5. Stonefield drylands.
6. Wetlands (offsite only)

1. Sweet briar-matagouri shrubland

This type is confined to two small patches in shallow gullies on the eastern edge of the site. Vegetation in these areas is dominated by exotic sweet briar (*Rosa rubiginosa*) with indigenous tūmatakuru/matagouri (At Risk – Declining), porcupine shrub (*Melicytus alpinus*) and mingimingi (Plate 1). Scattered exotic pines (mostly *Pinus contorta*) are emergent in places above the shrubs. There are also open areas, rocky ground, and exotic weeds, including mouse-ear hawkweed (*Pilosella officinarum*) and haresfoot trefoil (*Trifolium arvense*). Indigenous hard tussock and creeping pōhuehue (*Muehlenbeckia axillaris*) are also locally common.

Plate 1: Sweet briar-matagouri shrubland.

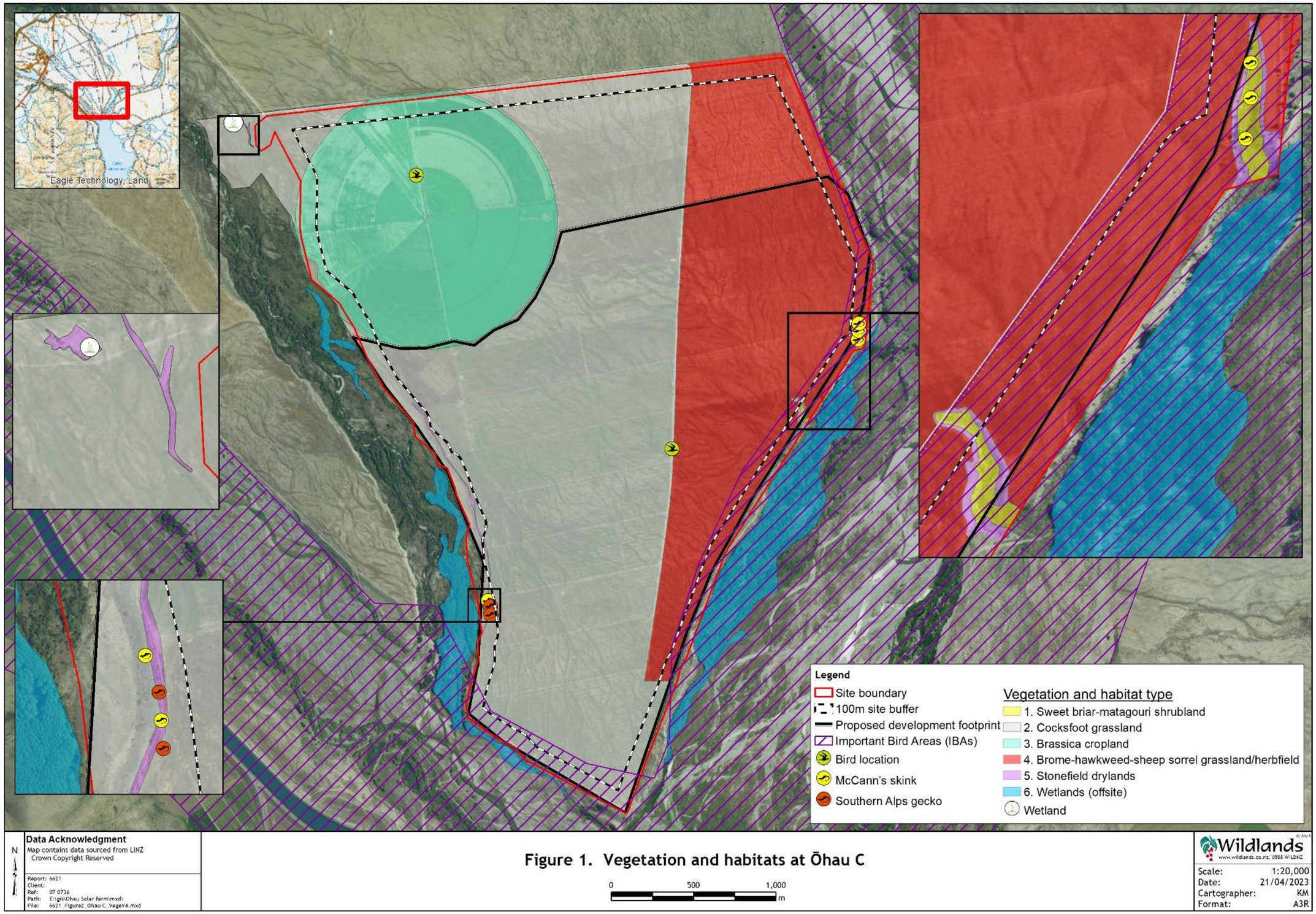

Figure 1. Vegetation and habitats at Ōhau C

2. Cocksfoot grassland

Cocksfoot (*Dactylis glomerata*) grassland is the most extensive vegetation type on the site and appears to have been sown mostly for hay and baleage production (Plate 2). The type is dominated by exotic species. It varies in height and composition across the site, in some paddocks the grass is over one metre tall where it is dominated by cocksfoot. In other areas it is shorter and comprises a mixture of exotics such as clovers (mostly *Trifolium repens and T. pratense*), lucerne (*Medicago sativa*) and other grasses including ryegrass (*Lolium perenne*) sweet vernal (*Anthoxanthum odoratum*) and red fescue (*Festuca rubra*). Around the margins, haresfoot trefoil and sheep's sorrel (*Rumex acetosella*) are also abundant and there are occasional patches where sweet briar is common.

Plate 2: Cocksfoot-dominant grassland, which covers much of the site.

3. Brassica cropland

In the northwest corner of the site there is a circular area of cropland under a centre-pivot irrigator which, at the time of the survey, was planted with a brassica crop. Little else appeared to be growing in this area. Stones and bare ground were abundant between crop plants (Plate 3).

4. Brome-hawkweed-sheep's sorrel grassland/herbfield

On the eastern side of the site there are numerous paddocks with exotics such as mouse-ear hawkweed, sheep's sorrel, and brome grasses (*Bromus tectorum* and *B. hordeaceus*) that are dominant (Plate 4). These areas appear to have been cultivated in the past but have not been resown recently. Cocksfoot, ryegrass, sweet vernal, clovers, and lucerne are all common exotics, along with herbaceous weeds such as haresfoot trefoil, viper's bugloss (*Echium vulgare*), and chicory (*Cichorium intybus*).

Plate 3: Irrigated brassica cropland, in the northern part of the site.

Plate 4: Brome-hawkweed-sheep's sorrel grassland/herbfield, which covers an extensive part of the site.

5. Stonefield drylands

Areas of stonefield and indigenous dryland vegetation are confined to the tops of old river terraces on the margins of the site. These areas are generally dominated by exotic weeds and grasses with mouse-ear hawkweed and haresfoot trefoil both abundant. However, local pockets of indigenous dryland vegetation persist on stony ground (Plate 5). Indigenous species observed in these areas included

creeping pōhuehue, maikaika/onion orchid (*Microtis unifolia*), blue wheatgrass (*Anthosachne solandri*) scabweed (*Raoulia hookeri*), and NZ harebell (*Wahlenbergia albomarginata*). Two At Risk - Declining species, mat daisy (*Raoulia australis*) and stout dwarf broom (*Carmichaelia monroi*), and Maniototo Cress (*Lepidium solandri* Threatened – Nationally Critical), were recorded just outside the site boundary.

Plate 5: Indigenous dryland vegetation with mat daisies (left) and scabweed (right) growing in stonefield dryland habitat on the margins on the site.

6. Wetlands

No wetlands are present on the subject site.

There is one small induced wetland within 100 metres outside of the northwest border of this site. It is located at the bottom of a small depression that appears to have been created by historic gravel extraction. Water pools in one corner of the gravel pit and exotic facultative wetland plants including crack willow (*Salix ×fragilis*), jointed rush (*Juncus articulatus*) and soft rush (*Juncus conglomeratus*) are growing here (Plate 4). Several other tree species are also present, including necklace poplar (*Populus deltoides*) and lodgepole pine. However, the surrounding area, including most of the old gravel pit, is dry and rocky, and supports multiple indigenous dryland species.

Other wetland habitats exist outside of the site along the floodplains of the both Tekapo and Twizel Rivers (Plate 6). Distance from the site varies but in both river beds there are wetlands within 100 metre of the site boundary. The largest and most extensive wetlands are in the Takapō/Tekapo River to the east of the site. However, both rivers have a similar network of riverine wetland habitats with shallow water, fens, swamps, and seepages. Considerable catchment modification has taken place in both of these rivers, which may have induced some of these wetlands through reduced water flow. Some wetlands have also been induced by vehicle tracks criss-crossing water channels.

Wetlands in both rivers are dominated by an exotic canopy of crack willow and alder (*Alnus glutinosa*) trees, but indigenous sedges and rushes are common beneath the canopy and around the margins of open water. Indigenous species observed in these areas include rautahi (*Carex maorica*), raupō (*Typha orientalis*), sedge (*Carex diandra*), spike sedge (*Eleocharis acuta*), and pūkio (*Carex secta*). Although no Threatened or At Risk species were observed,

extensive surveys of these wetlands were not undertaken as they were outside of the development site.

Another induced wetland was also recorded in an old gravel pit just to the northwest of the site (Figure 1). In this area, water pooling has allowed several crack willow and poplar (*Populus nigra*) trees to establish above weedy jointed rush and soft rush.

Plate 6: Wetland habitats within 100 metres of the site boundary. Large swamp wetland on margins of the Takapō River to the east of the site (left) and a small seepage wetland in the Twizel River, to west of the site (right).

5. FLORA

5.1 Overview

Fifteen indigenous and 42 exotic vascular plant species were recorded during the survey of the Ōhau C site (Appendix 1).

5.2 Threatened, at risk, and locally uncommon species

Only one species with a national threat ranking (de Lange *et al.* 2018) was recorded on the site: tūmatakuru/matagouri, classified as At Risk-Declining.

The national threat ranking is largely based on its restricted status in the North Island and matagouri is common in the South Island and the Mackenzie Basin. It was only recorded in shallow gullies on the eastern side of the site.

Four species with national threat rankings (de Lange *et al.* 2018) were recorded within 100 metres of the site boundary:

- Maniototo peppercress: Threatened – Nationally Critical.
- Stout dwarf broom: At Risk – Declining.
- Desert broom (*Carmichaelia petriei*): At Risk – Declining.
- Common mat daisy: At Risk – Declining.

Due to the proximity of Threatened and At Risk species to the property boundary, it is possible that individuals of these species would also be detected within the property in more detailed surveys.

Plate 7: Stout dwarf broom (At Risk – Declining) (left) and Maniototo peppercress (Threatened – Nationally Critical) (right).

5.3 Pest plants

Five plant species recorded at the site are listed as either 'pest' or 'Organisms of Interest' (OOI) in Environment Canterbury Regional Pest Management Plan (CRPMP; 2018-2038; Table 1).

Table 1: Pest plants and Organisms of Interest (PEST, OOL), listed in CRPMP, recorded at the Ōhau A site.

Scientific Name	Common Name(s)	Growth Form	Pest Status
Cytisus scoparius	Broom	Shrub	PEST
Echium vulgare	Vipers' bugloss	Herb	OOI
Hypericum perforatum	St John's wort	Herb	OOI
Pinus contorta *Pseudotsuga menziesii*	Wilding conifers	Tree	PEST

6. AVIFAUNA

The desktop assessment found records of 47 species (and two hybrid taxa) between January 2021 and January 2023 within five kilometres of the Ōhau C site. Of the 49 taxa, 33 are classified as indigenous and 16 as exotic. Records of seven Threatened species were found in the desktop assessment, including Nationally Critical kakī/black stilt (*Himantopus novaezelandiae*) and kotuku/white heron (*Ardea alba modesta*), Nationally Endangered tarapirohe/black-fronted tern, Nationally Vulnerable pūteketeke/Australasian crested grebe, taranui/Caspian tern (*Hydroprogne caspia*) and pārera/grey duck, and Nationally Increasing ngutu pare/wrybill (*Anarhynchus frontalis*).

Eight At Risk species were recorded, including: Declining pohowera/banded dotterel, tarāpuka/black-billed gull, kotoreke/marsh crake, pīhoihoi/New Zealand pipit and tōrea/South Island pied oystercatcher (*Haematopus finschi*), Relict māpunga/black shag and kawaupaka/little shag, and Naturally Uncommon Australian coot (*Fulica atra australis*).

Thirty bird species were recorded during the field survey (Table 2). Of these, 15 are indigenous and 15 exotic. One Threatened species (tarapirohe/black-fronted tern, Nationally Endangered) and four At Risk species (Declining pohowera/banded dotterel and tarāpuka/black-billed gull, and Relict māpunga/black shag and kawaupaka/little shag) were detected. Exotic passerines were the most common birds at the site, with skylarks (*Alauda arvensis*) being especially abundant. All species recorded during the field survey were also recorded in the desktop assessment.

Tarapirohe/black-fronted tern and pohowera/banded dotterel were observed during the field survey. Both species use the site for foraging and breed in or directly adjacent to the site. The site provides potential foraging and breeding habitat for kakī/black stilt and several other Threatened or At Risk species.

The stonefield dryland areas provide suitable habitat for pohowera/banded dotterel and South Island pied oystercatcher (*Haematopus finschi*, At Risk - Declining) to forage and breed, and may also be utilised by pihoihoi/New Zealand pipit. Banded dotterel were observed feeding in the cocksfoot grassland, brome-hawkweed-sheep sorrel grassland/herbfield, and brassica cropland, and they could use these habitats for breeding.

Wetlands adjacent to the site provide habitat suitable for matuku-hūrepo/Australasian bittern (Threatened-Nationally Critical) and kotoreke/marsh crake (At Risk-Declining). The *Carex* sp. and *Juncus* sp. provide suitable foraging areas and may provide breeding habitats. Neither of these species were detected during the site visit as these are highly cryptic species.

7. LIZARDS

Species recorded within a 20 kilometre radius of the Ōhau C site are listed in Table 3. Closest records and the likelihood of each species being found on-site are set out in Table 3.

Two lizard species were found during the field visit. McCann's skink (*Oligosoma maccanni;* Not Threatened) and Southern Alps gecko (*Woodworthia* "Southern Alps"; At Risk – Declining) were observed in stonefield dryland habitat (Figure 1). Two individuals of each species were found in rock piles at the base of a west-facing terrace slope in the southwestern part of the site (Plate 6). Three McCann's skinks were also found among rock piles in a gully in the northeastern part of the site.

Indigenous lizards are most often found where there is sufficient complex ground cover, such as dense vegetation (including rank exotic grass) and rock piles, which provides refuges from predators and inclement weather. High-quality habitat for most species of lizards inhabiting the Mackenzie District includes undeveloped outwash plains, dry river cobbles and talus slopes, especially where interspersed with indigenous shrubland, along with contiguous tracts of indigenous shrubland.

Table 2: Bird species records found in the desktop assessment and during the field survey at the Ōhau C site. Common names, scientific names, and threat classification are from Robertson *et al.* 2021.

Common Name(s)	Scientific Name	Threat Classification 2021	Likelihood of Presence at Site
Indigenous Species			
Australasian bittern/matuku-hūrepo	*Botaurus poiciloptilus*	Threatened-Nationally Critical	Possible
Black stilt/kakī	*Himantopus novaezelandiae*	Threatened-Nationally Critical	Highly likely
White heron/kōtuku	*Ardea alba modesta*	Threatened-Nationally Critical	Possible
Black-fronted tern/tarapirohe	*Chlidonias albostriatus*	Threatened-Nationally Endangered	Seen during visit
Australasian crested grebe/pūteketeke	*Podiceps cristatus australis*	Threatened-Nationally Vulnerable	Unlikely
Caspian tern/taranui	*Hydroprogne caspia*	Threatened-Nationally Vulnerable	Highly likely
Grey Duck/pārera	*Anas superciliosa*	Threatened-Nationally Vulnerable	Likely
Wrybill/ngutu pare	*Anarhynchus frontalis*	Threatened-Nationally Increasing	Likely
Banded dotterel/pohowera	*Charadrius bicinctus bicinctus*	At Risk-Declining	Seen during visit
Black-billed gull/tarāpuka	*Chroicocephalus bulleri*	At Risk-Declining	Seen during visit
Marsh crake/kotoreke	*Zapornia pusilla affinis*	At Risk-Declining	Likely
New Zealand pipit/pīhoihoi	*Anthus novaeseelandiae novaeseelandiae*	At Risk-Declining	Likely
South Island pied oystercatcher/tōrea	*Haematopus finschi*	At Risk-Declining	Likely
Black shag/māpunga	*Phalacrocorax carbo novaehollandiae*	At Risk-Relict	Seen during visit
Little shag/kawaupaka	*Microcarbo melanoleucos brevirostris*	At Risk-Relict	Seen during visit
Australian coot	*Fulica atra australis*	At Risk-Naturally Uncommon	Unlikely
Australasian shoveler/kuruwhengi	*Spatula rhynchotis*	Not Threatened	Highly likely
Black swan/kakīānau	*Cygnus atratus*	Not Threatened	Seen during visit
Grey duck – mallard hybrid	*Anas superciliosa × platyrhynchos*	Not Threatened	Seen during visit
Grey teal/tētē-moroiti	*Anas gracilis*	Not Threatened	Highly likely
Grey warbler/riroriro	*Gerygone igata*	Not Threatened	Seen during visit
Marsh crake/kotoreke	*Zapornia pusilla affinis*	At Risk-Declining	Possible
New Zealand scaup/pāpango	*Aythya novaeseelandiae*	Not Threatened	Highly unlikely
Paradise shelduck/pūtangitangi	*Tadorna variegate*	Not Threatened	Seen during visit
Pied stilt/poaka	*Himantopus himantopus leucocephalus*	Not Threatened	Seen during visit
Pied stilt x black stilt hybrid	*Himantopus himanoptus x novaezelandiae*	Not Threatened	Likely
Pūkeko	*Porphyrio melanotus melanotus*	Not Threatened	Unlikely
Shining cuckoo/pīpīwharauroa	*Chrysococcyx lucidus lucidus*	Not Threatened	Seen during visit
Silvereye/tauhou	*Zosterops lateralis lateralis*	Not Threatened	Seen during visit
South Island fantail/pīwakawaka	*Rhipidura fuliginosa fuliginosa*	Not Threatened	Seen during visit
Southern black-backed gull/karoro	*Larus dominicanus dominicanus*	Not Threatened	Seen during visit
Spur-winged plover	*Vanellus miles novaehollandiae*	Not Threatened	Highly likely
Swamp harrier/kāhu	*Circus approximans*	Not Threatened	Seen during visit
Welcome swallow/warou	*Hirundo neoxena neoxena*	Not Threatened	Seen during visit

Common Name(s)	Scientific Name	Threat Classification 2021	Likelihood of Presence at Site
White-faced heron/matuku moana	*Egretta novaehollandiae*	Not Threatened	Highly likely
Exotic Species			
Australian magpie	*Gymnorhina tibicen*	Introduced and Naturalised	Seen during visit
California quail	*Callipepla californica*	Introduced and Naturalised	Seen during visit
Canada goose	*Branta Canadensis*	Introduced and Naturalised	Seen during visit
Chaffinch	*Fringilla coelebs*	Introduced and Naturalised	Seen during visit
Common redpoll	*Acanthis flammea*	Introduced and Naturalised	Seen during visit
Dunnock	*Prunella modularis*	Introduced and Naturalised	Seen during visit
Eurasian blackbird	*Turdus merula*	Introduced and Naturalised	Seen during visit
Goldfinch	*Carduelis carduelis*	Introduced and Naturalised	Seen during visit
Greenfinch	*Chloris chloris*	Introduced and Naturalised	Seen during visit
House sparrow	*Passer domesticus*	Introduced and Naturalised	Seen during visit
Mallard	*Anas platyrhynchos*	Introduced and Naturalised	Likely
Passerine sp.	*Passeriformes* sp.	Introduced and Naturalised	Seen during visit
Rock pigeon	*Columba livia*	Introduced and Naturalised	Seen during visit
Skylark	*Alauda arvensis*	Introduced and Naturalised	Seen during visit
Song thrush	*Turdus philomelos*	Introduced and Naturalised	Seen during visit
Starling	*Sturnus vulgaris*	Introduced and Naturalised	Seen during visit
Yellowhammer	*Emberiza citronella*	Introduced and Naturalised	Seen during visit

Table 3: Lizard records from a Department of Conservation Bioweb Herpetofauna database search within a 20 kilometre radius of Ōhau C and an assessment of the likelihood of the presence of these species at the site. Conservation status is as per Hitchmough *et al.* 2021. The likelihood of occurrence for each species is based on their known habitat preferences and distribution in the general area.

Common Name	Scientific Name	Threat Classification	Recorded Distance from Ōhau C	Habitat Preference	Likelihood of Presence on Site
Lakes skink	*Oligosoma* aff. *chloronoton* "West Otago"	Threatened – Nationally Vulnerable	2.7 km	Scrubland, tussockland, rocky areas, scree, herbfield, fellfield, stony riverbeds and terraces.	Possible: potential habitat (rocky terraces) available on-site.
Southern grass skink	*Oligosoma* aff. *polychroma* Clade 5	At Risk – Declining	3.2 km	Prefers damp or well vegetated habitats such as rank grasslands, wetlands, stream/river edges, and gullies. Widespread from Banks Peninsula south to Stewart Island.	Possible: a widespread and commonly encountered species which may be confused with McCann's skink but is generally found in damper areas/areas with dense grass.
McCann's skink	*Oligosoma maccanni*	Not Threatened	On site	Open habitats – dry rocky environments such as rock outcrops and montane grassland.	Confirmed as present on-site during the habitat assessment.
Scree skink	*Oligosoma waimatense*	Threatened – Nationally Vulnerable	2.7 km	Creviced rock bluffs, alluvial outwash plains, dry river cobbles and terraces, talus slopes, boulderfield and scree (from lowland to alpine areas, <1,500m).	Possible: potential habitat (rocky terraces) available on-site.
Jewelled gecko	*Naultinus gemmeus*	At Risk – Declining	15.6 km	Scrubland, forest and tussockland. Often trees and shrubs like beech, mānuka, kānuka, mingimingi, matagouri, snow tussock and other dense vegetation.	Unlikely: minimal appropriate habitat (indigenous shrubland) available on-site.
Southern Alps gecko	*Woodworthia* "Southern Alps"	At Risk – Declining	1.1 km	Rocky scrubland, talus, boulderfield, scree, stony river terraces and creviced rock outcrops (from lowland and montane valleys to alpine areas, <1,900m).	Confirmed present on-site during habitat assessment.

Confirmed and potential lizard habitat was present in the following vegetation types:

- Sweet briar-matagouri shrubland.
- Cocksfoot grassland.
- Brome-hawkweed-sheep's sorrel grassland/herbfield.
- Stonefield drylands.

Areas of high quality lizard habitat are present on the site. These include the areas of stonefield dryland and sweet briar-matagouri shrubland, particularly where there are relatively deep rock piles amongst indigenous shrubland vegetation (i.e. embedded cobbles at the bottom of talus slopes). These areas could potentially support Threatened species (i.e. Lakes skink and/or scree skink), which are known from similar habitat in the Mackenzie Basin.

It is likely that lizards are present in both gullies in the northeastern part of the site and in other areas of stonefield dryland in the western part of the site. Due to time constraints, the western part of the site was not surveyed during the walk-over assessment.

Plate 8: Stonefield dryland and sweet briar-matagouri shrubland on the Ōhau C site, in the western part of the site where lizards were detected (left) and in a gully in the northeastern part of the site (right).

Areas of medium quality lizard habitat may be present on the site, including terrace slopes within cocksfoot grassland in the west of the site.

Most of the site, including the brassica cropland, brome-hawkweed-sheep's sorrel grassland/herbfield, and most of the cocksfoot grassland across the central plateau of the site is considered to comprise potential lizard habitat that is only of low to negligible

quality. McCann's skink may be in present in low densities in brome-hawkweed-sheep's sorrel grassland/ herbfield and cocksfoot grassland.

8. TERRESTRIAL INVERTEBRATES

The desktop survey revealed that four notable invertebrate species have been recorded within a five kilometre radius of the site (Table 4).

Table 5 lists the invertebrate species found during the field survey.

In general, habitat was lacking or was of low-quality for indigenous invertebrates. The invertebrate fauna was generally found to be lacking in diversity, though the hot weather is likely to have suppressed activity.

Table 5: Invertebrate species found in the field survey at the Ōhau C site.

Species	Common Name	Threat Status	Habitat	Species of interest?
Orocrambus vitellus	Grass moth	Not assessed	Indigenous and exotic grassland.	No.
Uropetala sp.	Giant dragonfly	Not Threatened	Damp banks (larvae); shrubland, treeland, and bush (adults).	No.
Bombus spp.	Bumblebee	Introduced and naturalised	Meadow with exotic flowers.	No.
Pieris rapae	Cabbage white butterfly	Introduced pest	Open fields with brassica plants for larval food.	No.
Zizina oxleyi	New Zealand blue butterfly	Not Threatened	Open, sunny, rocky areas; leguminous vegetation needed for larval food source.	Yes. Despite their Not Threatened status, they are declining.[1]

The field survey was carried out during hot, sunny, windy weather, when most invertebrates are unlikely to be active but butterflies and grasshoppers are active. However, robust grasshopper and minute grasshopper are more active in December and January. No robust grasshoppers or minute grasshoppers were found, but this is unsurprising given the lateness of the season when field surveys were carried out.

One New Zealand blue butterfly was seen in the grassland where there was clover present. Clovers are one of the potential exotic larval food plants for this species.

Robust grasshopper populations, if present, will be confined to the braided river margins off-site, in particular the eastern margin. Minute grasshopper and short-horned grasshopper may also be present in the open stonefield and herbfield habitat at the eastern margin of the site (Figure 1), though due to time and weather constraints this part of the site was not investigated. Some patches of relatively open ground – currently thickly overgrown with exotic herbs - could become habitat for indigenous grasshoppers if restored.

[1] Patrick B. and Patrick H. 2012: Butterflies of the South Pacific. Otago University Press and Otago Museum. ISBN 978 1 877578 04 5.

Table 4: Records of invertebrate species of interest found in the desktop evaluation within a five kilometre radius of the Ōhau C site.

Species	Common Name	Threat Status	Habitat	Reason for Designation as a Species of Interest	Likelihood of Occurrence on Site
Brachaspis robustus	Robust grasshopper	Threatened-Nationally Endangered (Trewick *et al.* 2022)	Open rocky areas on braided river beds.	Threatened by introduced predators and habitat loss.	Possible: potential habitat present at edge of site.
Sigaus minutus	Minute grasshopper	Threatened-Nationally Vulnerable (Trewick *et al.* 2022)	Open rocky areas.	Threatened by introduced predators and habitat loss.	Possible: potential habitat present on-site.
Phaulacridium otagoense	Short-horned grasshopper	At Risk-Declining	Open rocky areas and herbfields	Threatened by genetic incursion by *P. marginale*.	Possible: potential habitat present on-site.
Zizina oxleyi	New Zealand blue butterfly	Not Threatened (Hoare *et al.* 2017)	Stony areas with leguminous plants and shelter nearby.	In decline due to displacement by invasive common blue butterfly (*Zizina labradus*[1]).	Possible: habitat present on-site.

[1] Patrick B. and Patrick H. 2012. Butterflies of the South Pacific. Otago University Press and Otago Museum. ISBN 978 1 877578 04 5.

Tekapo ground wētā may also be present in dry, open areas of the site; their range and distribution are not well-known. A dragonfly in the common and widespread genus *Uropetala* was observed. Introduced insects were common: primarily cabbage white butterfly (*Pieris rapae*) and bumblebees (*Bombus* spp).

9. ECOLOGICAL VALUES

Descriptions of ecological values are set out below for:

- Indigenous vegetation.
- Avifauna.
- Lizards.
- Terrestrial invertebrates.

Indigenous Vegetation

Indigenous vegetation on the site is mostly confined to small pockets and scattered individual plants. The only At Risk plant species observed within the site is tūmatakuru, which is present in the stonefield drylands. This vegetation and habitat type is considered to be ecologically significant.

Avifauna

Black-fronted tern and banded dotterel feed within the Ōhau C site, with banded dotterel possibly breeding on-site as well. Pihoihoi/New Zealand pipit and South Island pied oystercatcher may also forage and breed within the Ōhau C site.

The key ecological avifauna values at Ōhau C are associated with the rivers, wetlands, and delta that are adjacent to the site. These areas are breeding and foraging habitats for multiple Threatened and At Risk species, most notably the Threatened – Nationally Critical kakī/black stilt. Wetland areas (off-site) provide foraging and potential breeding habitat for Australasian bittern (Threatened – Nationally Critical) and marsh crake (At Risk- Declining).

The river deltas bordering the southern edge of the site are particularly important in this regard. Multiple Threatened and At Risk species use the braided rivers and deltas to the south of the proposed solar farm site for foraging, roosting, and breeding.

Lizards

Two indigenous lizard species - McCann's skink and Southern Alps gecko - have been found on the site. There are limited areas of high and medium-quality lizard habitat on-site, including areas where lizards were detected and areas where lizards are considered likely to be present but were not detected during the walk-over assessment. Areas of high- and moderate-quality lizard habitat on-site include:

- Sweet briar-matagouri shrubland.
- Stonefield dryland.
- Possibly areas of cocksfoot grassland where there are terrace slopes in the western part of the site.

Threatened lizard species (i.e. lakes skink and/or scree skink) may be present on-site; most likely in areas of sweet briar-matagouri shrubland and stonefield dryland with relatively embedded rock and dry river cobbles.

Terrestrial Invertebrates

Most of the Ōhau C site is not good quality habitat for indigenous invertebrates. Some limited areas of open, dry habitat with short vegetation, particularly at the eastern margins of the site, may harbour Threatened or At Risk grasshopper and/or wētā species. New Zealand blue butterfly is also present and may be using the clover crop as larval hosts, although the indigenous broom may also provide suitable food sources.

Summary

Ecological features and values adjacent to the site, associated with the rivers and their margins, are extremely high.

Ecological values on-site vary considerably subject to the character of the vegetation and habitat types that are present. Most of the site has a cover of exotic pasture and part of it is irrigated and cropped. These areas have low value for indigenous plants but are nevertheless utilised by Threatened or At Risk indigenous birds and it is possible that lizards may also be present, albeit these types are unlikely to provide significant habitat for lizards. Undeveloped gullies on the margins of the site are important habitat for indigenous plants, avifauna, lizards, and invertebrates.

10. STATUTORY ASSESSMENT

10.1 Assessment of ecological significance for vegetation and habitats on-site

Each vegetation and habitat type within the site has been assessed against the ecological significance criteria in Environment Canterbury's Regional Policy Statement (Appendix 2), as set out below.

Cocksfoot grassland

Cocksfoot grassland areas are dominated by introduced pasture grasses and weedy herb species, which is the dominant vegetation type across the project site. Indigenous plants were present, but in low abundances. This vegetation type provides habitat for banded dotterel (At Risk – Declining), and breeding and foraging habitat for South Island pied oystercatcher and pihoihoi/New Zealand pipit (both At Risk – Declining). In addition, this vegetation type may also provide habitat for indigenous lizard populations. A targeted lizard survey is required to confirm whether lizards are present, the species, and their relative abundances. This type is considered to be ecologically significant as it meets the CRPS criteria for **rarity/distinctiveness** and **ecological context**.

Brassica cropland

The "brassica cropland" vegetation type was dominated by cultivated brassica, likely grown for stock feed, with low floral diversity. This vegetation type can provide foraging and breeding habitat for pihoihoi/New Zealand pipit, South Island pied oystercatcher, and banded dotterel. No ecologically significant habitat was identified for invertebrates, or lizards within this area, but targeted lizard surveys will determine if the vegetation type provides any suitable habitat. The area is considered to be ecologically significant, meeting the criteria for **rarity/distinctiveness** and **ecological context**.

Brome-hawkweed-sheep sorrel grassland/herbfield

This vegetation type is characterised by brome grasses and low-growing exotic herbs. No significant indigenous vegetation was identified in this area. However, the exotic grass may provide an important habitat for indigenous lizard species and may support foraging for banded dotterels. A targeted lizard survey is required to confirm whether lizards are present. The exotic clover in this area supports larval development for the New Zealand blue butterfly (At Risk - Declining). Therefore, this habitat meets the definition of ecologically significant for two criteria: **rarity/distinctiveness** and **ecological context**.

Sweet Briar – Matagouri Shrubland

This habitat is dominated by a mix of exotic sweet briar and indigenous tūmatakuru/matagouri which is classified as At Risk - Declining. This vegetation type provides habitat for indigenous lizards, and it is likely that At Risk lizard species are present. Therefore, this vegetation type meets the CRPS criteria for **rarity/ distinctiveness** and **ecological context**.

Stonefield drylands

Drylands on this site primarily have a cover of exotic herbs, but they also support patches of indigenous vegetation. This vegetation type provides habitat for indigenous lizards such as McCann's skink and Southern Alps gecko (At Risk - Declining). It also provides habitat for the minute grasshopper (At Risk - Declining), and foraging and breeding habitat for banded dotterels, South Island pied oystercatcher, and pihoihoi/ New Zealand pipit. This habitat type meets the definition of ecologically significant for **rarity/distinctiveness** and **ecological context.**

10.2 Assessment of ecological significance for vegetation and habitats off-site

Vegetation and habitats off-site were not formally assessed against the CRPS criteria. However, off-site wetlands and braided rivers directly adjacent to the site are ecologically significant.

Various indigenous and exotic plants, such as *Carex* spp. and *Juncus* spp, characterise off-site wetlands. Vegetation in these wetlands provides foraging habitat for Australasian bittern (Threatened – Nationally Critical) and marsh crake (At Risk – Declining).

The off-site braided river delta to the southeast of this site is a release location and breeding ground for kakī/black stilt (Threatened – Nationally Critical). The braided rivers also provides habitat for robust grasshopper (Threatened - Nationally Endangered).

10.3 Mackenzie District Plan

Two vegetation habitat types present at the site meet the definition of indigenous vegetation in the Mackenzie District Plan (Table 6), and are therefore subject to rules relating to the clearance of indigenous vegetation.

Table 6: Vegetation and habitat types at the Ōhau C site and Mackenzie District Plan definitions.

Vegetation Habitat Type	Status	Improved Pasture	Natural Wetland
Sweet briar-matagouri shrubland	Indigenous	**Yes**	No
Cocksfoot grassland	Exotic	**Yes**	No
Brassica cropland	Exotic	**Yes**	No
Brome-hawkweed-sheep's sorrel grassland/herbfield	Exotic	**Yes**	No
Stonefield drylands	Indigenous	**Yes**	No
Wetlands (offsite)	Indigenous	No	**Yes**

Five vegetation and habitat types within the site meet the definition of improved pasture which excludes these habitats from the definition of indigenous vegetation (although the two are not mutually exclusive) and therefore are not subject to indigenous vegetation clearance rules (Figure 2).

No wetlands are present on the site. However, significant natural wetlands occur adjacent to the site. Rule 8 of the Mackenzie District Councils Vegetation Clearance Rules specifies that clearance may not occur within 100 metres of an ecologically significant wetland or within 50 metres of all other wetlands. Off-site wetlands meet the ecological significance criteria.

11. POTENTIAL ECOLOGICAL EFFECTS

11.1 Overview

The works proposed will involve the following activities:

- Minor earthworks.
- Shading.
- Trenching.
- Introduction of new surfaces.
- Machinery movement around site.
- Auxiliary construction, such as buildings, pylons, service roads or fences required for solar farm functioning.
- Long-term weed control.
- Rabbit and hare control.
- Native plantings or other offsets on-site.

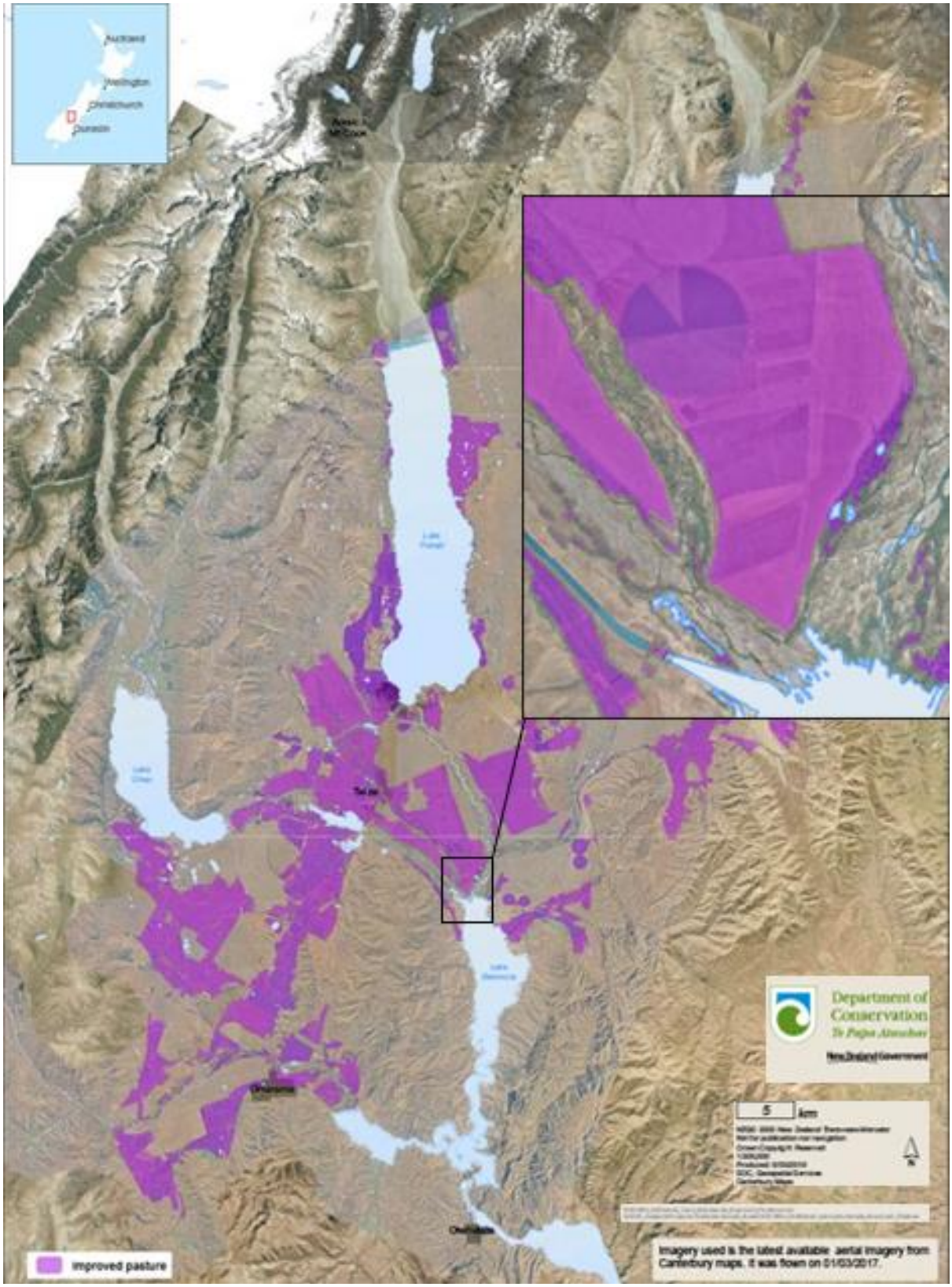

Figure 2: Areas of improved pasture within the Mackenzie Basin as identified by the Department of Conservation in 2018. All of the Ōhau C site is classified as improved pasture.

The works proposed (Figure 3) could potentially have the following effects of the ecology of the site:

- Clearance of indigenous vegetation.
- Clearance of At Risk or Threatened plants.
- Microclimate changes beneath solar panels resulting in changes to vegetation.
- Microclimatic effects on At Risk flora.
- Risk of introduction of pest plants.
- Disturbance (including death, displacement and injury) and harm to lizards.
- Loss of indigenous lizard habitat, and habitat reduction through panel shading.
- Fragmentation of lizard habitat.
- Disturbance of lizards during earthworks.
- Breeding failure/avoidance of lizards.
- Disturbance (including death or injury) of avifauna during construction.
- Ongoing disturbance to lizards.
- Reduction in invertebrate habitat.
- Mortality of Threatened or At Risk invertebrates.
- Disturbance to invertebrates during construction.
- Reduction of habitat quality due to shading.
- Ongoing disturbance to invertebrates.
- Loss of avifauna habitat.
- Disturbance of breeding avifauna.
- Death or injury of avifauna during construction.
- Ongoing disturbance.
- Risk of bird strike.
- Sedimentation of nearby rivers

The scope of this assessment does not include a comprehensive evaluation of the impact of ongoing weed control. It is considered likely that ongoing solar generation will require the control of vegetation within the development footprint to ensure that panels are not shaded. However, insufficient information is available to adequately assess the impacts of vegetation control. The magnitude of effects associated with vegetation control around the development will depend on many factors, including how often vegetation is managed, how vegetation responds to altered microclimatic conditions, which species thrive at the site over time, and which weed management techniques are used. Weeds could be managed mechanically, chemically, or through the use of grazing animals. These techniques will vary in the effects to which they affect biodiversity. Some of these techniques may have impacts on all of the biodiversity present at the site.

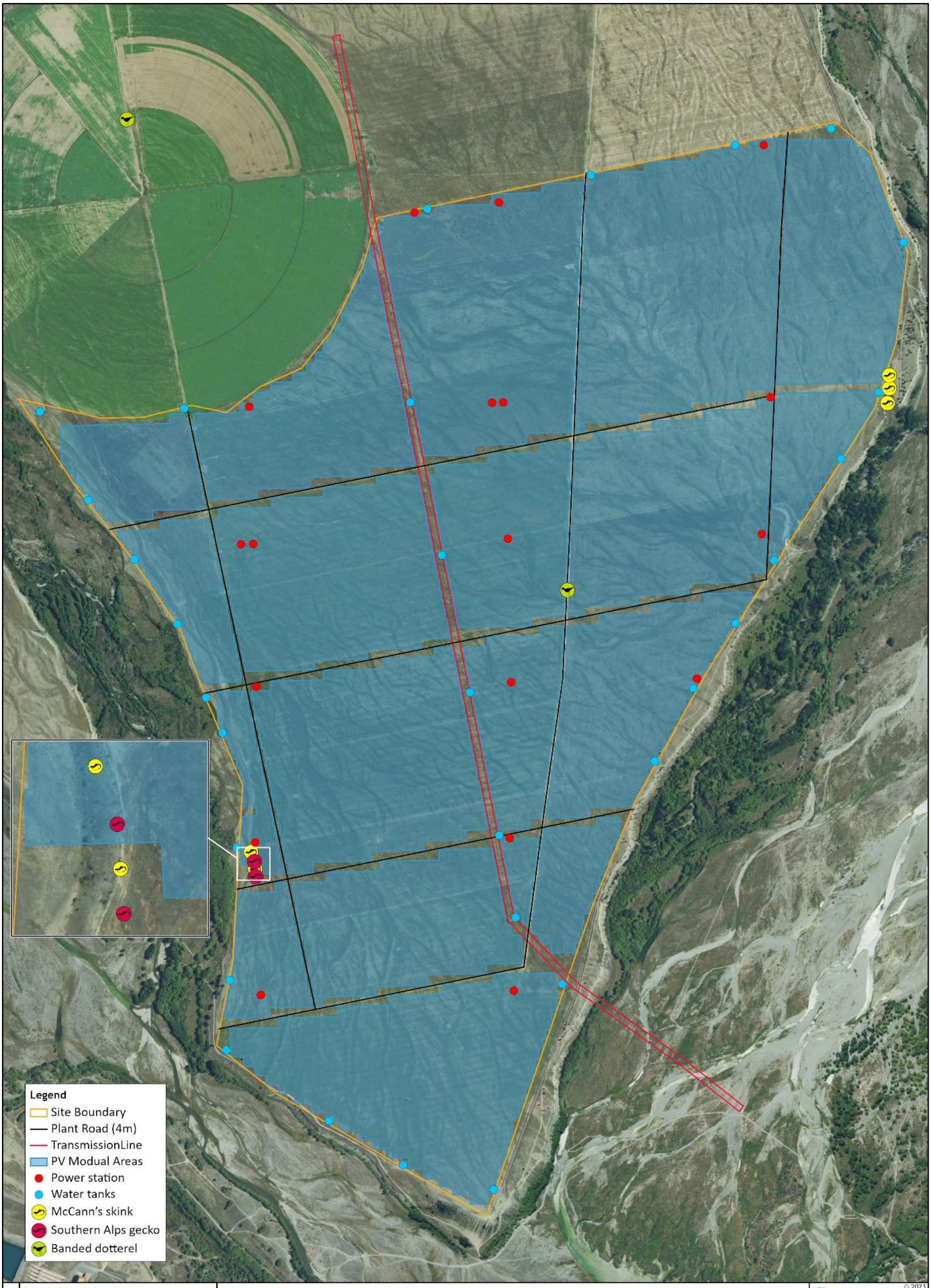

Figure 3. Map of indigenous fauna observed on site in relation to the proposed works.

11.2 Vegetation and flora

General

The vegetation at the site is predominantly grazed exotic grasses with relatively small pockets of indigenous vegetation. There is potential risk to indigenous vegetation during the construction and ongoing operations of the solar farm, including destruction of At Risk plants, clearance of indigenous vegetation, microclimate changes beneath the solar panels, and changes to the site's overall floristic composition.

Clearance of Indigenous Vegetation

The proposed works will require vegetation clearance for access roads, trenching, and pole installation. Most of the onsite vegetation is exotic grassland. Vegetation clearance will have a **negligible** effect on indigenous vegetation.

Clearance of At Risk Plants

The sweet briar-matagouri shrubland supports matagouri (At Risk – Declining), and the stonefield drylands support populations of mat daisy and stout dwarf broom (both At Risk – Declining). Development of the solar farm could result in some individuals of these species being removed. Installation of the solar panels requires relatively little earthworks (poles will be primarily inserted into the ground), but depending on the placement, this may cause harm to plant species.

As heavy machinery moves around the site during construction, this could result in damage to At Risk plant species.

However, most of the site is dominated by exotic vegetation species, and indigenous species are confined to small pockets of suitable habitat, or are individual plants. These areas could be avoided during development. It is therefore considered that these project impacts will have a **minor** or **less than minor** adverse effect on indigenous plants.

Microclimate Changes Beneath Solar Panels, Resulting in Changes to Vegetation

Changes in the microclimate beneath solar panels is likely to affect the floristic composition of the site. Most of the site is exotic grassland, and species native to the Mackenzie Basin typically thrive in full sun. Therefore, species that thrive in shade, slightly lower temperatures, and increased soil moisture are likely to colonise the spaces underneath the solar panels. These species are likely to be non-native, which will have a **less than minor** adverse effect on the floristic composition of the site.

Microclimate Effects on At Risk Plants

At Risk plant species could be shaded out due to the presence of the solar panels. The solar panels will rotate as well, which will limit the height of larger At Risk shrub species, or exclude them from being within the rotational range of each solar panel. These project impacts could have a **minor** adverse effect on At Risk plants if these are not avoided.

Risk of Introduction of Pest Plants

If the works require the importation of metal, soil, or fill for contruction, there is the potential that these materials will be contaminated with seeds of pest plants and ecological weeds which are not already present at the site. This, combined with clearence of exisitng vegetation could acceleate the estblishment of undesirable species at the site, which would have a **more than minor** adverse effect, depending on the species introduced.

11.3 Avifauna

Overview

There are five potential effects on avifauna: permanent habitat modification/loss (e.g. South Island pied oystercatcher breeding on farmland), displacement resulting from construction disturbance (especially along the Ōhau and Twizel Rivers and within the Department of Conservation black-stilt breeding centre), impacts on breeding birds (e.g. death or injury if breeding on-site), ongoing disturbance to birds during operation and impact trauma (bird strike) with panel arrays.

Habitat Modification or Loss

Although plans for the site have not been finalised, the development of the solar farm will affect species such as banded dotterel, pihoihoi/New Zealand pipit, and South Island pied oystercatcher which will lose foraging (and potentially breeding) habitat within the open grassland areas, and black-fronted tern will lose foraging habitat for large insects within open short grass areas. Without mitigation, this effect is likely to be **minor**.

Displacement of Breeding Avifauna

Disturbance from construction activities includes noise, vibration, machinery and human activity. This disturbance is likely to cause birds the change their behaviour and abandon or temporarily avoid the site (and surrounding area) during the breeding season. This leads to behavioural and physiological responses which are presumed to be costly, and can lead to changes in habitat use, parental care, reproductive failure and may have long-lasting effects on populations (c.f. Weston *et al.* 2012). There is a high risk that the disturbance from construction activities will displace a number of Threatened and At Risk species in the Ōhau and Twizel Rivers and nearby wetlands. Without mitigation, this effect is likely to be **more than minor**.

Death or Injury During Construction

If birds are breeding within the construction site, these birds will not only be subject to construction disturbance but also adults, chicks or eggs maybe injured or killed by ground clearance and machinery. Without mitigation, this effect is likely to be **more than minor**.

Ongoing Disturbance

This can occur through the placement of roads, maintenance tracks and yards. If an accessway brings vehicles in close proximity to the Ōhau or Twizel riverbeds and the wetland areas, this will provide ongoing disturbance to breeding, roosting and foraging birds. Without mitigation, this effect is likely to be **more than minor**.

Risk of Bird Strike

There is currently no information available on the solar array layout at the proposed solar farm. As such, more information and further investigations is required to determine direct affects at the site regarding the risk of bird strike with solar array panels. The level of effect has been determined at a conservative level and may change based on final plans. Without mitigation, this effect is likely to be **more than minor**.

11.4 Lizards

Overview

As the plans for the site has not been finalised and targeted surveys have not yet been undertaken, effects on lizards have been determined based on the habitats observed during the site visit and both species recorded and likely to be present on the site. The level of effect has been determined at a conservative level and may change based on final plans and the types and level of disturbance proposed. Final plans for the solar farm construction require targeted surveys to determine direct effects to lizards at the site, and ultimately inform a Lizard Management Plan.

Injury/Death/Displacement

Vehicle strikes are likely to cause injury and death to indigenous lizards during solar panel installation. Trenching and minor earthworks may (fatally) injure lizards present at the site. The proposed solar farm will likely result in the permanent displacement, injury and death of individual lizards within the proposed development footprint. This effect is likely to be **more than minor.**

Habitat Loss and Reduction of Habitat Quality

Lizard habitat has been identified within the proposed solar farm footprint. Habitat loss may occur due to trenching and the development of access roads. Habitats may also be reduced in quality where panels are constructed. Reduction of habitat quality can displace lizards into habitats that may already likely be at carrying capacity, increasing competition and breeding avoidance. If lizard habitat loss cannot be avoided, the proposed development will result in permanent and cumulative ongoing habitat loss for indigenous lizards at this site. This effect is likely to be **more than minor.**

Fragmentation

The proposed solar farm may result in the potential local extirpation or fragmentation of an unknown sized lizard population. Ongoing cumulative fragmentation of lizard

habitats within the Canterbury Region may result in the eventual localised extinction of lizard species without mitigation. This effect is likely to be **more than minor.**

Disturbance During Earthworks

Disturbance during earthworks for trenching wires includes effects to lizards such as dust, vibration, and noise. This disturbance is likely to disrupt normal behaviour, including social dynamics in lizard populations adjacent to the earthwork footprint as a result of construction activity. Across the site, this effect is likely to be **more than minor.**

Breeding Failure/Avoidance

The proposed solar farm and associated earthworks may lead to affected behaviour of lizards and/or social interactions, increase in stress, leading to reduced population functionality, such as poor breeding and low population recruitment. This effect is likely to occur through panel shading, altering habitat composition and quality and earthworks. Without mitigation, this effect is likely to be **more than minor**.

Reduction of High Quality Habitats Due to Shading

High quality habitats within the site could be shaded out due to the construction of the panels, resulting in the gradual shift in vegetation and species composition. This could displace more habitat specific lizard species (such as Lakes skink, if present) and reduce population abundance of more common lizards such as southern grass and McCann's skink. Without mitigation, this effect is likely to be **more than minor**.

Ongoing Disturbance

Vehicle strikes, noise and dust may affect lizard populations along newly-formed roads and vehicle accessways especially in areas where new tracks are created with cobbles, which provides refugia and basking opportunities for lizards. While there is limited published literature about the impacts of dust on lizards, it is likely that lizards would avoid this habitat if there was heavy dust deposition. Without mitigation, this effect is likely to be **minor**.

11.5 Terrestrial invertebrates

General

The presence of notable orthopteran species (Tekapo ground wētā, minute grasshopper, and robust grasshopper) on-site is possible but unconfirmed. Therefore, in predicting ecological effects on terrestrial invertebrates, it is necessary to be conservative and assume that notable species are present.

Reduction in Invertebrate Habitat

Habitat for notable invertebrates (Table 3) has been identified within the proposed development footprint. The proposed development will result in habitat loss for invertebrates at this site. This effect is likely to be **more than minor.**

Mortality of Invertebrates

All earthworks, including for the placement of trenching and the cut-fill earthworks for establishing contours, will cause the removal and destruction of any notable invertebrates present on the surface of the ground during works. Vehicle strikes will also cause the death of invertebrates. This effect is likely to be **more than minor**.

Disturbance During Works

Dust and vibrations associated with earthworks are likely to disturb insects and affect their behaviour. Little has been published on the effects of dust on invertebrates, but dust settling on insect bodies may cause injury from abrasion and/or blocking external breathing apparatus. This effect is likely to be **more than minor**.

Reduction of Habitat Quality Due to Shading

High quality habitats within the site could be shaded out due to the solar panels. Shading has the double-edged effect of both reducing habitat quality through a gradual shift in vegetation composition and structure, and reducing sunlight availability for basking species such as robust and minute grasshoppers. The creation of shaded areas is likely to benefit the New Zealand blue butterfly, but overall this effect is likely to be **more than minor**.

Ongoing Disturbance

Vehicle strikes, vibration, and dust from ongoing works may affect invertebrate populations near newly-formed roads and vehicle accessways, particularly if they approach the river bed. This effect is likely to be **more than minor**.

Creation of Concrete and Cobbled Areas

Concrete provides basking opportunities for indigenous invertebrates, including New Zealand blue butterfly. This effect is likely to result in a **net gain.**

Note: The proposed solar farm site is immediately adjacent to two rivers, which provide habitat for many freshwater invertebrates. International studies have shown that solar farm proximity can be detrimental to freshwater invertebrates. Adverse impacts are therefore likely from the development and ongoing operations of this solar farm on local indigenous freshwater invertebrates and thereby nearby rivers. An assessment of effects on freshwater invertebrates was beyond the scope of this assessment.

11.6 Freshwater

While there are no waterways within the site, consideration of the surrounding waterways remains important. Works will result in the disturbance of sediment, which has the potential to enter waterways through overland flows, this can have a number of negative effects on freshwater fauna species. Small galaxiids and bullies, as well as many macroinvertebrate species utilise hard surfaces and interstitial spaces for

foraging, spawning and shelter, an increase in fine sediment within the waterways they inhabit would result in loss of this habitat (Ryan 1991; Jowett and Boustead 2001).

Sedimentation of a waterway can cause a decrease in the survival rate of fish eggs as it can reduce both space and oxygen availability within the interstitial spaces of the substrate (Ryan 1991), impacting the recruitment rates of fish that spawn in the area. Sedimentation can also lead to an increase in invertebrate drift as habitat becomes less suitable, this can result in a change in the community composition, diversity and abundance (Mathers *et al.* 2022; Davis *et al.* 2022). Changes in macroinvertebrate community will cause follow on impacts for the fish species that feed on them. Finally, sedimentation can also reduce the availability of refuges within the substrate for small indigenous fish species, which can increase the likelihood of negative interactions with introduced salmonids (Coughlan 2022; Sowersby *et al.* 2015).

The impact of sediment in surrounding waterways could be **minor**.

12. MANAGEMENT OF POTENTIAL EFFECTS

12.1 Spatial design considerations

Two vegetation types on the site are considered low value, despite meeting the criteria for ecological significance. Cocksfoot grassland and brome-hawkweed-sheep sorrel herbfield comprise most of the proposed solar farm footprint. These habitats potentially provide foraging and breeding habitat for various indigenous bird and lizard species, and a New Zealand Blue Butterfly was observed in the brome-hawkweed-sheep sorrel herbfield. However, there are no At Risk or Threatened plant species in these vegetation types. However, these two types extend beyond the solar farm boundary within the property. Therefore, while this type of habitat would be reduced by the development, it would not be removed completely from the wider ecosystem.

Higher value vegetation and habitats are also present on the site, primarily along the property boundaries. These include the stonefield drylands and sweet briar-matagouri shrublands. These types should be excluded completely from development, as they already exist in small patches, and support populations of protected indigenous lizard species.

To ensure that higher value habitats are protected from solar farm development, the proposed development footprint should be adjusted (Figure 4). This would thereby exclude the high value habitats, and provide a buffer region for avifauna on the offsite braided rivers and wetlands.

Stonefield drylands and sweet briar-matagouri shrubland would benefit from protection and enhancement. These habitats include areas of indigenous and ecologically significant vegetation as well as important habitats of Threatened and At Risk plants, invertebrates, lizards, and birds. Additionally, a buffer of 100 metres around waterways and wetlands should be implemented, to ensure that avifauna, wetlands, and the adjacent braided river systems are not adversely affected by the proposed works.

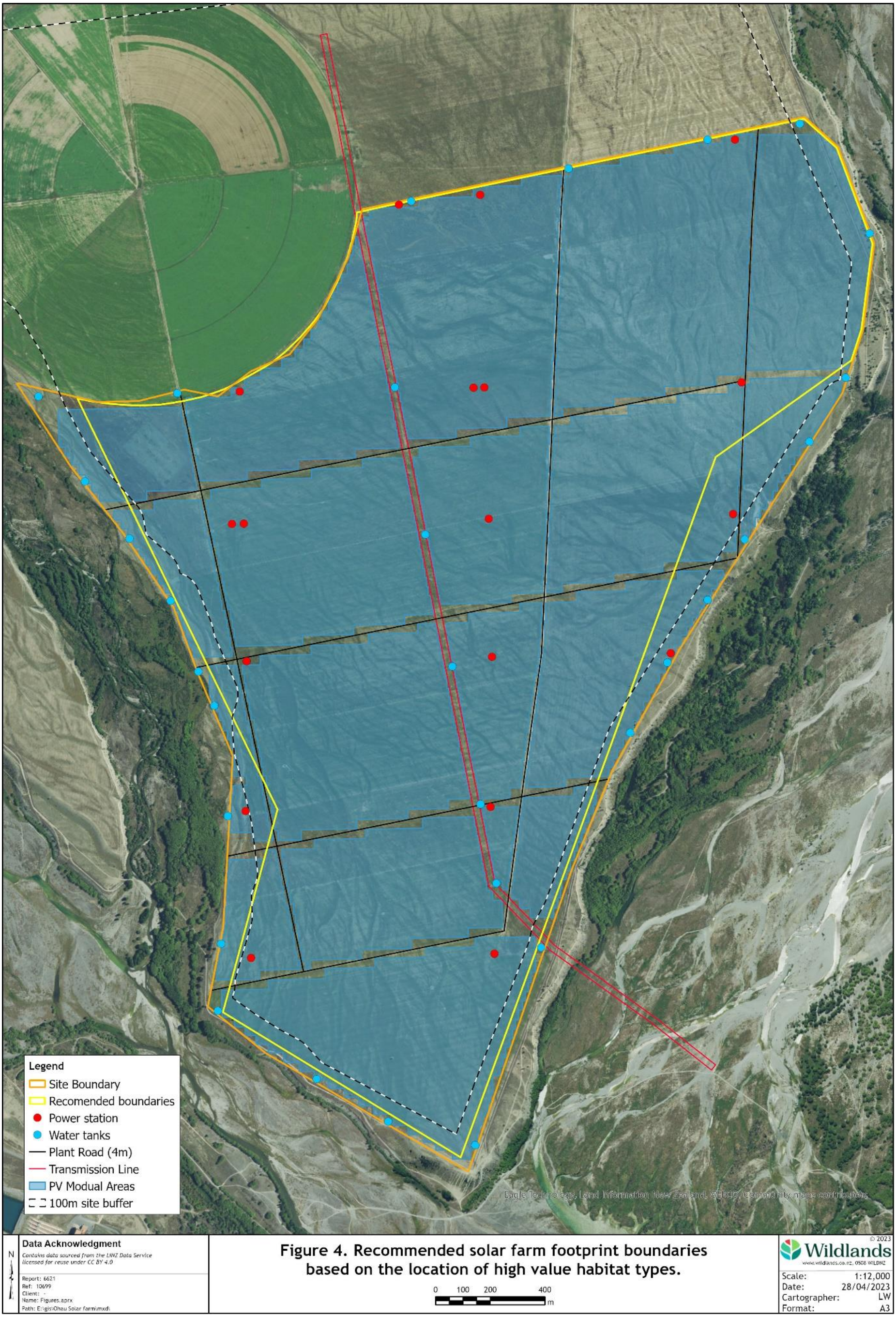

Figure 4. Recommended solar farm footprint boundaries based on the location of high value habitat types.

Furthermore, any land on the property not utilised for solar farm operations would benefit from protection and enhancement as well. 'Unused' land would benefit from indigenous plantings, habitat creation for indigenous lizards and invertebrates, and protection from lagomorph browsing. See Section 13.7 Ecological Enhancement Plan, below, for further details.

Any area that is enhanced or protected should be legally protected to ensure that biodiversity loss does not occur over the lifetime of the project. Legal protection options include QEII covenants.

12.2 Vegetation and flora

Avoidance of Indigenous Vegetation and Notable Plant Species

The current panel area mostly comprises exotic grasslands and planted exotic vegetation. Therefore, it will be possible for design of the solar farm to avoid areas with indigenous and ecologically-significant vegetation and known locations of Threatened and At Risk plants.

Solar panel locations should be selected so that the locations of ground supports for the panels avoid At Risk or Threatened species. Solar panels should also be constructed in areas where At Risk indigenous species density is low, to minimise the effects of shading. Access to and around the site by machinery should be planned carefully to avoid destruction to At Risk species or patches of predominantly indigenous vegetation.

More detailed vegetations surveys will be required to ensure that At Risk species are avoided wherever possible.

Biosecurity Management Plan

Risk of introduction of pest plants can be mitigated by utilising the existing access road as much as possible and avoiding indigenous habitats. Any soil or fill bought into the site could be sourced locally. Ideally, no fill will be bought in from outside of the site and if it is necessary to bring it in then it should be from a 'clean' source in close proximity. Surveys and control of pest plants and ecological weeds should be undertaken to ensure that new species don't establish and expand.

Indigenous Planting

The applicant intends to plant indigenous species between and surrounding the solar panels to promote native species regeneration. Indigenous planting advice should be provided by a qualified vegetation ecologist and plants should be sourced locally. In addition, ongoing invasive weed control will be implemented through sheep grazing and manual removal of invasive species.

If these actions are taken, it is considered that the effects of the project on indigenous vegetation and At Risk flora will be **less than minor to minor**.

12.3 Avifauna

Loss of Habitat and Impacts on Breeding Birds

The proposed solar farm footprint is mostly grassland of various types. Although access to similar habitat is readily available in the surrounding area, the habitat loss will affect breeding and foraging birds if construction work occurs during the breeding season. Construction activities during the breeding season (July – March) are likely to injure or kill breeding birds, eggs, and chicks. Ideally, as much construction work as possible should occur outside the bird breeding season. However, given the size of the project, it is inevitable that some construction will occur during the breeding season, and a bird management plan will therefore be needed, including surveying for breeding birds no more than eight days prior to the start of works. A suitably qualified and experienced avifauna ecologist should produce the Avifauna Management Plan and undertake the pre-works surveys.

Disturbance During Construction

Proposed works must avoid disturbing birds in the rivers and wetland areas adjacent to the site. To avoid this disturbance, a buffer area of 100 metres should be maintained between the near edge of rivers/wetlands and any area where machinery and power tools are used. These buffer zones must be total exclusion areas, and cannot be used for vehicle access to the construction site. In particular, the river delta near the southern corner of the site and the area of wetland and the braided riverbeds must be avoided.

Habitat Enhancement

The site is in close proximity to the Department of Conservation release site for kakī/black stilt, which is classified as an Important Bird Area, and measures to protect river and wetland habitats should be implemented. Primarily, this would involve pest control around the Ōhau C site, especially near the rivers. Stonefield drylands within the site should be maintained and buffer zones or setback areas will be required to protect avifauna habitat.

Ongoing Disturbance

Vehicle access should be limited to be at least 100 metres away from all waterbodies and river areas. Vehicles must drive slowly within the solar farm as birds will breed within gravel areas and could potentially utilise the vehicle tracks as breeding sites.

Prevention of future disturbance, death, or injury due to solar farm activities will partly be dependent on the final solar farm design. Providing clear areas between solar panel arrays will allow birds to navigate the access corridors and avoid bird strikes when landing or departing from the site. Monitoring of the solar farm should be undertaken after the construction phase and during the lifetime of the solar farm, to assess whether mortality due to bird strike actually occurs.

12.4 Lizards

Further Surveys Required

A targeted lizard survey, following the relevant Department of Conservation Inventory and Monitoring Toolbox for Herpetofauna (Lettink and Monks, 2012), is required to more accurately assess the lizard species, abundances, and areas of lizard habitat on site to inform a Lizard Management Plan (see below).

Lizard Management Plan (LMP)

Unless all areas of lizard habitat identified following a targeted lizard survey can be absolutely avoided from all adverse impacts of development, then a LMP and associated Wildlife Act Authority will be required for the project. The actual details of lizard management (including any offsetting or compensation measures) will be addressed in the LMP. The LMP should contain:

- Ways to adequately avoid lizards and their habitats where possible.
- A thorough assessment of alternatives to lizard salvage, including
  - Compensation or other suitable means to enhance lizard populations offsite.
- Habitat restoration and enhancement, including:
  - Appropriate indigenous vegetation planting and pest animal and plant control.
  - Salvage and relocation of lizards to an alternative location outside of the development footprint, if sufficient avoidance or onsite mitigation is not feasible.

Avoid High Quality Lizard Habitats

Where high quality lizard habitats are present, these should be avoided. These areas include the stonefield drylands and sweet briar matagouri shrubland. Avoidance of high quality habitats should be the most important measure considered for the mitigation of potential effects on lizards, such as habitat loss, mortality, and disturbance.

Project Design that Includes Corridors

Corridors could also be created whereby areas of land are avoided, and preserved within the site to provide connectivity for species across the wider site, and to link habitats, both of high and low quality. This may help to preserve genetic diversity within more Threatened species, if these are found to be present within the site.

Site development with the implementation of these measures and a LMP may result in a **minor adverse** effect on lizards.

12.5 Terrestrial invertebrates

Habitat Avoidance

Destruction of indigenous brooms and other indigenous flowering plants should be avoided where possible, to ensure continued breeding and feeding plant access for New Zealand blue butterfly. Loss of areas of bare ground and rock should be avoided where

possible, to minimise the loss of basking areas for New Zealand blue butterfly. Therefore, dry, open habitats should be avoided. If these habitats cannot be avoided, which is likely as much of the site is open, then habitat enhancement in other sections of the site should be implemented.

Further Studies

Notable orthopterans may all be present on-site. Surveys for all these species are necessary. The surveys should be carried out in the open habitat areas, particularly towards the east of the site.

Invertebrate Management Plan

A Grasshopper Management Plan will be required if robust grasshopper are found in further surveys due to their protection under the Wildlife Act (1953). An Invertebrate Management Plan will be required if minute grasshopper or short-horned grasshopper, and/or Tekapo ground wētā, are found to be present.

Habitat Restoration

Ōhau C contains several patches of dry, open habitat that could be enhanced or restored for indigenous invertebrates such as short-horned grasshopper and minute grasshopper. Predator control throughout the site, through implementation of a predator control plan designed by a suitably-qualified ecologist, would benefit terrestrial invertebrates.

12.6 Freshwater fauna

A sediment management plan is necessary to ensure that there are no accidental discharges of disturbed sediment into the adjacent waterways. This should include consideration of the timing of works to avoid disruption of sediment when high rainfall events are predicted.

A setback from the surrounding waterways would also reduce the risk of sediment or incidental chemical pollution occurring.

12.7 Wildlife management

A Wildlife Act 1953 authority (permit) is required to carry out modification or land development that have adverse impacts on indigenous New Zealand fauna, including some invertebrates, all lizards and most avifauna (Department of Conservation 2019).

As protected species are likely to be present within the proposed solar farm footprint and adverse effects may be unavoidable, fauna management plans are likely to be required: Lizard Management Plan, Avian Management Plan, Robust Grasshopper Management Plan. An Invertebrate Management Plan will also likely be recommended for the protection of At Risk and Threatened invertebrate populations within the site if others are found during targeted surveys. Management plans are often required as a resource consent condition, as are continuing to meet all other legal obligations (such as obtaining required permits) when carrying out consented activities.

If vegetation clearance or works are to be undertaken during the avifauna breeding season, especially within 100 metres of any river or wetland area, an Avifauna Management Plan will be required to avoid and mitigate adverse effects.

If required, and depending on levels and types of disturbance, fauna management plans should contain measures that clearly avoid, mitigate, offset, or compensate for the disturbance to species, populations, and their habitats. Wildlife management actions for lizards, avifauna, and invertebrates could include avoidance of habitat and/or relocation of lizards or invertebrates and site management (e.g., habitat enhancement, pest management, monitoring) at specific sites. The Department of Conservation will need to be reasonably confident that, on balance, lizard, avifauna, and invertebrate populations to be affected will not be worse off than prior to development of the site. *In situ* mitigation management of lizards, avifauna, and invertebrates, or offsetting or compensatory tools, may be needed.

12.8 Ecological Enhancement Plan (EEP)

12.8.1 Overview

The Mackenzie Basin has undergone extensive landscape modification and degradation due to human activities, particularly the introduction of agriculture and associated exotic plant species. Development of the Mackenzie Basin is likely to continue.

FNSF intends to ecologically enhance 89 hectares of unused land on the site. This is the first project of its kind in the Basin and represents a substantial opportunity to preserve the unique ecology of the Mackenzie country. In order to restore ecological functions and improve biodiversity, an Ecological Enhancement Plan (EEP) will be developed that emphasises the restoration of indigenous vegetation, and results in habitat creation for indigenous fauna.

The EEP will prioritise the restoration of regionally typical indigenous vegetation and habitats as well as the management of problematic exotic species. Site enhancement could therefore contribute significantly to the recovery of the vegetation and habitats in the Mackenzie Basin, and promote long-term ecological resilience across the wider landscape.

Relatively little is known about the management and restoration of dryland ecosystems in Aotearoa New Zealand and restoration will likely be challenging and will require adaptive management that is informed by long-term monitoring. Ongoing monitoring will assess the success of the EEP and ensure that management adapts to achieve the desired outcomes.

The EEP is intended to generate a net gain for ecology at the site, and is complemented by a range of actions that avoid or minimise the potential for adverse effects of this project. Prioritising these actions will ensure that, across the project, potential adverse effects are mitigated in the most effective manner.

12.8.2 Indigenous revegetation

The total area of the proposed enhancement zone to be revegetated, where required, is 89 hectares. This will be undertaken differently in two zones: an enhancement zone and a visual screening zone, as described below.

Enhancement Zone

The EEP will be focussed on the enhancement zone, which will be restored to be representative of the original outwash plain vegetation that typifies the Pukaki Ecological District. The area will be managed to attain the dominance of indigenous shrubs, tussocks, and herbs, with exposed stony gravel.

The total number of indigenous plants to be planted in the enhancement zone will be between 500,000-750,000, and will be a mixture of the following eco-sourced species (among others):

- Matagouri
- *Olearia lineata*
- *Corokia cotoneaster*
- *Coprosma propinqua*
- *Phyllocladus alpinus*
- *Sophora microphylla*
- Desert broom (*Carmichaelia petriei*)
- *Hebe* species
- Golden spaniard (*Aciphylla aurea*)
- *Carex* species
- *Celmisia semicordata*
- *Festuca novae-zelandiae*
- *Gaultheria antipoda*
- *Poa* species

Visual Screening Zone

Selected parts of the EEP will be dedicated to visual screening, and this zone will comprise the areas closest to the development footprint. A 40 metre wide strip surrounding the entire development footprint will be revegetated with shrubs and trees that will reach a mature height of at least three metres. This area will be planted with taller-growing eco-sourced species such as:

- Mānatu/ribbonwood (*Plagianthus regius* subsp. *regius*)
- Kānuka (*Kunzea robusta*)
- Matagouri
- *Olearia lineata*
- *Corokia cotoneaster*
- *Coprosma propinqua*

Some of these species are not typical of the outwash vegetation that would have originally occurred at the site, but is typical of the Ecological District, and is therefore

considered to be ecologically-appropriate. This part of the EEP is nevertheless expected to generate benefits for local fauna (this is expanded upon below). Planting of taller stature species may require adaptation of the existing soil conditions to ensure that species reach the required height. If this is required, biosecurity measures and ecological-appropriateness will need to be taken into account.

12.8.3 Ongoing maintenance

Pest Animal Control

Pest mammals have significant detrimental effects on indigenous ecology and particularly notable impacts in the Mackenzie Basin are due to the effects of lagomorphs, mustelids, rodents, and domestic stock.

Stock exclusion is appropriate at the site and would provide benefits for many biodiversity types. The most appropriate control strategy for mammalian pests is yet to be determined, with different strategies likely to have various benefits and risks. A cost-benefit analysis for pest control options will be required as all options have trade-offs. Appropriate management must consider the existing biodiversity values of the site and should be implemented by suitably qualified and experienced pest control operators.

Predator-proof fencing and eradication of introduced mammals may be an appropriate way to enhance the habitat for a wide variety of indigenous fauna and this option is being considered by FNSF. Sufficiently regular pest monitoring and fencing maintenance would be required long-term, to ensure that mammals are excluded from the enhancement site.

Landscape-scale pest control is associated with significantly higher risk than predator-proof fences, because mice are a predator of many indigenous fauna, and these are unlikely to be controllable without the ongoing use of aerially broadcast toxins or very intensive ground-based control. If other introduced mammals are controlled, but not mice, mouse numbers can be expected to increase substantially. This may erode any positive effect of pest control if mice prove to be significant predators. Pest control in the area would have to be undertaken in perpetuity to remain effective. In contrast, predator-proof fences, as suggested above, can be kept mouse-free (Hutcheon *et al*. 2011; Reardon *et al*. 2012).

Landscape-scale control could possibly be considered for a smaller area (10-100 hectares), and predator-proof fencing around the whole site, plus implementation of a predator-control plan within the site, would benefit all invertebrates.

Exotic Vegetation Management

The area subject to the EEP is likely to require ongoing maintenance to control weeds, particularly as planted species become established. Notably, vegetation dynamics are likely to change with mammal exclusion. For example, lagomorph control may exacerbate the dominance of some weedy species.

While the optimal techniques require further consideration and are beyond the scope of this assessment of ecological effects, it is likely that implementation of the EEP will

involve the use of various combinations of mechanical methods for the control of invasive species, soil cultivation, and weed control. Light grazing by sheep may be required to keep weeds down and should not result in substantial adverse effects of indigenous fauna if limited to low numbers, although the land should not be used for farming.

The use of herbicides, pesticides and fertilisers are likely to be generally inappropriate in the reserve, as many indigenous fauna are sensitive to sprays. Sprays should also be avoided on land around the reserve.

Site Access

Access to the parts of the site to be restored should be undertaken on foot to avoid disturbance to fauna. If absolutely necessary, vehicle access to the reserve should be limited to essential visits inside the fence (e.g. for plant care or monitoring), and speed should be kept to below 20 kph.

To avoid damage to nest sites or disturbance of breeding birds, site maintenance and replanting should be undertaken during the non-breeding period, particularly if vehicles are to be used. If this is impractical, site maintenance could be undertaken during the breeding season but after a survey for breeding activity by a suitably qualified and experienced avifauna ecologist, no more than seven days before works start.

Legal Protection

The land needs to be formally protected as a dedicated reserve to ensure that there is long-term protection and associated benefits. This may include protection using a QEII covenant. As noted above, while light grazing (e.g. with sheep) may be necessary to control weeds, the site should not be used for farming.

Monitoring

Monitoring will be necessary to determine the success of the EEP and ongoing management, including the uptake of enhanced habitat by relevant fauna species. To ensure success of the EEP implementation programme, monitoring is likely to be required for at least 10 years for some species, such as larger-bodied skinks.

12.8.4 Habitat creation for fauna species

Indigenous revegetation and the control of weeds and pest animals will enhance existing habitat and increase its suitability and availability for Threatened and At Risk indigenous fauna. The benefits and options for additional habitat creation are described below.

Avifauna

Permanent habitat creation through restoration of the outwash plain and stonefield grassland will provide breeding habitat for Threatened and At Risk species, including South Island pied oystercatcher, banded dotterel, and New Zealand pipit, and potentially black-fronted tern. If implementation of the EEP successfully creates habitat

that avifauna use, this will have critical implications for the management of this area to avoid disturbance to nesting birds.

Tree species to be planted within the visual screening zone surrounding the entire development footprint and adjacent to the rivers and wetlands may provide roosting sites for shag species, including black shag and little shag. Shags prefer trees which are close to or overhanging water.

Lizards

Permanent habitat creation will be undertaken for lizard species present within the area. Permanent habitat creation should include the use of rock piles, targeted planting, pest control, and the exclusion of stock from high value sites.

The addition of habitat refuges for lizards should include rock piles deposited along dry river channels. Installation of these rock piles would be undertaken in a way that facilitates connectivity between high value lizard sites and is likely to support lizard population recovery and gene flow between otherwise isolated populations. These sites may also be utilised for lizard releases following any lizard salvage (as a requirement in the LMP), if required within areas of disturbance. Following successful implementation of the EEP, it may be possible to release threatened larger-bodied skinks into the site, to increase the population viability of these species long-term within the Mackenzie Basin.

Invertebrates

This plan is designed to provide benefits for all indigenous invertebrates, but particularly robust grasshopper, Tekapo ground wētā, short-horned grasshopper, minute grasshopper, New Zealand blue butterfly, carabid beetles, and moths.

Grasshoppers will benefit from enhancement of open gravel riverbed habitat. Weeds will be removed mechanically as herbicides are not tolerated by grasshoppers. Indigenous gravel riverbed species will be included in the planting plan. Further from the river, areas of rocks, lichen, mosses, and bare earth with little or no vegetative cover will be created. The bare habitat should ideally be interspersed with pohuehue among larger rocks, and indigenous grasses, which will provide habitat for indigenous moths which feed on grasses, lichens, and mosses. Carabid beetles will benefit from rock stacks and other indigenous vegetation planted. New Zealand blue butterfly will benefit from indigenous legumes (e.g. broom) planted, as well as being able to utilise bare open areas and shelter under foliar cover.

12.8.5 Anticipated outcomes of the EEP

This work will require a restoration plan, and will need to be implemented by suitably qualified and experienced ecologists and restoration specialists. If the EEP is implemented appropriately, it is likely to result in the following suite of **positive** effects:

- Vegetation and flora:
  - Permanent habitat creation for Threatened and At Risk plants.
  - Increase in the extent of indigenous vegetation.
  - Protection of palatable plant species from grazing.

- Protection from conversion to other land uses, such as farming.

- Avifauna:
  - Permanent habitat creation.
  - Creation of roosting habitats.
  - Increased breeding success.

- Lizards:
  - Permanent habitat creation.
  - Creation of breeding habitats.
  - Reduction in landscape-level habitat fragmentation.
  - Creation of a suitable release site for lizards affected by other developments, including species that have been extirpated at Ōhau C.
  - Release of populations from predator pressure.

- Terrestrial invertebrates:
  - Permanent habitat creation.
  - Creation of breeding habitats.
  - Release of populations from predator pressure.

Very little is known about the management and restoration of dryland ecosystems in Aotearoa New Zealand. While challenging, this project will generate nationally important information regarding the management of dryland ecosystems. The project would help to address a critical dryland ecosystem knowledge gap and thus enhance the management of these ecosystems more widely throughout Canterbury and Aotearoa New Zealand.

12.9 Assessment of potential effects following mitigation

Levels of ecological effects on indigenous biodiversity following the implementation of appropriate mitigation actions are presented in Table 7. Accurate prediction of the levels of effect with mitigation in place is not straightforward, but the table gives a broad picture of how effects can be reduced significantly with mitigation measures in place.

There are numerous ways by which indigenous biodiversity could be adversely affected and the ecological effects of this development could be substantial if the project is not designed appropriately to address the ecological features and values known to be present at this site.

Notably, most of these potentially adverse effects can be avoided or greatly reduced if the project is implemented thoughtfully. Mitigation actions that involve designing the project to avoid areas that are important to biodiversity are likely to be disproportionately important to the maintenance of biodiversity at this site. Further surveys, as well as management plans designed by suitably qualified ecologists, will be required to ensure that adequate mitigation is implemented for the project.

Table 7: Potential significance of ecological effects if appropriate and effective mitigation is implemented.

Effect	Level of Effect Without Mitigation	Level of Effect With Mitigation (without EEP)	Estimated Level of Effect with Successful[1] EEP
Clearance of At Risk flora	Minor	Less than minor	**Positive**
Vegetation clearance	Negligible	Negligible	**Positive**
Microclimatic changes beneath solar panels, resulting in changes to vegetation	Less than minor	Negligible	Negligible
Microclimatic effects on At Risk flora	Minor	Less than minor	**Positive**
Risk of introduction of pest plants	Minor to more than minor	Minor	Minor
Injury/death/displacement of lizards	More than minor	TBC[2]	TBC[2]
Loss of lizard habitat	More than minor	Minor	**Positive**
Lizard habitat/population fragmentation	More than minor	TBC[2]	TBC[2]
Disturbance to lizards due to earthworks	More than minor	TBC[2]	TBC[2]
Lizard breeding failure and/or avoidance	More than minor	TBC[2]	TBC[2]
Reduction of high quality lizard habitats due to shading	More than minor	TBC[2]	**Positive**
Ongoing disturbance to lizards	Minor	TBC[2]	TBC[2]
Death or injury of avifauna	More than minor	Minor	Minor
Ongoing disturbance of avifauna	More than minor	Minor	Minor
Loss or modification of avifauna habitat	Minor	Less than minor	**Positive**
Displacement of breeding avifauna	More than minor	Minor	Less than minor
Risk of bird strike	More than minor	Minor	Minor
Creation of concrete and cobbled areas	Positive	Positive	**Positive**
Reduction in invertebrate habitat	More than minor	Less than minor	**Positive**
Mortality to invertebrates	More than minor	Minor	Minor
Disturbance to invertebrates during works	More than minor	Less than minor	Less than minor
Reduction in invertebrate habitat quality due to shading	More than minor	Minor	**Positive**
Ongoing invertebrate disturbance	More than minor	Less than minor	Less than minor

13. CONCLUSIONS

This report describes the potential ecological effects of a proposed solar energy development in the Mackenzie Basin. Various desktop and field surveys have provided information to support the findings presented in this report. The Ōhau C site consists predominantly of grazed and cultivated land, with indigenous vegetation on the site margins.

[1] The level of effect provided here assumes thoughtful design and appropriate implementation, as well as ongoing monitoring that drives adaptive management of the EEP.

[2] The level of effect with mitigation will be determined by the outcome of a lizard management plan, which is yet to be developed for this project.

The most ecologically valuable vegetation and habitats within this site are sweet briar-matagouri shrubland, brome-hawkweed-sheep sorrel grassland/herbfield and stonefield drylands. Five Threatened or At Risk plant species are likely to occur on-site. A broad assemblage of avifauna uses, or is likely to use the site, including various Threatened and At Risk species. Two lizard species have been recorded on-site, one of which is classified as At Risk. An additional two At Risk and two Threatened lizard species may occur on-site but further surveys are required to confirm whether they are present. One invertebrate species that is in decline has been recorded on-site, and an additional four notable species may be present.

Significant ecological values also occur adjacent to the site and some could potentially be affected by the development, including ecologically-significant wetlands and braided river systems. Furthermore, the Ōhau C site is adjacent to an Important Bird Area, where captive bred kakī/black stilt are released annually.

A variety of potential ecological effects are outlined in this report. However, details of the project design have not been finalised, which provides a substantial opportunity to avoid adverse effects. Subject to project design, some potential ecological effects may not apply. Many of the residual potential effects can be mitigated effectively through thoughtful project design.

For some biodiversity types, it is difficult to accurately assess the level of ecological effects of the project, and the degree to which these can be mitigated. Further ecological information will need to be collected to fully understand the types and levels of ecological effects on some features.

Development and land use change within high value vegetation and habitats, such as indigenous lizard and invertebrate habitat at the margins should be avoided. The cocksfoot grassland and brassica cropland habitats, which comprise most of the site, are likely to be more suitable for development, subject to the findings of a targeted lizard survey.

The site would benefit from ecological enhancement, as most of it is currently highly disturbed and cultivated. Without development, it is likely to remain in a degraded state. However, development of a solar farm provides an opportunity to enhance the ecosystem and habitats and to restore parts of it to be more representative of an indigenous-dominant outwash plain. The creation of additional shelter and basking areas for invertebrates is likely to result from the proposed development, which will provide limited benefits for some invertebrate species.

The applicant's intent is to design the project to avoid adverse ecological effects, and to achieve a net gain for local indigenous biodiversity. Sensitive design of the solar farm, combined with appropriate ecological management and enhancement, can achieve positive benefits for indigenous biodiversity at this site.

ACKNOWLEDGMENTS

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VASCULAR PLANT SPECIES RECORDED DURING THE FIELD SURVEY

Threat status of indigenous species is from de Lange *et al.* 2018.

Pest plant species recorded are classified as either 'pests' or 'Organisms of Interest' (OOI) according to their status under the Environment Canterbury Regional Pest Management Plan (CRPMP; 2018-2038).

Species	Common Name	Plant Type	Native or Exotic	Conservation Status	Pest Status
Achillea millefolium	Yarrow	Dicot herb	Exotic		
Agrostis capillaris	Brown top	Grass	Exotic		
Aira caryophyllea	Silvery hair grass	Grass	Exotic		
Anthoxanthum odoratum	Sweet vernal	Grass	Exotic		
Anthosachne solandri	Native wheatgrass, blue wheatgrass	Grass	Native	Not Threatened	
Bromus catharticus	Prairie grass	Grass	Exotic		
Bromus tectorum	Downy brome	Grass	Exotic		
Bromus hordeaceus	Soft brome	Grass	Exotic		
Carmichaelia australis	Native broom, common broom	Shrub	Native	Not Threatened	
Carex breviculmis	Grassland sedge	Sedge	Native	Not Threatened	
Capsella bursa-pastoris	Shepherds purse	Dicot herb	Exotic		
Carmichaelia monroi	Stout dwarf broom	Shrub	Native	At Risk - Declining	
Chenopodium album	Fathen	Dicot herb	Exotic		
Cichorium intybus	Chicory	Dicot herb	Exotic		
Cirsium arvense	Californian thistle	Dicot herb	Exotic		
Coprosma propinqua	Mingimingi, mikimiki	Shrub	Native	Not Threatened	
Cytisus scoparius	Scotch broom	Shrub	Exotic		PEST
Dactylis glomerata	Cocksfoot	Grass	Exotic		
Discaria toumatou	Matagouri, tūmatakuru	Tree	Native	At Risk - Declining	
Echium vulgare	Vipers bugloss	Dicot herb	Exotic		OOI
Festuca novae-zelandiae	Fescue tussock, hard tussock	Grass	Native	Not Threatened	
Festuca rubra	Red fescue	Grass	Exotic		
Geranium molle	dovesfoot cranesbill	dicot herb	Exotic		
Hypericum perforatum	St Johns wort	dicot herb	Exotic		OOI
Juncus articulatus	Jointed rush	rush	Exotic		
Juncus conglomeratus	Soft rush	rush	Exotic		
Lepidium solandri	Maniototo peppercress	Dicot herb	Native	Threatened - Nationally Critical	
Lolium perenne	ryegrass	grass	Exotic		
Lotus pedunculatus	lotus	dicot herb	Exotic		
Medicago sativa	lucerne	dicot herb	Exotic		
Melicytus alpinus	porcupine shrub	shrub	Native	Not Threatened	
Microtis unifolia	onion orchid, maikaika	orchid	Native	Not Threatened	
Muehlenbeckia axillaris	creeping pōhuehue	vine	Native	Not Threatened	
Pilosella officinarum	mouse-ear hawkweed	dicot herb	Exotic		OOI

Species	Common Name	Plant Type	Native or Exotic	Conservation Status	Pest Status
Pinus contorta	lodgepole pine	tree	Exotic		PEST
Pinus species	Wilding pines	tree	Exotic		
Plantago lanceolata	narrow-leaved plantain	dicot herb	Exotic		
Polygonum aviculare	wireweed	dicot herb	Exotic		
Populus deltoides	eastern cottonwood, necklace poplar	tree	Exotic		
Raoulia australis	common mat daisy	dicot herb	Native	At Risk - Declining	
Raoulia hookeri	scabweed	dicot herb	Native	Not Threatened	
Rumex acetosella	sheeps sorrel	dicot herb	Exotic		
Salix ×fragilis	crack willow	tree	Exotic		
Sedum acre	stonecrop	dicot herb	Exotic		
Thelymitra longifolia	white sun orchid	orchid	Native	Not Threatened	
Trifolium arvense	haresfoot trefoil	dicot herb	Exotic		
Trifolium pratense	red clover	dicot herb	Exotic		
Trifolium repens	white clover	dicot herb	Exotic		
Trifolium subterraneum	subterranean clover	dicot herb	Exotic		
Veronica arvensis	field speedwell	dicot herb	Exotic		
Verbascum thapsus	woolly mullein	dicot herb	Exotic		
Vulpia bromoides	vulpia hair grass, brome fescue, squirrel-tailed fescue	grass	Exotic		
Vulpia myuros	vulpia hair grass, rats tail fescue	grass	Exotic		
Wahlenbergia albomarginata	NZ harebell	dicot herb	Native	Not Threatened	
Erodium cicutarium	storksbill	dicot herb	Exotic		
Leontodon taraxacoides	hawkbit	dicot herb	Exotic		
Poa trivialis	rough-stalked meadow grass	grass	Exotic		
Rosa rubiginosa	sweet briar, briar rose	shrub	Exotic		OOI
Populus alba	white poplar, silver poplar	tree	Exotic		

EVALUATION OF ECOLOGICAL SIGNIFICANCE OF ECOSYSTEMS, HABITATS, AND SPECIES AT THE ŌHAU C SITE AGAINST THE CANTERBURY RPS APPENDIX 3 CRITERIA SET

Ecological Significance Criteria	Shrubland	Cocksfoot Grassland	Herbfield	Dryland	Brassica cropland
Representativeness					
1. Indigenous vegetation or habitat of indigenous fauna that is representative, typical or characteristic of the natural diversity of the relevant ecological district. This can include degraded examples where they are some of the best remaining examples of their type, or represent all that remains of indigenous biodiversity in some areas.	Threshold Not Met	Threshold Not Met	Threshold Not Met	Threshold Not Met	Threshold Not Met
2. Indigenous vegetation or habitat of indigenous fauna that is a relatively large example of its type within the relevant ecological district.	Threshold Not Met	Threshold Not Met	Threshold Not Met	Threshold Not Met	Threshold Not Met
Rarity/Distinctiveness					
3. Indigenous vegetation or habitat of indigenous fauna that has been reduced to less than 20% of its former extent in the Region, or relevant land environment, ecological district, or freshwater environment.	Threshold Not Met	Threshold Not Met	Threshold Not Met	Threshold Not Met	Threshold Not Met
4. Indigenous vegetation or habitat of indigenous fauna that supports an indigenous species that is Threatened, At Risk or uncommon, nationally	**Threshold Met.** Shrubland supports potential habitat for At Risk lizard species.	**Threshold Met.** Foraging banded dotterels (*Charadrius bicinctus,* At Risk – Declining) observed, and potential	**Threshold Met.** New Zealand Blue Butterfly (*Zizina oxleyi* – Declining) observed. Foraging banded	**Threshold Met.** Southern Alps gecko observed (*Woodworthia* "Southern Alps" – At Risk – Declining). Stonefield	**Threshold Met.** Foraging banded dotterels (*Charadrius bicinctus* – At Risk – Declining) observed

Ecological Significance Criteria	Shrubland	Cocksfoot Grassland	Herbfield	Dryland	Brassica cropland
or within the relevant ecological district.	Matagouri (At Risk – Declining) present.	foraging and breeding habitat for tōrea/South Island pied oystercatcher (*Haematopus finschi,* At Risk – Declining) and pīhoihoi/New Zealand pipit (*Anthus novaeseelandiae novaeseelandiae*, At Risk – Declining). Supports potential habitat for At Risk lizard species.	dotterels (*Charadrius bicinctus* – At Risk – Declining) observed.	drylands provide habitat for minute grasshopper (*Sigaus minutus* – At Risk – Declining) foraging for banded dotterels (*Charadrius bicinctus* – At Risk – Declining) and potential foraging and breeding habitat for tōrea/South Island pied oystercatcher (*Haematopus finschi,* At Risk – Declining) and pīhoihoi/New Zealand pipit (*Anthus novaeseelandiae novaeseelandiae*, At Risk – Declining)	and potential foraging and breeding habitat for tōrea/South Island pied oystercatcher (*Haematopus finschi,* At Risk – Declining) and pīhoihoi/New Zealand pipit (*Anthus novaeseelandiae novaeseelandiae*, At Risk – Declining)
5. The site contains indigenous vegetation or an indigenous species at its distribution limit within Canterbury Region or nationally.	Threshold potentially met if Threatened lizard species are confirmed present.	Threshold Not Met	Threshold Not Met	Threshold Not Met	Threshold Not Met
6. Indigenous vegetation or an association of indigenous species that is distinctive, of restricted occurrence, occurs within an originally rare ecosystem, or has developed as a result of an unusual environmental factor or combination of factors.	Threshold Not Met	Threshold Not Met	Threshold Not Met	Threshold Not Met	Threshold Not Met
Diversity and Pattern					
7. Indigenous vegetation or habitat of indigenous fauna that contains a high diversity of indigenous ecosystem or habitat types, indigenous taxa, or has changes in species composition reflecting the existence of diverse natural features or ecological gradients.	Threshold Not Met	Threshold Not Met	Threshold Not Met	Threshold Not Met	Threshold Not Met

Ecological Significance Criteria	Shrubland	Cocksfoot Grassland	Herbfield	Dryland	Brassica cropland
Ecological Context					
8. Vegetation or habitat of indigenous fauna that provides or contributes to an important ecological linkage or network, or provides an important buffering function.	Threshold Not Met	Threshold Not Met	Threshold Not Met	Threshold Not Met	Threshold Not Met
9. A wetland which plays an important hydrological, biological or ecological role in the natural functioning of a river or coastal system.	Threshold Not Met	Threshold Not Met	Threshold Not Met	Threshold Not Met	Threshold Not Met
10. Indigenous vegetation or habitat of indigenous fauna that provides important habitat (including refuges from predation, or key habitat for feeding, breeding, or resting) for indigenous species, either seasonally or permanently.	**Threshold Met.** Shrubland provides habitat for At Risk lizard species.	**Threshold Met.** Provides habitat for At Risk lizard species. This habitat type provides important seasonal habitat for indigenous avifauna	**Threshold potentially met.** Provides potential habitat for minute and short horned grasshopper, and Tekapo ground wētā. This habitat type provides important seasonal habitat for indigenous avifauna	**Threshold Met.** Stonefield drylands provide habitat for the Southern Alps gecko (*Woodworthia* "Southern Alps"; At Risk-Declining). Robust grasshopper may use these rocks as a breeding site. This habitat type provides important seasonal habitat for indigenous avifauna	**Threshold potentially met.** This habitat type may provide seasonal habitat for indigenous avifauna, including tōrea/South Island pied oystercatcher (*Haematopus finschi,* At Risk – Declining) and pīhoihoi/New Zealand pipit (*Anthus novaeseelandiae novaeseelandiae*, At Risk – Declining)

MACKENZIE DISTRICT PLAN RULES AND DEFINITIONS

Vegetation Clearance

Rule 1 - Indigenous Vegetation Clearance excluding indigenous vegetation clearance associated with the Waitaki Power Scheme, the National Grid or the Opuha Scheme
Section 19 – Ecosystems and Indigenous Biodiversity

1.1 Permitted Activities – Indigenous Vegetation Clearance
1.1.1 Clearance of indigenous vegetation is a permitted activity provided one or more of the following conditions are met:

1. The clearance is within 2m of, and for the purpose of:
a) the maintenance or repair of, existing fence lines, vehicle tracks, roads, stock tracks, stock crossings, firebreaks, drains, ponds, dams, stockyards, farm buildings, water troughs and associated reticulation piping, or airstrips; or
b) the operation, maintenance, repair or upgrade of network utilities permitted by Rule 16.1.1.(j).

2. The clearance is of indigenous vegetation which has been planted and is managed specifically for the purpose of harvesting and subsequent replanting of plantation forest within 5 years of harvest and the clearance is not within a location specified in Rule 1.3.2; or

3. The clearance is of the indigenous understorey to plantation forest, and is incidental to permitted or otherwise authorised plantation forest clearance and the clearance is not within a location specified in Rule 1.3.2; or

4. The clearance is of indigenous vegetation which has been planted and/or is managed as part of a domestic garden or has been planted for amenity purposes or as a shelterbelt and the clearance is not within a location specified in Rule 1.3.2; or

5. The clearance is of indigenous vegetation carried out by or on behalf of a local authority for erosion and flood control works, including within 75m of a lake, 20m of the bank of a river, or 50m of any wetland;

6. The clearance is of indigenous vegetation within a defined Farm Base Area (see Appendix R); or

7. The clearance is of indigenous vegetation within an area of improved pasture and the clearance is not within a location specified in Rule 1.3.2.

8. The clearance is not within:
a) 100m of a lake
b) 20m of the bank of a river
c) 100m of an ecologically significant wetland
d) 50m of all other wetlands

1.2 Restricted Discretionary Activity – Indigenous Vegetation Clearance

1.2.1 Unless permitted under Rule 19.1 the clearance of indigenous vegetation clearance is a restricted discretionary activity provided the following conditions are met:
1. The farm enterprise has a Farm Biodiversity Plan (see Definitions).
2. The clearance is not within a Site of Natural Significance or on land above 900m in altitude.

3. The clearance is not within:
a) 100m of a lake
b) 20m of the bank of a river
c) 100m of an ecologically significant wetland
d) 50m of all other wetlands

Definitions[1]:

Improved Pasture: means an area of land where exotic pasture species have been deliberately sown or maintained for the purpose of pasture production, and species composition and growth has been modified and is being managed for livestock grazing.

Indigenous Vegetation: means a community of vascular plants, mosses and/or lichens that includes species native to the ecological district. The community may include exotic species, but does not include vegetation that has been planted as part of a domestic garden, for amenity purposes or as a shelterbelt, or exotic woody pest plants.

Significant indigenous vegetation and significant habitats of indigenous fauna:
means areas of indigenous vegetation or habitats of indigenous fauna which:
a) meet the criteria listed in the Canterbury Regional Policy Statement's Policy 9.3.1 and Appendix 3; or
b) are listed in Appendix I as a Site of Natural Significance; and
c) includes any areas that do not comprise improved pasture within the glacial derived or alluvial (depositional) outwash and moraine gravel ecosystems of the Mackenzie Basin as shown on Figure 1.

Vegetation Clearance: means the felling, clearing or modification of trees or any vegetation by cutting, crushing, cultivation, spraying, burning, irrigation, artificial drainage, and mob stocking. It includes oversowing, topdressing or overplanting on land that is not improved pasture. Clearance of vegetation shall have the same meaning.

Wetland: means a permanently or intermittently wet area, shallow water and land water margins that supports a natural ecosystem of plants and animals that are adapted to wet conditions.

[1] https://www.mackenzie.govt.nz/__data/assets/pdf_file/0003/513948/S03-Definitions-1-PC19-Amendment.pdf

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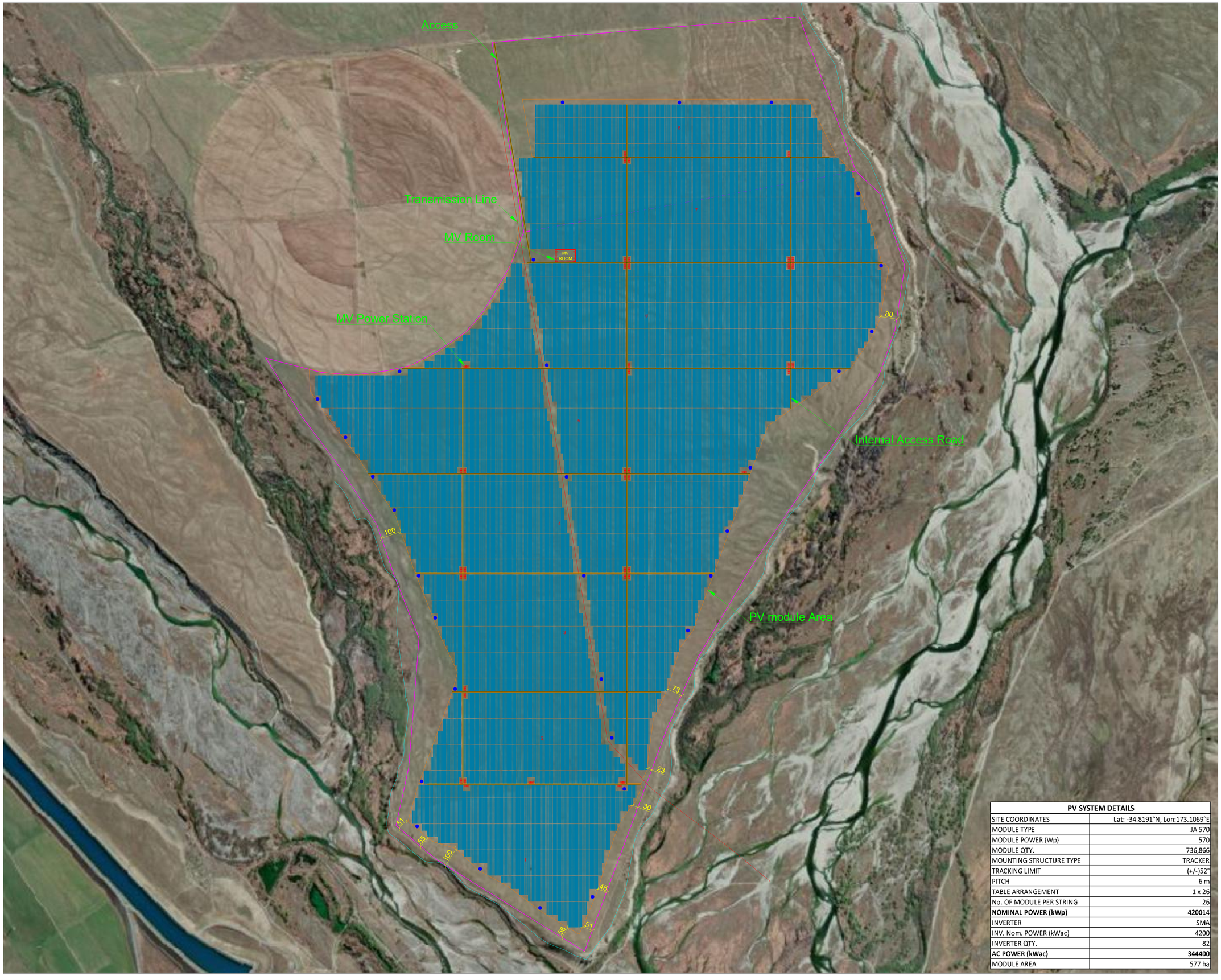
Appendix E: Site Layout Plan and Drawings



PV SYSTEM DETAILS	
SITE COORDINATES	Lat: -34.8191°N, Lon:173.1069°E
MODULE TYPE	JA 570
MODULE POWER (Wp)	570
MODULE QTY.	736,866
MOUNTING STRUCTURE TYPE	TRACKER
TRACKING LIMIT	(+/-)52°
PITCH	6 m
TABLE ARRANGEMENT	1 x 26
No. OF MODULE PER STRING	26
NOMINAL POWER (kWp)	**420014**
INVERTER	SMA
INV. Nom. POWER (kWac)	4200
INVERTER QTY.	82
AC POWER (kWac)	**344400**
MODULE AREA	577 ha

PRELIMINARY DESIGN

N
W E
S

GENERAL NOTES

1. ALL DIMENSIONS ARE IN METER UNLESS OTHERWISE SPECIFIED.
2. FINAL LAYOUT WILL BE DETERMINED AFTER SITE SURVEY.

TRACKER OPTION

LEGEND

- SITE BOUNDARY
- TRANSMISSION LINE
- PLANT ROAD (4m Width)
- MEDIUM VOLTAGE POWER STATION
- MV ROOM
- WATER TANK (FIRE FIGHTING)
- PV MODULE (570Wp)
  (1 x 26 MODULE TRACKER TABLE)

REFERENCE DRAWINGS

No.	DRAWING TITLE	DRAWING No.

R	DATE	DESCRIPTION OF REVISION	REMARKS
F	03-05-2023	UPDATED 100m OFFSET FROM BOUNDARY TO MODULE	
E	22-03-2023	UPDATED INTERNAL ROAD/ INVERTER STATION	
D	15-12-2022	DRAFT - LAYOUT UPDATED	
C	29-11-2022	DRAFT - LAYOUT UPDATED	
B	20-09-2021	DRAFT - DRAINAGE ROUTE UPDATED	
A	14-09-2021	DRAFT	

PROJECT NAME :

GENESIS - OHAU C - 420MWp
NEW ZEALAND

OWNER'S ENGINEER :

GENERAL CONTRACTOR :

AQUILA CAPITAL
GENERATING ESSENTIAL INVESTMENTS

Aquila Capital Renewables Asia Pte. Ltd.
138 Market Street #15-03 CapitaGreen
Singapore 048946. www.aquila-capital.com

		SIGN
DRAWN BY	: HARI	H.S
DATE	: 03-05-2023	
CHECKED BY	: ARUL	A.M
DATE	: 03-05-2023	
APPROVED BY	: TIMO	T.K
DATE	: 03-05-2023	

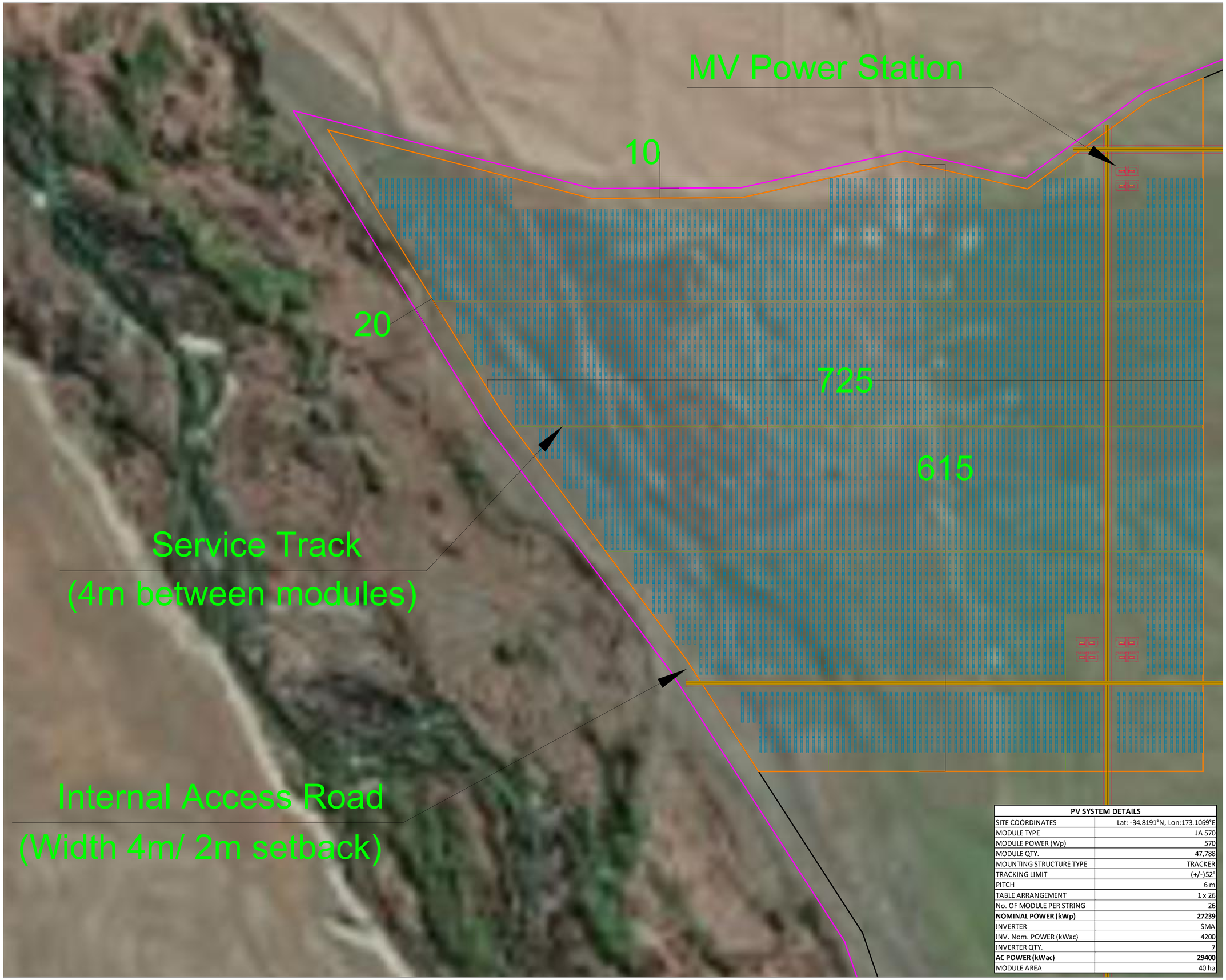
TITLE :

MODULE GENERAL ARRANGEMENT LAYOUT

DRAWING No.

ACRA-NZ-GS-OHA-001

SHEET SIZE	SHEET	SCALE	REV
A1	1 OF 1	1:8500	F



PV SYSTEM DETAILS	
SITE COORDINATES	Lat: -34.8191°N, Lon:173.1069°E
MODULE TYPE	JA 570
MODULE POWER (Wp)	570
MODULE QTY.	47,788
MOUNTING STRUCTURE TYPE	TRACKER
TRACKING LIMIT	(+/-)52°
PITCH	6 m
TABLE ARRANGEMENT	1 x 26
No. OF MODULE PER STRING	26
NOMINAL POWER (kWp)	**27239**
INVERTER	SMA
INV. Nom. POWER (kWac)	4200
INVERTER QTY.	7
AC POWER (kWac)	**29400**
MODULE AREA	40 ha

PRELIMINARY DESIGN

N
W E
S

GENERAL NOTES

1. ALL DIMENSIONS ARE IN METER UNLESS OTHERWISE SPECIFIED.
2. FINAL LAYOUT WILL BE DETERMINED AFTER SITE SURVEY.

TRACKER OPTION

LEGEND

- SITE BOUNDARY
- TRANSMISSION LINE
- PLANT ROAD (4m Width)
- MEDIUM VOLTAGE POWER STATION
- PV MODULE (570Wp) (1 x 26 MODULE TRACKER TABLE)

REFERENCE DRAWINGS

No.	DRAWING TITLE	DRAWING No.

R	DATE	DESCRIPTION OF REVISION	REMARKS
F	27-03-2023	REFERENCE	
E	22-03-2023	UPDATED INTERNAL ROAD/ INVERTER STATION	
D	15-12-2022	DRAFT - LAYOUT UPDATED	
C	29-11-2022	DRAFT - LAYOUT UPDATED	
B	20-09-2021	DRAFT - DRAINAGE ROUTE UPDATED	
A	14-09-2021	DRAFT	

PROJECT NAME :

GENESIS - OHAU C
NEW ZEALAND

OWNER'S ENGINEER :

GENERAL CONTRACTOR :

AQUILA CAPITAL
GENERATING ESSENTIAL INVESTMENTS

Aquila Capital Renewables Asia Pte. Ltd.
138 Market Street #15-03 CapitaGreen
Singapore 048946. www.aquila-capital.com

		SIGN
DRAWN BY	: PHAM	P.H
DATE	: 27-03-2023	
CHECKED BY	: ARUL	A.M
DATE	: 27-03-2023	
APPROVED BY	: TIMO	T.K
DATE	: 27-03-2023	

TITLE :

MODULE GENERAL ARRANGEMENT LAYOUT

DRAWING No.

ACRA-NZ-GS-OHA-001

SHEET SIZE	SHEET	SCALE	REV
A1	1 OF 1	.....	F

Appendix F: Proposed Conditions of Consent

PROPOSED CONDITIONS

1. The activity shall be carried out in general accordance with the assessment and approved plans contained in the resource consent titled *The Point Solar Farm Assessment of Environmental Effects Report*, prepared by Williamson Water & Land Advisory, dated May 2023 and all supporting technical report.

2. This resource consent is granted for a term of 35 years.

Landscaping

3. Implementation of the landscape plan prepared by Rough Milne Mitchell (titled: *Proposed Solar Farm Plan*), dated 25 May 2023, and provided with resource consent titled *The Point Solar Farm Assessment Effects*, prepared by Williamson Water & Land Advisory, is to be undertaken within the first two planting seasons (approximately March-September) directly following commencement of any of the works relating to the solar farm (from detailed design stage onwards) and shall be maintained by the consent holder from that point onwards for the term of the resource consent to the satisfaction of Mackenzie District Council or duly delegated Council officer.
4. The vegetation identified within the landscape plan prepared by Rough Milne Mitchel (titled: *Proposed Solar Farm Plan*) shall not be cut down, damaged or destroyed (except for the purposes of replacing any vegetation that has died or represents an unacceptable risk to buildings or people as a result of a natural event) without the prior written consent of the Council. Such consent may be given in the form of resource consent.
5. The Consent Holder shall ensure that the ground underneath the solar panels is covered in established vegetation at all times to prevent sediments entering stormwater. Should the vegetation under the solar panels not thrive in the shade of the solar panels then the vegetation shall be immediately replaced with shade tolerant species.

General Management Plans

6. The Consent Holder shall submit to Council for certification a Construction Management Plan (CMP) from a Chartered Professional Engineer or the suitably qualified person as defined by Council's Engineering Standard prior to commencing construction. The CMP shall contain information on, and site management procedures, including but not limited to:

    (a) The timing of building and construction works, including hours of work, key project and site management personnel.
    (b) The transportation of construction materials from and to the site and associated controls on vehicles through sign-posted site entrance / exits and the loading / unloading of materials.
    (c) Publicity measures and safety measures, including signage, to inform adjacent landowners and occupiers, pedestrians and other road users.
    (d) Construction drawings, plans, procedures, methods and measures to demonstrate that all the construction activities undertaken on the site will meet the safe distances within the New Zealand Electrical code of Practice for Electrical Safe Distance 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 clearance (Section 3);
iii. Ground to conductor clearance (Section 4);
iv. Mobile plant to conductor clearance (Section 5); and
v. People to conductor clearance (Section 9).

(e) Details on how existing National Grid transmission lines and support structures will remain accessible during and after construction activities.

(f) Details on any areas that may be "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.

7. The Consent Holder or its agent /contractor shall submit an Erosion Sediment Control Plan (ESCP) to the Council's assigned monitoring officer for certification by the Council's Compliance Manager. The ESCP must be prepared by a suitably qualified person who shall provide certification that the erosion and sediment controls in the ESCP have been designed in accordance with the relevant best practice guidelines. As a minimum, the ESCP shall include the following:
   (a) The expected duration (timing and staging) of earthworks;
   (b) Details of all erosion and sediment controls;
   (c) Diagrams and / or plans of a scale suitable for on-site reference, showing the locations of any cut and fill operations (including earthworks for internal accessways);
   (d) The commencement and completion dates for the implementation of the proposed erosion and sediment controls;
   (e) Measures to minimise sediment being deposited on public roads;
   (f) Measures to ensure sediment or dust discharge from the earthwork's activity does not create a nuisance on neighbouring properties;
   (g) Measures to prevent spillage of fuel, oil and similar contaminants;
   (h) Means of ensuring contractor compliance with the ESCP; and
   (i) The name and telephone number of the person responsible for monitoring and maintaining all erosion and sediment control measures.

8. A Construction Traffic Management Plan (CTMP) shall be prepared by a suitably qualified and experienced person. The objective of the CTMP is to provide a framework to be adopted by the Consent Holder to avoid, remedy or mitigate any actual or potential adverse traffic effects of the construction works. The CTMP shall be submitted to Mackenzie District Council for certification at least three months prior to the construction commencement date.

9. The CTMP shall include consideration of:
   (a) Minimisation of the safety impacts of construction activities on the users of public roads;
   (b) Means by which the total number of truck movements to and from the construction activities could be minimised (e.g. back loading of departing vehicles); and
   (c) Means by which the movement of large machinery can be undertaken at times and in a manner that minimises effects on public road users.

Lizards

10. At least three months prior to the construction commencement date, the Consent Holder shall provide for the certification of Mackenzie District Council a Lizard Management Plan to minimise any potential effects on indigenous skinks / geckos within the vegetation. Copies of any Department of Conservation permits (if required) shall be attached to the plan. The Lizard Management Plan shall be prepared by a suitably qualified and experienced herpetologist and shall include:
    (a) Timing of the works;
    (b) A description of the salvaging methodology;
    (c) A description of relocation methodology, including transfer methods, relocation site(s) selection and habitat enhancement methods (such as deployment of logs and pest control).

Avifauna

11. At least three months prior to the construction commencement date, the Consent Holder shall provide for the certification of Mackenzie District Council an Avifauna Management Plan (AMP). The AMP shall be prepared by a suitably qualified and experienced ecologist. The purpose of the AMP is to minimise any potential effects on avifauna from the construction and operational activities. The AMP shall include:
    (a) Timing of works to minimize disturbance during breeding times and disturbance to eggs and chicks;
    (b) Proposed measures for maintaining appropriate setbacks during peak breeding season (September – December); and
    (c) A process for ensuring no nesting birds are present within vegetation to be cleared if works are required during peak breeding season (September – December).

Robust Grasshopper

12. At least three months prior to the construction commencement date, the Consent Holder shall provide for the certification of Mackenzie District Council a Robust Grasshopper Management Plan (RGMP). The purpose of the RGMP is to describe the specific procedures to address potential adverse effects associated with the construction and operation of the project on the Robust Grasshopper. The RGMP shall be prepared by a suitably qualified and experienced ecologist and shall include:

    (a) Timing of works; and
    (b) Relocation methods, including transfer methods and selection of appropriate relocation site(s).

Ecological Enhancement Plan

13. At least three months prior to the construction commencement date, the Consent Holder shall provide for certification of Mackenzie District Council an Ecological Enhancement Plan (EEP). The purpose of the EEP is to describe how indigenous vegetation on the site will be managed during the term of the resource consent. The EEP shall be prepared by a suitably qualified and experienced ecologist and shall include:

    (a) Measures for how invasive species will be managed on site;
    (b) Measures outlining soil cultivation and weed control; and
    (c) Monitoring to assess the ongoing success of the ecological enhancement initiatives.

Works in Proximity to National Grid Infrastructure

14. The Consent Holder shall provide Transpower NZ Ltd 10 working days notice in writing prior to commencing the proposed works.
    Advice note: notification can be sent to transmission.corridor@transpower.co.nz

15. No buildings or structures shall be located within 12 metres of the centre of Transpower's transmission lines.

16. No buildings or structures shall be located within 12 metres of any outer visible edge of the foundation of the National Grid support structures on site, except for non-conductive fencing, which can be located 6 m from any outer visible edge of the support structure foundation.

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

18. All buildings, structures and vegetation must be located to ensure vehicle access is maintained to Transpower's National Grid transmission lines and support structures for maintenance at all reasonable times, and emergency works at all times.

19. All machinery and mobile plant operated in associated with the works shall maintain a minimum clearance distance of 4 metres from the live overhead conductors (wires) of Transpower's National Grid transmission lines at all times to avoid the potential of machinery striking the lines.

20. All machinery, mobile plant and vehicles operating within 12 metres of the 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 transmission lines.

21. Any proposed vegetation or trees within 12 metres either side of Transpower's National Grid transmission lines 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.

22. Any proposed new trees or vegetation outside of 12 metres either side of the centreline of Transpower's National Grid transmission lines must be setback sufficiently to ensure the trees / vegetation 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.

23. The CMP as required under Condition 6, must be provided to Transpower NZ Ltd for its certification at least 20 working days prior to being submitted to Council.

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

Appendix G: Glint and Glare Study

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.

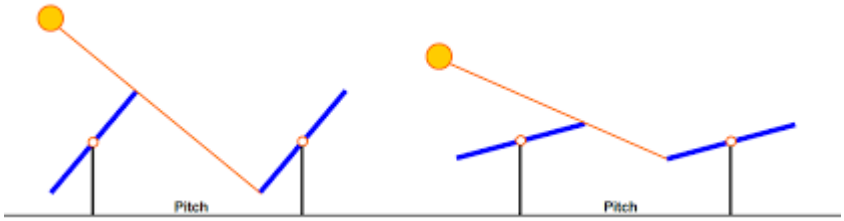


Figure 1. Example of how panel tilt decreasing after the start of shading, therefore avoiding high tilt angles that may cause low angle reflections (i.e. towards ground observers).

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.

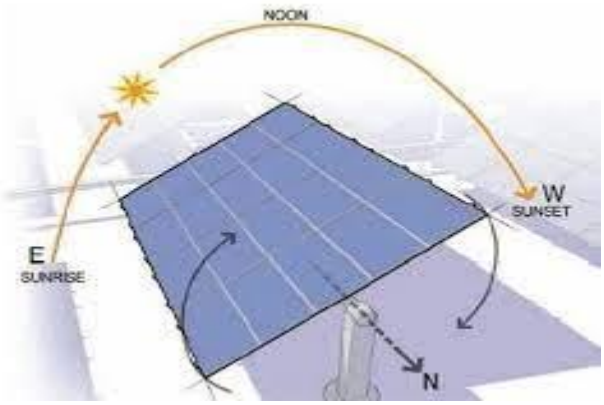
References:

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=cmVjb3JkX251bWJlcj02NjY5JmZpbGVuYW1lPVxcbnMwMS0wMDI5XGZpbGVkYXRhMiRcREIwMy0wMDMwXFNoYXJlZEFwcHNcRExHU1xQbGFuc1xQTEFOTklOR1xGLTMzNzNcMTMgQXBwZW5kaXggRSBHbGludCBhbmQgR2xhcmUgQXNzZXNzbWVudC5wZGYmaW1hZ2VfbnVtYmVyPTEzJmltYWdlX3R5cGU9cGxhbm5pbmcmbGFzdF9tb2RpZmllZF9mcm9tX2Rpc2s9MTcvMDkvMjAxNSAwODo0OTozMA==

Solar mounting options:



Single Axis tracker

Fixed tilt solar farm

East-West solar mounting

Appendix H: Pre-Application Minutes

Laila Alkamil <laila.alkamil@wwla.kiwi>

Re: Ohau Solar Farm - Pre -App minutes

1 message

Laila Alkamil <laila.alkamil@wwla.kiwi>
To: Laila Alkamil <laila.alkamil@wwla.kiwi>

2 June 2023 at 10:25

On Fri, 1 Jul 2022, 10:38 Laila Alkamil, <laila.alkamil@wwla.kiwi> wrote:

Hi all,

Please see the minutes below from the pre-app meeting - let me know if I've missed anything.

1. Solar panels will be classed as building structures and utilities (will need to check Section 16 for rule provisions)
2. Plan Change 18 (section 17) applies to the works as well.
3. Consent likely will be required for both sites as a discretionary activity.
4. All of the rural zone is classified as an Outstanding Natural Landscape and therefore a landscape assessment for Ohau C will be required.
5. Landscape assessment would also be required for Ohau A for structures in a No Building Overlay.
6. Ecological Assessment will also be required for clearance of indigenous biodiversity.
7. Stormwater consent will be need to be applied for under the regional council (ECAN)
8. Landscape assessment for either site will need to be comprehensive (visual simulations / cross sections, etc)
9. Rachael Willox (Senior Planner) will provide AEE report for other solar farm consented in the district and contact for Mana Whenua representative.
10. Consultation with affected landowners will be determined once landscape assessment is complete.

In terms of the next steps, would you like me to progress with the preliminary planning assessment for both sites? Based on our conversation with Rachael, it sounds like they are similar in terms of consenting requirements - i.e. a comprehensive landscape assessment and ecological report will be required as part of the AEE. The preliminary planning assessment however may help in the site-selection process.

Kind regards
Laila

Laila Alkamil | Planner
Williamson Water and Land Advisory

Phone | +64 27 266 8405
Email | Laila.Alkamil@wwla.kiwi
Web | https://www.wwla.kiwi/

10/1 Putaki Drive | Kumeu | Auckland | New Zealand

Appendix I: Stakeholder and Mana Whenua Correspondence

WILLIAMSON WATER & LAND ADVISORY

Laila Alkamil <laila.alkamil@wwla.kiwi>

Fwd: solar farm development in Ngāi Tahu rohe

1 message

Greg Hay <greg@fnsf.co.nz> 3 March 2023 at 13:29
To: John Telfer <johnt@fnsf.co.nz>, Richard Homewood <Richard@fnsf.co.nz>, Laila Alkamil <laila.alkamil@wwla.kiwi>

see below for my approach to Ngai Tahu. No reply as yet.

-------- Forwarded message --------
From: **Greg Hay** <greg@fnsf.co.nz>
Date: Tue, 28 Feb 2023 at 06:37
Subject: solar farm development in Ngāi Tahu rohe
To: <jacqui.caine@ngaitahu.iwi.nz>

Tēnā koe Jacqui

Ko Ingarangi te whakapaparanga mai. Ko Te Mata te maunga, Ko Tukituki te Awa, No Havelock North ahau, Kei Whangārei au e noho ana, Ko Greg Hay toko ingoa.

I am writing to introduce myself on behalf of Far North Solar Farm with the hope of initiating a korero about plans to construct a solar farm within the rohe of Ngāi Tahu.

I wanted to reach out to you personally as the Group Head Strategy & Environment to express our sincere hope that we might be able to visit, manaaki and korero to explain a little more about our intention to invest in the rohe and what a solar farm actually is.

Large-scale solar farms are new to Aotearoa and whilst the vast majority of us acknowledge the need to find cleaner and more sustainable energy sources, we feel it is only tika to make sure that Ngāi Tahu as tangata whenua are properly consulted about our planned developments.

Our mahi is focused on two sites in Te Manahuna near Ōhau roto and we have agreements in place with landowners there. The solar farm would be a significant development and cover some 900 hectares. We also have multiple other sites in various stages of development across the motu.

Naturally, a development of the scale we are proposing will necessitate a level of formal procedure over a long period of time, but our intention here, today, really is in the spirit of whanaungatanga as I believe establishing meaningful relationships begins with trust.

There is of course much more detail to share but at the risk of writing a short story here, perhaps we could expand on this kaupapa kanohi ke te kanohi later in March if that suited you?

I look forward to your thoughts, Jacqui

Ngā mihi nui
Greg
021545054

WILLIAMSON WATER & LAND ADVISORY

Laila Alkamil <laila.alkamil@wwla.kiwi>

Fwd: Ngai Tahu meeting confirmed

1 message

Richard Homewood <Richard@fnsf.co.nz> 5 April 2023 at 09:11
To: Laila Alkamil <Laila.Alkamil@wwla.kiwi>

---------- Forwarded message ---------
From: **Greg Hay** <greg@fnsf.co.nz>
Date: Thu, 30 Mar 2023, 10:28 am
Subject: Re: Ngai Tahu meeting confirmed
To: Richard Homewood <Richard@fnsf.co.nz>
Cc: John Telfer <johnt@fnsf.co.nz>, John Andrews <john@fnsf.co.nz>

In person.

On Thu, 30 Mar 2023 at 10:26, Richard Homewood <Richard@fnsf.co.nz> wrote:

> Hey Greg
>
> Great news
>
> Is it in person or Teams?
>
> Cheers
>
> On Thu, 30 Mar 2023, 10:11 am Greg Hay, <greg@fnsf.co.nz> wrote:
>
> > Morning all
> >
> > Have confirmed a meeting with Jacqui Caine, Group Head, Strategy & Environment at Ngai Tahu for Friday 19th May 11-12pm.
> >
> > Please confirm who wants/needs to attend today so they can schedule an invite. Max of three people imo... does Aquila need to be there at this stage??
> >
> > cheers
> >
> > --
> >
> > Greg Hay
> >
> > Communications Lead
> >
> > Email: greg@fnsf.co.nz
> >
> > Web: www.fnsf.co.nz
> >
> > MB: +6421545054

WILLIAMSON WATER & LAND ADVISORY

Laila Alkamil <laila.alkamil@wwla.kiwi>

Fwd: Ohau solar farm

1 message

Richard Homewood <Richard@fnsf.co.nz> 26 May 2023 at 16:28
To: Laila Alkamil <Laila.Alkamil@wwla.kiwi>

---------- Forwarded message ---------
From: **Greg Hay** <greg@fnsf.co.nz>
Date: Fri, 26 May 2023 at 15:51
Subject: Ohau solar farm
To: Fiona Pimm (Rep) <Fiona.Pimm@ngaitahu.iwi.nz>, Justin Tipa (Rep) <Justin.Tipa@ngaitahu.iwi.nz>, Jo McLean (Rep) <Jo.McLean@ngaitahu.iwi.nz>
Cc: Richard Homewood <Richard@fnsf.co.nz>, John Telfer <johnt@fnsf.co.nz>, Aziz Elbayeh <aziz@fnsf.co.nz>

Kia ora koutou

Firstly, Justin and Jo, it was nice to be able to meet and mihi kanohi ke te kanohi earlier in the week at the Murihiku Regenerate Wānanga. Thank you both for your time. Fiona, I haven't been able to introduce myself in person yet so my apologies.

Picking up Jacquie's email introduction, and following on from the brief korero I have had with you both Justin and Jo, Far North Solar Farm would very much like to formally engage with each of you as we seek to progress our solar farm developments in Te Manahuna, Ohau.

I note that Waihao and Moeraki each use consultancy Aukaha in matters relating to project developments and resource consents while Te Rūnanga to Arowhenua engage Aoraki Environmental Consultancy Limited (AEC).

Our approach to you each as mana whenua has two different aspects to it, I think. One is concerning the official matters relating to resource consenting and the requirements therein regarding developers and mana whenua. The other is in seeking to establish a friendly relationship based on mutual trust and respect which endures and prospers over time.

Our proposed solar farm developments would be on the whenua generating renewable energy for up to 60 years so it is a relationship that could conceivably span generations.

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If you would be kind enough to also advise a contact at your respective consultancies I will forward to them also, if that is appropriate. We are keen to understand if tangata whenua would like to prepare a cultural values assessment / impact report based on the proposed developments. Please note the link to download the material only remains active for six days.

I look forward to your thoughts and guidance.

Ngā mihi nui
Greg

--

Greg Hay

Communications Lead

Email: greg@fnsf.co.nz

Web: www.fnsf.co.nz

MB: +6421545054

image001.jpg
7K

WILLIAMSON WATER & LAND ADVISORY

Laila Alkamil <laila.alkamil@wwla.kiwi>

Fwd: Solar farm development in Ngāi Tahu rohe

1 message

Greg Hay <greg@fnsf.co.nz> 30 June 2023 at 12:49
To: Laila Alkamil <laila.alkamil@wwla.kiwi>

correspondence with Ngai Tahu themselves. Our approach was to go tho them at an iwi level and engage, they then filtered it down to the Rūnanga to process as mana whenua.

---------- Forwarded message ---------
From: **Jacqui Caine** <Jacqui.Caine@ngaitahu.iwi.nz>
Date: Mon, 22 May 2023 at 10:12
Subject: Solar farm development in Ngāi Tahu rohe
To: Greg Hay <greg@fnsf.co.nz>, Fiona Pimm (Rep) <Fiona.Pimm@ngaitahu.iwi.nz>, Justin Tipa (Rep) <Justin.Tipa@ngaitahu.iwi.nz>, Jo McLean (Rep) <Jo.McLean@ngaitahu.iwi.nz>, Tania Wati (Rep) <TuahuririRep@ngaitahu.iwi.nz>
Cc: Kelly Chapman <Kelly.Chapman@ngaitahu.iwi.nz>

Tēnā koutou katoa

I'm writing to connect Papatipu Rūnanga and Far North Solar Farms about solar projects that Far North Solar Farms are seeking to progress in the Ngāi Tahu takiwā.

I met with Far North Solar Farms on Friday – they ran through the attached presentation and are keen to engage with mana whenua. You will see there are three projects being considered within the Ngāi Tahu takiwā:

- The Point and Ohau Solar - Arowhenua, Moeraki, Waihao (the Representatives are Fiona Pimm, Justin Tipa and Jo McLean respectively)
- Waipara - Ngāi Tūāhuriri Rūnanga (the Representative is Tania Wati)

Greg - I have copied the Representatives into this email so you can connect with them direct. They may refer you to their Rūnanga Chair or relevant Regional Environmental Entity. I will leave it to you to follow up with them direct.

Jo McLean and the Executive Director for Waihao, Trudy Heath, will be at the Murihiku Regenerate Innovation and Energy Wānanga this week so there may be an opportunity for you to connect with them there should you or your colleagues attend.

Ngā mihi

Jacqui

> ---------- Forwarded message ---------
> From: **Greg Hay** <greg@fnsf.co.nz>
> Date: Tue, 28 Feb 2023 at 06:37
> Subject: solar farm development in Ngāi Tahu rohe
> To: <jacqui.caine@ngaitahu.iwi.nz>

WILLIAMSON WATER & LAND ADVISORY

Laila Alkamil <laila.alkamil@wwla.kiwi>

Fwd: Aukaha Letter of Engagement - J005169

1 message

Greg Hay <greg@fnsf.co.nz> 30 June 2023 at 12:47
To: Laila Alkamil <laila.alkamil@wwla.kiwi>

See correspondence and attachments for your reference. This is for Te Runanga o te Waihao (one of the three runanga we were advised to engage with by Ngai Tahu).

---------- Forwarded message ---------
From: **Makareta Wesley-Evans** <makareta@aukaha.co.nz>
Date: Tue, 13 Jun 2023 at 14:43
Subject: Aukaha Letter of Engagement - J005169
To: Greg Hay <greg@fnsf.co.nz>
Cc: aukaha@emailmyjob.com <aukaha@emailmyjob.com>

Kia ora Greg

Thank you for lodgment of your application through our website. The attached letter of engagement is background on what Aukaha (formerly KTKO) undertakes, our hourly rates and a copy of our Term & Conditions - which you agreed to at the time of submitting your application. For more information on what we do here at Aukaha, you can visit our website at www.aukaha.co.nz

We are currently experiencing staff shortages due to the effects of COVID, which means there may be a delay in the consents processes. We do apologize for the inconvenience this may cause and appreciate your understanding and patience while we work through this.

I will be your contact for all administration matters. If you have any questions or concerns please do not hesitate to get in touch, otherwise you will hear back from us very soon.

Kā mihi

Makareta Wesley-Evans

Kaimahi Whakaaetaka Taiao (Consents Officer)|Mana Taiao

Aukaha

Level 2, 266 Hanover Street, Dunedin 9016 | PO Box 446, Dunedin 9054

Tari: 03 477 0071

www.aukaha.co.nz

Aukaha Letter of Engagement - J005169 .pdf
175K

Tēnā koe Jacqui

Ko Ingarangi te whakapaparanga mai. Ko Te Mata te maunga, Ko Tukituki te Awa, No Havelock North ahau, Kei Whangārei au e noho ana, Ko Greg Hay toko ingoa.

I am writing to introduce myself on behalf of Far North Solar Farm with the hope of initiating a korero about plans to construct a solar farm within the rohe of Ngāi Tahu.

I wanted to reach out to you personally as the Group Head Strategy & Environment to express our sincere hope that we might be able to visit, manaaki and korero to explain a little more about our intention to invest in the rohe and what a solar farm actually is.

Large-scale solar farms are new to Aotearoa and whilst the vast majority of us acknowledge the need to find cleaner and more sustainable energy sources, we feel it is only tika to make sure that Ngāi Tahu as tangata whenua are properly consulted about our planned developments.

Our mahi is focused on two sites in Te Manahuna near Ōhau roto and we have agreements in place with landowners there. The solar farm would be a significant development and cover some 900 hectares. We also have multiple other sites in various stages of development across the motu.

Naturally, a development of the scale we are proposing will necessitate a level of formal procedure over a long period of time, but our intention here, today, really is in the spirit of whanaungatanga as I believe establishing meaningful relationships begins with trust.

There is of course much more detail to share but at the risk of writing a short story here, perhaps we could expand on this kaupapa kanohi ke te kanohi later in March if that suited you?

I look forward to your thoughts, Jacqui

Ngā mihi nui

Greg

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FNSF_Solar.pdf
3745K

WILLIAMSON WATER & LAND ADVISORY

Laila Alkamil <laila.alkamil@wwla.kiwi>

Fwd: Ohau solar farm development

1 message

Greg Hay <greg@fnsf.co.nz> 30 June 2023 at 12:56
To: Laila Alkamil <laila.alkamil@wwla.kiwi>

Correspondence with Te Rūnanga o Moeraki - they have not responded to emails and requests to engage. However, they are represented by the same agency as used by Arowhenua so it is likely that they will get access to the same report. I did meet with Justin Tipa at the Murihiku Regenerate Wānanga in Invercargill in May. I gave him a hard copy (attached) and talked about the proposal and asked how we should go forward with engagement etc.

---------- Forwarded message ---------
From: **Greg Hay** <greg@fnsf.co.nz>
Date: Tue, 6 Jun 2023 at 13:32
Subject: Ohau solar farm development
To: Justin Tipa (Rep) <Justin.Tipa@ngaitahu.iwi.nz>
Cc: Richard Homewood <Richard@fnsf.co.nz>, John Telfer <johnt@fnsf.co.nz>, Aziz Elbayeh <aziz@fnsf.co.nz>

Kia ora Justin

Hope you are well. Just following up on my previous email regarding our wish to engage with Te Rūnanga o Moeraki as mana whenua in Ohau over plans to develop a utility-scale solar farm near the northern shores of lake Benmore in the Mackenzie basin.

We have engaged with Arowhenua on the issue and have supplied information to their environmental consultant to assess. It is likely we will submit a resource consent application for the solar farm shortly.

Arowhenua have indicated a site visit would be required as part of their process and have suggested we try to ensure a Moeraki representative is there at the same time. Would this be something that interests you?

We are also keen to understand if you would like to prepare a cultural values assessment / impact report based on the proposed developments.

Ngā mihi
Greg

Ngai Tahu (email).pdf
3741K

WILLIAMSON WATER & LAND ADVISORY

Laila Alkamil <laila.alkamil@wwla.kiwi>

Fwd: Ohau solar farm

1 message

Greg Hay <greg@fnsf.co.nz> 30 June 2023 at 12:57
To: Laila Alkamil <laila.alkamil@wwla.kiwi>

more to add to the pile.

---------- Forwarded message ---------
From: **Greg Hay** <greg@fnsf.co.nz>
Date: Fri, 26 May 2023 at 15:51
Subject: Ohau solar farm
To: Fiona Pimm (Rep) <Fiona.Pimm@ngaitahu.iwi.nz>, Justin Tipa (Rep) <Justin.Tipa@ngaitahu.iwi.nz>, Jo McLean (Rep) <Jo.McLean@ngaitahu.iwi.nz>
Cc: Richard Homewood <Richard@fnsf.co.nz>, John Telfer <johnt@fnsf.co.nz>, Aziz Elbayeh <aziz@fnsf.co.nz>

Kia ora koutou

Firstly, Justin and Jo, it was nice to be able to meet and mihi kanohi ke te kanohi earlier in the week at the Murihiku Regenerate Wānanga. Thank you both for your time. Fiona, I haven't been able to introduce myself in person yet so my apologies.

Picking up Jacquie's email introduction, and following on from the brief korero I have had with you both Justin and Jo, Far North Solar Farm would very much like to formally engage with each of you as we seek to progress our solar farm developments in Te Manahuna, Ohau.

I note that Waihao and Moeraki each use consultancy Aukaha in matters relating to project developments and resource consents while Te Rūnanga to Arowhenua engage Aoraki Environmental Consultancy Limited (AEC).

Our approach to you each as mana whenua has two different aspects to it, I think. One is concerning the official matters relating to resource consenting and the requirements therein regarding developers and mana whenua. The other is in seeking to establish a friendly relationship based on mutual trust and respect which endures and prospers over time.

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I look forward to your thoughts and guidance.

Ngā mihi nui
Greg

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Greg Hay

Communications Lead

Email: greg@fnsf.co.nz

Web: www.fnsf.co.nz

MB: +6421545054

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7K

Agreement for Consultant Engagement Between (client): Far North Solar Farms And Aoraki Environmental Consultancy Limited (AEC)	
Purpose: Initial consultation on proposed construction of solar farm within the Arowhenua rohe, review of documentation, hui to discuss and site visit Project Reference: FNS P1	Project Location: Within Te Manahuna rohe - The Point and Ohau Solar

Scope of work – Stage 1 Initial consultation

AEC will:

- Review all documentation, including proposed site plan and draft resource consent application
- Meet with Greg Hay and team by Zoom/MS teams to discuss proposal, documentation provided.
- Attend site visit alongside AEC Cultural Consultants, Greg Hay and team, and Mackenzie District Council
- Provide a formal written report of the Rūnanga response to the proposal, including any recommendations.

It is acknowledged that other Rūnanga (Te Rūnanga o Moeraki and Te Rūnanga o Waihao) will need to be consulted separately as well (and to be in attendance at the site visit).

Expected Delivery date: TBC
Hourly rates (based on actual time recorded by individual team member) as follows:
Principal Planner - $225.00 per hour plus GST
Senior Environmental Policy Advisor - $225.00 per hour plus GST
Cultural consultants – per consultant - $175.00 per hour plus GST
Site visit: Travel time at half hourly rate per person attending
Mileage at IRD current rate

Every endeavour is made to meet timeframes, however Rūnanga work is variable and unexpected events such as sickness or tangi may result in delays in AEC receiving feedback back from the Rūnanga. AEC will make every effort to ensure that this does not delay your work, and AEC will advise you if any delays may occur and discuss with you amended timeframes.

Signed by Far North Solar Farms on behalf of: Aziz Elbayeh Printed Name: Aziz Elbayeh Date: 1/6/2023	For Aoraki Environmental Consultancy Ltd: Name: Ally Crane Date: 1 June 2023
Far North Solar Farms Accounts billing email address: AZIZ@FNSF.CO.NZ Client order number: GH1	Bank Account: ANZ Timaru 01-0886-0744067-000 GST number: 120-625-084 Reference: FNS P1
Aoraki Environmental Consultancy Limited is a charitable company that is owned by and supports Arowhenua Rūnanga.	