

Under the

FAST-TRACK APPROVALS ACT 2024

In the matter of

an application to construct and operate a solar farm across approximately 320 hectares, and connect and supply electricity to the national grid

By

LODESTONE ENERGY LIMITED

Applicant

STATEMENT OF EVIDENCE OF MICHAEL HARDING

TERRESTRIAL ECOLOGY

for

DIRECTOR GENERAL OF CONSERVATION

2 February 2026

Table of Contents

Introduction	3
Qualifications and Experience	3
Code of Conduct	5
Scope	5
Material Considered	5
Summary	6
Ecological Context	7
Vegetation and Flora at the Solar Farm Site	9
Significance of Vegetation and Flora	12
Adverse Effects of the Solar Farm.....	14
Management of Adverse Effects	16
Conclusion.....	19
Attachment 1: DOC Vegetation and Flora Report.....	20

List of Abbreviations

BBOP	Business and Biodiversity Offsets Programme
CRPS	Canterbury Regional Policy Statement
DOC	Department of Conservation
MDC	Mackenzie District Council
MDP	Mackenzie District Plan
NPS-IB	National Policy Statement for Indigenous Biodiversity 2023
PC13	Mackenzie District Plan Change 13
PC18	Mackenzie District Plan Change 18
RFI	Request for Information
SONS	Sites of Natural Significance
WDC	Waitaki District Council

Introduction

1. My full name is Michael Arthur Coupland Harding.
2. I have been asked by the Director General of the Department of Conservation (DOC) to provide expert evidence on the terrestrial indigenous vegetation and flora at the site of Lodestone Energy Limited's proposed Haldon solar farm.

Qualifications and Experience

3. I am an independent Environmental Consultant working from offices in Nelson and Dunedin. I have papers in Botany and Geology from Otago University (1980) and a Diploma in Parks and Recreation Management (with Distinction) from Lincoln University (1986). I have seven years' experience in national park management and conservation advocacy, and a subsequent thirty years' experience as an independent ecologist.
4. My work as an independent ecologist has included field surveys of indigenous vegetation and habitat, assessments of ecological significance, assessments of priorities for protection of indigenous ecosystems, and advice on management of indigenous ecosystems, throughout New Zealand though principally in the eastern South Island.
5. I am intimately familiar with the vegetation, flora and ecosystem processes of the Mackenzie Basin. Much of my consultancy work in recent years has been field survey and assessment of dryland ecosystems in the Waitaki Basin, including the part of the basin that lies within Mackenzie District. Work that is especially relevant to this consent application includes:
 - a) Administration of a riverbed vegetation survey (at 739 sites) throughout the Waitaki Basin (DOC Project River Recovery contract, 2002/2003), an outcome of which is a published report.¹

¹ Woolmore, C.B.; 2011. The vegetation of braided rivers in the upper Waitaki basin, South Canterbury, New Zealand. *Canterbury Series 0211*. Department of Conservation, Christchurch.

- b) Preparation of a Canterbury Land Protection Strategy,² which describes the indigenous ecosystems of each ecological district in Canterbury Region, assesses the extent to which each ecosystem is depleted, and identifies priorities for protection.
- c) Survey of vegetation and/or collation of specialists' survey reports on high country pastoral leases, including six Waitaki Basin properties, for the Pastoral Lease Tenure Review Programme (DOC contracts, 1994 to 2015).
- d) Survey and review of 24 existing Mackenzie District Sites of Natural Significance (SONS) (Appendix I, MDP) and survey of an additional 74 SONS (MDC contracts), most of which lie in the Mackenzie Basin. This work comprised approximately 420 hours field survey work in the Mackenzie Basin between 2013 and 2020.
- e) Review of consent applications for vegetation clearance at sites in the Mackenzie Basin, assessment of those applications against Mackenzie District Plan (MDP) vegetation clearance rules, and assessment of the ecological significance of those sites (independent advice to MDC). This work comprised approximately 180 hours field survey work in the Mackenzie Basin between 2014 and 2020.
- f) Survey of and contribution to scientific research into the distribution and health of threatened dryland cress (*Lepidium*) species in the Waimakariri Basin, Mackenzie Basin and Central Otago (2021 to 2023).³
- g) Preparation of maps of land converted to pasture or crops throughout the Waitaki Basin (including the Mackenzie Basin) in 2020 (MDC and WDC contract) and a revision of that mapping in 2026 (DOC contract).
- h) Preparation and presentation of evidence on terrestrial ecology at the Environment Court Hearing for Mackenzie District Plan Change 13 (Eleventh Decision-2017).
- i) Preparation and presentation of evidence on terrestrial ecology at the Commissioner Hearing 2020, and at the Environment Court Hearing 2024, for Mackenzie District Plan Change 18.

² Harding, M.A. 2009. Canterbury Land Protection Strategy. Nature Heritage Fund, Wellington.

³ Walker, S.; Harding, M.A.C.; Loh, G. 2023. The pattern of declines and local extinctions of endemic inland *Lepidium* species in the eastern South Island. NZ Journal of Ecology 47(1): 3547.

- j) Preparation and presentation of terrestrial ecology evidence at the Commissioner Hearing 2023 in response to an application for construction of a solar farm at Balmoral Station (Mackenzie Basin).

Code of Conduct

6. I have read the code of conduct for expert witnesses contained in the Environment Court's Practice Note 2023 (the Code). I have complied with the Code when preparing this written statement of evidence. The data, information, facts, and assumptions I have considered in forming my opinions are set out in my evidence. Unless I state otherwise, this evidence is within my sphere of expertise, and I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

Scope

7. I have been asked by the Director General of Conservation to provide expert evidence on terrestrial vegetation and flora in response to the application by Lodestone Energy Limited for consent to construct and operate a solar farm at Haldon Station.
8. The principal issues addressed in this evidence are:
 - a) The characteristics and value of indigenous ecosystems at this part of the Mackenzie Basin (ecological context).
 - b) The vegetation and flora at the solar farm site and the significance of that indigenous vegetation and flora.
 - c) The likely adverse effects of a solar farm.
 - d) The management of those adverse effects.

Material Considered

9. In preparing this evidence I have read the following documents. Other documents and papers are referenced in footnotes throughout this evidence.
 - a) Lodestone Energy Limited – Haldon Solar Project – Application for Approvals Under the Fast-Track Approvals Act 2024. Mitchell Daysh, 29 August 2025.

- b) AgScience Limited, 31 July 2025. Haldon Solar Project Ecological Impact Assessment, 52p.
- c) SLR Terrestrial Invertebrate Assessment Haldon Solar Farm, 20 January 2026 (draft), 21p (plus appendices).
- d) Lodestone Energy Limited. Applicant Response to Panel Minute 1, 12 December 2025.
- e) Lodestone Energy Limited, Response to Letter RFI under s67, 23 January 2026, 15p.
- f) Harding, M. Haldon Station Solar Array Site Vegetation Assessment, 10 December 2025. Report to DOC (Attachment 1 of this evidence), 10p.

Summary

10. The proposed Haldon solar farm site (the **site**) lies on the lower-altitude part of the Tekapō outwash terrace sequence, which is a Threatened (critically endangered) ‘naturally uncommon’ ecosystem. Depositional landforms in the Mackenzie Basin – such as these outwash gravels – are exceptional nationally for their scale, connectedness and lack of development.
11. Vegetation at the site is modified and degraded, as is typical for undeveloped (uncultivated/unirrigated) outwash terrace sites. However, this vegetation has more indigenous species than naturalised/exotic species and has a high proportion of indigenous non-vascular plant cover (mosses and lichens). It supports populations of at least eight At Risk and Threatened vascular plant species, including a ‘nationally critical’ species (*Lepidium solandri*).
12. Vegetation and flora at the site have not yet been adequately surveyed. The Application still lacks a description of the vegetation and flora that is adequate for a complete assessment of the ecological importance of the site, or for robust assessment of the effects of the activity. Vegetation and flora at the site are likely to be more important/significant than documented to date.
13. Despite the limited information, data gathered to date, principally from a brief DOC inspection (Attachment 1), confirms that the site supports ‘indigenous vegetation’ (as

defined by the Mackenzie District Plan) and that the site is ecologically significant (as assessed against the Canterbury Regional Policy Statement criteria).

14. Construction of the solar farm will clear vegetation and disturb soils over a substantial proportion of the site (c.13 hectares). The use and movement of heavy machinery will disturb vegetation and compact soils across a much greater area. Dryland sites, even in a degraded state, are vulnerable to this type of disturbance.
15. An ongoing effect of the solar farm will be altered environmental conditions at the site, notably microclimate factors such as air humidity, air temperature and photosynthetically available radiation. These changes will affect plant growth and vegetation succession, favouring naturalised species (especially exotic grasses), which will out-compete and likely displace the specialised indigenous dryland vegetation and flora. These changes will likely affect the whole site, not just the areas directly shaded by the panels.
16. It will not be practical to remedy or minimise/mitigate these adverse effects, without creating further adverse effects on the dryland vegetation and flora. Unless the activity is avoided at this site, there will be a net loss of ecologically significant indigenous vegetation and populations of at least eight At Risk or Threatened plant species.
17. Opportunities to offset or compensate for the adverse effects of the activity are constrained by the vulnerability and irreplaceability of indigenous biodiversity at the site.
18. If the activity is permitted, these adverse effects would be best compensated by secure protection and ongoing conservation management of intact (uncultivated/unirrigated) land elsewhere on the Tekapō outwash terrace sequence.

Ecological Context

19. The floor of the Mackenzie Basin is dominated by moraines, outwash terraces, alluvial terraces and riverbeds. These fluvio-glacial landforms and river terraces form extensive sequences stretching from the main upper valleys and lakes to the lower part of the basin at the Waitaki River. They are exceptional nationally for their scale, connectedness and lack of development. Nowhere else in the eastern South Island are intact fluvio-glacial landforms present to this extent.

20. These depositional landforms are classified as ‘historically rare’ (aka ‘naturally uncommon’) ecosystems.⁴ The national importance of these landforms is recognised by their threat status: outwash gravels (critically endangered), braided riverbeds (endangered), and moraine (vulnerable).⁵ The site of the proposed solar farm at Haldon Station lies on outwash gravels (late Otiran outwash surface) overlain in parts by more recent river gravels (Holocene alluvial plain or terrace).⁶ It is part of the extensive Tekapō outwash terrace sequence.⁷
21. The Tekapō outwash terrace sequence is the largest and most intact of those remaining in the Mackenzie Basin. It is unaffected by the extensive earthworks (canals and dams) of the Waitaki Power Scheme, except that its lower reaches lie beneath the waters impounded by the Benmore Dam (Lake Benmore).
22. The site of the proposed solar farm lies at the lowest-altitude part of the outwash terrace, at a location which experiences a climate that is drier, warmer, frostier than elsewhere in the basin.⁸ Also, the site has a greater accumulation of wind-blown silt (loess) than upland parts of the Tekapō outwash terrace sequence.
23. Vegetation of the Tekapō outwash terrace sequence has been modified. The naturally occurring shrubland and tussockland communities have been degraded, over many years, by burning, grazing, and pests (notably rabbits). Herbfield, loamfield and stonefield communities persist, though bare ground has been colonised by ubiquitous naturalised species such as mouse-ear hawkweed (*Pilosella officinarum*), sheep’s sorrel (*Rumex acetosella*) and exotic grasses.
24. Despite its degraded state and the frequent dominance of exotic species (such as hawkweed), the Tekapō outwash terrace supports more indigenous species than exotic

⁴ Williams, P.A.; Wiser, S.; Clarkson, B.; Stanley, M.C. 2007. New Zealand’s historically rare terrestrial ecosystems set in a physical and physiognomic framework. *NZ Journal of Ecology* 31: 119-128.

⁵ Holdaway, R.J.; Wiser, S.K.; Williams, P.A. 2012. Status assessment of New Zealand’s naturally uncommon ecosystems. *Conservation Biology* 26: 619-629.

⁶ Barrell, D.J.A.; Andersen, B.G.; Denton, G.H.; Smith Lyttle, B. 2013. Glacial geomorphology of the central South Island, New Zealand - digital data. GNS Science Monograph 27a. GIS digital data files + explanatory notes (17 p). Lower Hutt, New Zealand. GNS QMAP seamless digital data 2013. Geological Map of New Zealand 1:250 000. Lower Hutt, New Zealand. GNS Science.

⁷ David Barrell, GNS, pers.comm. 26 January 2026.

⁸ Woolmore, C.B.; 2011. The vegetation of braided rivers in the upper Waitaki basin, South Canterbury, New Zealand. Canterbury Series 0211. Department of Conservation, Christchurch. & Leathwick, J.; Wilson, G.; Rutledge, D.; Wardle, P.; Morgan, F.; Johnston, K.; McLeod, M.; Kirkpatrick, R. 2003. Land Environments of New Zealand. David Bateman, Auckland. 184p.

species and supports a high number of Threatened or At Risk plant species. At least 79 listed⁹ Threatened or At Risk plant species have been recorded from the outwash and moraine ecosystems of the Mackenzie Basin.¹⁰ The Mackenzie Basin is the national stronghold for many of these species' populations.

25. Land-use change over recent years, notably conversion of dryland farmland to irrigated dairying pasture, has substantially reduced the extent of indigenous vegetation on depositional landforms in the Mackenzie Basin. An analysis for MDP PC13 showed that, on the basin floor within Mackenzie District, 5,700 hectares of land conversion occurred before 1990, 11,400ha between 1990 and 2001, 7,700ha between 2001 and 2009, and 24,000ha between 2009 and July 2016.¹¹ Subsequent 'converted land' mapping has confirmed the extent of this loss.
26. The dominance of 'naturally uncommon' fluvioglacial landforms, the continued presence of indigenous vegetation – albeit reduced and degraded – on those landforms, and the ubiquitous presence of a high number of Threatened and At Risk plant species confirm the ecological significance of undeveloped (that is, uncultivated & unirrigated) land in the Mackenzie Basin. The presence of indigenous vegetation on the degraded basin-floor landforms, the ecological significance of that vegetation, and the protection of that vegetation were recently confirmed by the Environment Court in its decision for Mackenzie District Plan Change 18.¹² A High Court appeal of that decision has been recently withdrawn.

Vegetation and Flora at the Solar Farm Site

27. Vegetation at the proposed solar farm site (**the site**) is typical of that present at undeveloped parts of the lower Tekapō outwash terrace sequence. Aerial images show the ground cover at the site is like that of nearby areas. My inspection of the site and my survey work at nearby sites confirm that undeveloped parts of the lower Tekapō outwash

⁹ de Lange, P.J; Gosden, J.; Courtney, S.P; Fergus, A.J.; Barkla, J.W; Beadel, S.M.; Champion, P.D; Hindmarsh-Walls, R.; Makan, T.; Michel, P. 2024. Conservation status of vascular plants in Aotearoa New Zealand, 2023. New Zealand Threat Classification Series 43. Department of Conservation, Wellington, New Zealand.

¹⁰ Mackenzie District Plan Change 18 (ENV-2021-CHC-93), Statement of Evidence, Nicholas Head, 14 June 2024, para 47 & Appendix 2.

¹¹ Mackenzie District Plan Change 18 (ENV-2009-CHC-192), Affidavit of Dr Susan Walker, para 8.

¹² Environment Court Decision No. [2025] NZEnvC 125.

terrace sequence support similar mosaics of grassland, herbfield, loamfield, and stonefield vegetation.¹³

28. Vegetation and flora at the site have not yet been adequately described or assessed. The Applicant's Ecological Impact Assessment (EIA) quantitatively assessed vegetation at 192 1m² plots (eight within each of 24 10m² plots) in one season (October-November 2024).¹⁴ The survey effort is not described in the EIA¹⁵, though is later described as "approximately 144 hours of field work assuming 8 hour days, although field days were potentially longer in duration".¹⁶ It remains unclear how many of those survey hours were dedicated to vegetation or flora, or the expertise of those gathering the data.
29. I inspected the site on 20th November 2025. That brief (5-hour) inspection was to quantitatively assess the vegetation at locations representative of the vegetation across the site. Another ecologist (Dr Susan Walker) searched for notable flora at predetermined points over that 5 hour period. The results of this survey work were provided to the applicant in early December 2025 and are appended to this evidence as Attachment 1.
30. That survey should not be regarded as comprehensive. Instead, it was a time-limited sample of vegetation and flora at some parts of the solar array site in one season (late spring/early summer). Other species are likely to be present at other parts of the site and in other seasons, such as dryland annual species in early spring. A more comprehensive survey is needed to determine the presence and distributions of Threatened and At Risk species across the site.
31. The dryland vegetation of outwash terraces is difficult to survey. Many species are sparsely distributed, very small, and frequently the same colour as the substrate (soil or stones). See, for example, the image of *Convolvulus verecundus* (At Risk, declining) on page 6 of Attachment 1. Some species, such as orchids or spring annuals, are only visible for a short time in one season. Adequate survey of this vegetation requires many hours of

¹³ Vegetation type names follow the method proposed by: Atkinson, I.E.A. 1985. Derivation of mapping units for an ecological survey of Tongariro National Park, North Island, New Zealand. NZ Journal of Botany 23: 361-378.

¹⁴ Lodestone Energy Limited, Response to Panel RFI, 23 January 2026, p2.

¹⁵ AgScience Limited, 31 July 2025. Haldon Solar Project Ecological Impact Assessment, 52p.

¹⁶ Lodestone Energy Limited, Response to Panel RFI, 23 January 2026, p2.

careful survey at each of the spring-summer-autumn seasons by ecologists who are familiar with the cryptic flora of these sites.

32. I have spent more than 600 hours surveying vegetation on depositional landforms in the Mackenzie Basin since 2013. I am very familiar with the effort and experience that is required to survey such sites to an extent that is adequate for robust ecological assessment. A recent survey of spring-annual flora in Central Otago showed that adequate survey of dryland sites requires at least 28 person-hours per 100 hectares.¹⁷ Therefore, adequate survey of the 320ha site would require approximately 90 hours searching by ecologists with experience in the detection and identification of dryland species.
33. In response to a request from the Panel, the applicant has stated that 144 hours' survey work were undertaken and that, in addition to survey of 1m² plots, "small species were also specifically searched for across the 100 m² plots, belt transects, and walkover surveys, including targeted seasonal timing".¹⁸ These surveys recorded the presence of only four At Risk vascular plant species.¹⁹
34. In contrast, our 10 person-hour December 2025 inspection (which should not be regarded as a comprehensive survey) recorded the presence of one Threatened and seven At Risk vascular plant species.²⁰ Several of these species, while sparsely distributed (as is typical for many dryland species), are present across the site. The most likely explanation for the Applicant's failure to record these species is that the surveyors were not sufficiently familiar with the dryland flora likely to be present at the site, nor sufficiently experienced to detect those cryptic plant species.
35. The Applicant's limited understanding of dryland flora is revealed in its 23 January 2026 response to the Panel's RFI, which lists the "nationally threatened flora" identified by desktop analysis for targeted survey at the site.²¹ The list includes six species²² that are found only at ephemeral wetlands or lake margins; habitats which are clearly not present

¹⁷ Dr Susan Walker, Manaaki Whenua-Landcare Research, personal communication, December 2025.

¹⁸ Lodestone Energy Limited, Response to Panel RFI, 23 January 2026, p2.

¹⁹ AgScience Limited, 31 July 2025. Haldon Solar Project Ecological Impact Assessment, p3.

²⁰ Harding, M. Haldon Station Solar Array Site Vegetation Assessment, December 2025. Report to DOC (Attachment 1), p3.

²¹ Lodestone Energy Limited, Response to Panel RFI, 23 January 2026, p1 (Table 1).

²² (*Chaerophyllum colensoi* var. *delicatulum*, *Centipeda minima*, *Isolepis basilaris*, *Pseudognaphalium ephemereum*, *Ranunculus brevis* and *Triglochin palustris*).

at the site. Conversely, the list omits two threatened dryland species (*Carmichaelia nana* and *Pimelea sericeovillosa* subsp. *pulvinaris*); species which are present on outwash terraces nearby and may be present at the site.²³

36. Further, some of the threat rankings presented in the list (Table 1) are incorrect. For example, *Lepidium solandri* and *Lepidium sisymbrioides* are ranked as ‘nationally critical’, not ‘nationally endangered’.²⁴ The list appears to derive from a dated (2012) threat ranking assessment.²⁵
37. The Application still lacks a description of the vegetation and flora that is adequate for a complete assessment of the ecological importance of the site, or for robust assessment of the effects of the activity. The adequacy of field survey data relies not only on survey effort (person-hours) but also on the skills and experience of the surveyors. The failure of AgScience to record several notable plant species at the site, to correctly identify other species,²⁶ and to correctly anticipate which species are likely to be present, suggest inadequate skills and experience.

Significance of Vegetation and Flora

38. Vegetation at the solar farm site, except possibly at areas directly adjacent to the pivot irrigator, meets the Mackenzie District Plan (MDP) definition for indigenous vegetation as it comprises a community of species native to the ecological district, regardless of the presence/dominance of exotic species.²⁷ The Application misleadingly describes vegetation at the site as “introduced low-fertility grassland”.²⁸

²³ Several additional At Risk plant species are also likely to be present.

²⁴ de Lange, P.J.; Gosden, J.; Courtney, S.P.; Fergus, A.J.; Barkla, J.W.; Beadel, S.M.; Champion, P.D.; Hindmarsh-Walls, R.; Makan, T.; Michel, P. 2024. Conservation status of vascular plants in Aotearoa New Zealand, 2023. New Zealand Threat Classification Series 43. Department of Conservation, Wellington, New Zealand

²⁵ de Lange, P.J.; Rolfe, J.R.; Champion, P.D.; Courtney, S.P.; Heenan, P.B.; Barkla, J.W.; Cameron, E.K.; Norton, D.A.; Hitchmough, R.A. 2013. Conservation status of New Zealand indigenous vascular plants, 2012. *New Zealand Threat Classification Series 3*. Department of Conservation, Wellington, New Zealand. 70p.

²⁶ The naturalised grass, *Festuca filiformis*, which is common at the site, was identified incorrectly as *Festuca rubra*. See Attachment 1.

²⁷ In the Mackenzie District Plan (MDP) definitions, ‘indigenous vegetation’ “means a community of vascular plants, mosses and/or lichens that includes species native to the ecological district and many [sic] include exotic species.”

²⁸ Lodestone Energy Limited – Haldon Solar Project – Application for Approvals Under the Fast-Track Approvals Act 2024. Mitchell Daysh, 29 August 2025, p37.

39. The applicant's ecological assessment challenges the MDP definition for indigenous vegetation.²⁹ For completeness, vegetation at the solar array site also meets the earlier MDP definition for indigenous vegetation, as the number of indigenous species exceeds 30% of the total number of species present (52% of all species; 42% of vascular species).
40. Vegetation at the site is ecologically significant when assessed against the MDP and Canterbury Regional Policy Statement (CRPS) criteria.³⁰ The site supports:
- Indigenous vegetation or habitat of indigenous fauna that is typical or characteristic of the ecological district (Criterion 1).
 - Indigenous vegetation or habitat of indigenous fauna that is a relatively large example of its type within the ecological district (Criterion 2).
 - Indigenous vegetation or habitat of indigenous fauna that supports an indigenous species that is threatened or at risk (Criterion 4). The site supports at least one Threatened and seven At Risk vascular plant species; 50% of the indigenous vascular plant species I recorded at the site are listed as Threatened or At Risk.
 - Indigenous vegetation that occurs within an originally rare ecosystem (Criterion 6). Outwash gravels are a Threatened naturally uncommon ecosystem.
41. The presence of three Threatened and one At Risk invertebrate species³¹ confirms that the site is also ecologically significant as fauna habitat.
42. All parts of the site are ecologically significant. The entire site supports indigenous vegetation, possibly except at the edge directly adjacent to the irrigated pasture. At Risk plant species observed during my December site inspection are present at scattered locations across the site. The three populations of the Threatened plant species observed (*Lepidium solandri*) are not confined to one part of the site (see Figure 2, Attachment 1). Further survey would almost certainly record these – and perhaps additional – Threatened and At Risk plant species at other parts of the site.

²⁹ AgScience Limited, 31 July 2025. Haldon Solar Project Ecological Impact Assessment, p40-41.

³⁰ Canterbury Regional Policy Statement, Policy 9.3.1 and Appendix 3.

³¹ SLR Terrestrial Invertebrate Assessment Haldon Solar Farm, 20 January 2026 (draft), p20.

43. The Applicant states, with respect to At Risk and Threatened species, that “neither AgScience nor DOC detected meaningful populations of these species within the solar footprint”.³² That statement reflects a lack of understanding of dryland species, the populations of which are typically small and sparsely distributed at such sites. In my assessment, the populations of the At Risk and Threatened plant species at the site are ‘meaningful’ in the sense that they are important for the species and are ecologically significant.

Adverse Effects of the Solar Farm

44. Construction of the solar farm will clear vegetation and disturb soils over a significant proportion of the site. The Applicant calculates the area of direct clearance of vegetation to be approximately 13 hectares.³³ However, the use and movement of heavy machinery will disturb vegetation and compact soils across a much greater area. Dryland sites, even in a degraded state, are vulnerable to this type of disturbance. Exposed and/or compacted soils provide favourable habitat for invasive naturalised plant species (like hawkweed), which compete with slow-growing and long-lived specialist indigenous species. This disturbance will not be confined to one part of the site; instead, all parts of the 320ha area will be affected (except perhaps the transmission corridor, if vehicles are excluded).

45. An important long-term effect of the activity will be the shading and sheltering effects of the solar farm panels. Assessment of those effects is constrained by the lack of New Zealand studies. However, a consistent finding of overseas studies is that solar arrays alter the baseline environmental conditions at a site and that these effects vary from location to location.

46. A meta-analysis of the effects of photovoltaic power station (solar farm) construction on terrestrial ecosystems found that it had a significant effect on microclimate factors such as air humidity, air temperature and photosynthetically available radiation.³⁴

³² Lodestone Energy Limited, Response to Panel Minute, 12 December 2025, p12.

³³ Lodestone Energy Limited – Haldon Solar Project – Application for Approvals Under the Fast-Track Approvals Act 2024. Mitchell Daysh, 29 August 2025. p83.

³⁴ Zhang Y, Tian Z, Liu B, Chen S and Wu J (2023) Effects of photovoltaic power station construction on terrestrial ecosystems: A meta-analysis. *Front. Ecol. Evol.* 11:1151182.

47. The analysis found that the solar panels block sunlight from reaching the ground, enhancing vegetation cover, and thereby further limiting photosynthetically available radiation beneath the panels. Air temperatures are lower beneath the panels, cooling the land surface, increasing air humidity, and regulating plant distribution and growth. Local shading and redistribution of precipitation, as well as evaporation of soil water, affect plant growth and community succession.³⁵
48. Increased humidity and redistribution of precipitation mean the solar array will affect vegetation across the whole site, not just that directly beneath the panels. I have observed changes to plant growth and community succession at artificially shaded and/or sheltered locations elsewhere in the Mackenzie Basin. The adverse edge/off-site effects of land-use change on specialised dryland flora in the eastern South Island high country are documented in the dryland cress (*Lepidium*) study to which I contributed.³⁶
49. The site has climatic conditions that are like those of deserts: high solar radiation, extreme temperatures, a wide daily and seasonal temperature range, and low precipitation. The indigenous species that occupy the site are well adapted to those extremes and are relatively intolerant of and less competitive in more benign climates. This is particularly true for the Threatened and At Risk plant species and is a reason why their distributions are confined to such specialised habitats.
50. Vegetation at the site is especially vulnerable to the effects of a solar farm. The long term effect of the solar farm will likely be a rapid reduction in the percentage cover of indigenous vegetation (especially lichens) and the eventual loss of most if not all indigenous plant species. The vegetation will likely change from herbfield, lichenfield, stonefield and loamfield to grassland and/or herbfield vegetation dominated (probably exclusively) by naturalised (exotic) plant species, particularly grasses.
51. This is consistent with the Applicant's assessment, which states that "the imposition of artificial shade is anticipated to increase total species richness and cover, whilst reducing the cover of bare ground, lichens, and wire moss."³⁷

³⁵ Zhang Y, Tian Z, Liu B, Chen S and Wu J (2023) Effects of photovoltaic power station construction on terrestrial ecosystems: A meta-analysis. *Front. Ecol. Evol.* 11:1151182.

³⁶ Walker, S.; Harding, M.A.C.; Loh, G. 2023. The pattern of declines and local extinctions of endemic inland *Lepidium* species in the eastern South Island. *NZ Journal of Ecology* 47(1): 3547.

³⁷ Lodestone Energy Limited – Haldon Solar Project – Application for Approvals Under the Fast-Track Approvals Act 2024. Mitchell Daysh, 29 August 2025. p85.

52. The Applicant states that vegetation at the site is “on a long-term decline trajectory”.³⁸ The only evidence presented to support this is in the Applicant’s AEE,³⁹ which relies on an analysis by Dr Espie of data that do not appear to have been peer reviewed or published. Those data and Dr Espie’s analyses have been presented in a very similar form previously, in Environment Court evidence for review of the MDP (PC13 & PC18). A technical review found important problems with Dr Espie’s presentation of these data and the scientific reliability of his inferences. It stated that the conclusions which Dr Espie has drawn from these data cannot be relied upon.⁴⁰
53. Dr Espie’s analysis is inconsistent with published data.⁴¹ The site may be on a trajectory of decline from a pastoral farming perspective. However, evidence of ongoing declines in indigenous biodiversity at such sites is lacking. I have been surveying sites like the Haldon Solar Farm site throughout the Mackenzie Basin for more than 20 years. In my assessment, indigenous vegetation at these degraded sites is generally stable and at some sites gradually recovering. The principal cause of decline of indigenous plant biodiversity in the Mackenzie Basin over recent years is land-use change.

Management of Adverse Effects

54. The activity will have adverse effects on indigenous vegetation and flora (and habitats of indigenous fauna). The accepted approach to managing adverse effects of an activity on indigenous biodiversity requires a sequential assessment of opportunities to avoid, minimise, and remedy those effects. If it is not possible to avoid, minimise and remedy adverse effects, then opportunities to offset or compensate are considered.
55. It is not apparent that the Applicant has adequately considered all the ways in which the adverse effects can be avoided. One obvious option is to construct the solar farm on nearby land from which indigenous vegetation has already been removed, such as on the adjacent irrigated land. That site does not appear to support indigenous vegetation, so the adverse effects of the activity on indigenous biodiversity there would likely be minor.

³⁸ Lodestone Energy Limited, Response to Panel RFI, 23 January 2026, p5.

³⁹ AgScience Limited, 31 July 2025. Haldon Solar Project Ecological Impact Assessment, p17-27.

⁴⁰ Mackenzie District Plan Change 18 (ENV-2021-CHC-94) Statement of Evidence, Dr Susan Walker, 2 August 2024, para 45-53.

⁴¹ For example: Walker, S.; Comrie, J.; Head, N.; Ladley, K.J.; Clarke, D. 2016. Hawkweed invasion does not prevent indigenous non-forest vegetation recovery following grazing removal. NZ Journal of Ecology 40: 137-149.

56. To manage potential adverse effects on terrestrial ecology the Applicant proposes to construct a rabbit proof fence and develop a Plant Monitoring Plan.⁴² Exclusion of rabbits from the site will likely exacerbate – not reduce – adverse effects on indigenous vegetation, as it will reduce or eliminate browsing of the competitive fast-growing naturalised grasses that are likely to dominate the site following construction of the solar array. A Plant Monitoring Plan will simply measure – not address – the likely adverse effects of the activity.
57. Further actions proposed by the Applicant to manage adverse effects are protection of “any identified individuals (e.g., marking/caging)” of threatened plants, and propagation and planting of *Lepidium solandri* at suitable microsites adjacent to the site.⁴³ Protection of individual threatened plants in situ is unlikely to be sustainable, due to likely changes to microclimate and vegetation at the site (discussed above). Propagation of *Lepidium solandri* is achievable⁴⁴ but the likelihood of successful establishment of plants in the wild is uncertain. Further, there are populations of seven At Risk vascular plant species at the site and likely to be additional At Risk and Threatened plant species present.⁴⁵ No management of adverse effects has been proposed for those At Risk species.
58. The main threat to the survival of *Lepidium solandri*, and to other specialised dryland plant species, is habitat loss. A recent comprehensive survey of dryland cress (*Lepidium*) species throughout the eastern South Island found that land-use change, and the edge/off-site effects of that land development, were the most important cause of their decline.⁴⁶ For that reason, the national stronghold for *Lepidium solandri* is the Mackenzie Basin, which is the only location in the eastern South Island where large intact sequences of undeveloped land on depositional landforms remain.
59. In my experience, the complexity and vulnerability of the dryland vegetation at outwash terrace sites mean that it will not be possible to manage the adverse effects of the proposed activity at the site. Therefore, if the site is not avoided, there will be a net loss

⁴² Lodestone Energy Limited – Haldon Solar Project – Application for Approvals Under the Fast-Track Approvals Act 2024. Mitchell Daysh, 29 August 2025. p95-96.

⁴³ Lodestone Energy Limited, Response to Panel RFI, 23 January 2026, p4.

⁴⁴ I have observed plants in propagation at Manaaki Whenua-Landcare Research’s Lincoln nursery.

⁴⁵ For example, an additional At Risk (declining) species (*Raoulia beauverdii*) was recorded in the Applicant’s (AgScience) survey.

⁴⁶ Walker, S.; Harding, M.A.C.; Loh, G. 2023. The pattern of declines and local extinctions of endemic inland *Lepidium* species in the eastern South Island. NZ Journal of Ecology 47(1): 3547.

of indigenous vegetation on a 'critically endangered' naturally uncommon ecosystem, and a net loss of populations of at least eight Threatened and At Risk vascular plant species.

60. Opportunities to offset or compensate for the residual adverse effects of the activity are constrained by the vulnerability and irreplaceability of the vegetation and flora at the site. The National Policy Statement for Indigenous Biodiversity (NPS-IB) principles and definitions do not apply to renewable energy projects. However, the NPS-IB principles derive from the Business and Biodiversity Offsets Programme (BBOP).
61. The BBOP guidance states that “Irreplaceability is a term used to reflect the extent to which the loss of an area and its biodiversity will compromise regional conservation targets”.⁴⁷ The proposed activity will compromise conservation targets by removing vegetation/habitat from – and fragmenting – a nationally important and ecologically significant outwash terrace sequence.
62. The BBOP guidance states that “vulnerability indicates the likelihood or imminence of biodiversity loss (e.g., of a particular species or ecosystem, or of a specific site) due to current or impending threats”.⁴⁸ The proposed activity will lead to the direct loss of substantial proportion of a Threatened (critically endangered) ecosystem and losses of populations of Threatened and At Risk plant species that the ecosystem supports.
63. If, regardless of the magnitude of the adverse effects, consideration is given to granting consent for the activity, the magnitude of compensation should, accordingly, be high. The most effective compensation for vegetation/flora effects would be secure protection and ongoing conservation management of intact (uncultivated/unirrigated) land elsewhere on the Tekapō outwash terrace sequence. This would not avoid a net loss of this ecosystem but would help prevent further incremental loss of the remaining undeveloped parts of the sequence.

⁴⁷ Business and Biodiversity Offsets Programme (BBOP). 2012. Guidance Notes to the Standard on Biodiversity Offsets, BBOP, Washington DC. p10.

⁴⁸ *ibid*, p11.

Conclusion

64. The Haldon solar farm site is clearly, despite the lack of comprehensive data, an important and ecologically significant site for indigenous vegetation and flora. The proposed activity will very likely have adverse effects on that indigenous vegetation and flora; effects that cannot be remedied, minimised/mitigated or offset. Protection of indigenous vegetation at the site, and the populations of the At Risk and Threatened species it supports, can only be achieved by avoiding the activity. If the activity is permitted, the adverse effects would be best compensated by secure protection and ongoing conservation management of intact (uncultivated/unirrigated) land elsewhere on the Tekapō outwash terrace sequence.



Mike Harding
2 February 2026

Attachment 1: DOC Vegetation and Flora Report

HALDON STATION SOLAR ARRAY SITE

VEGETATION ASSESSMENT



Report prepared for

DEPARTMENT OF CONSERVATION

Mike Harding

December 2025

Contents

<u>1.0</u>	<u>Introduction</u>	22
<u>2.0</u>	<u>Survey Method</u>	22
<u>3.0</u>	<u>Vegetation</u>	22
<u>4.0</u>	<u>Flora</u>	23
<u>5.0</u>	<u>Ecological Assessment</u>	26
	<u>5.1 Indigenous Vegetation</u>	26
	<u>5.2 Ecological Significance</u>	26
	<u>Appendix 1 - RECCE Plot Data</u>	28
	<u>Appendix 2 – Species List</u>	29
	<u>Appendix 3 – Lepidium solandri</u>	31

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Details of the solar array proposal were provided by Lodestone Energy. Access to the site and refreshments following the site inspection were provided by Edward Klisser (Haldon Station). The site visit was arranged by Christina Schipper (Resource Management Planner, DOC) and Murray Brass (Senior RMA Planner, DOC). Transport to and on the site was provided by Marianne Marot (DOC, Twizel). The targeted notable plant survey was undertaken by Dr Susan Walker (Manaaki Whenua-Landcare Research) with the assistance of Marianne Marot. This assistance is acknowledged and appreciated.

1.0 Introduction

This document provides a description of the vegetation and flora at a proposed solar array site at Haldon Station, Mackenzie District, Canterbury. It includes an assessment of ecological significance. This document has been prepared at the request of the Department of Conservation to assist with its response to this Fast Track Approvals Act application.

2.0 Survey Method

The field survey upon which this report is based was undertaken by two ecologists (Mike Harding & Susan Walker) over a period of approximately five hours on 20th November 2025, with the assistance of DOC community ranger Marianne Marot. Two principal methods were employed: quantitative survey of vegetation at locations representative of the vegetation using the RECCE plot method⁴⁹ (Mike Harding); and time-limited searches for notable flora close to predetermined points at 500-m spacings (Susan Walker & Marianne Marot). Survey tracks and plot locations are illustrated in Figure 1.

This survey should not be regarded as comprehensive. Instead, it is a time-limited sample of vegetation and flora at some parts of the solar array site in one season (late spring/early summer). Other species are likely to be present at other parts of the site and in other seasons, such as dryland annual species in early spring. More comprehensive survey would be needed to determine the distributions of Threatened and At Risk species across the site.

3.0 Vegetation

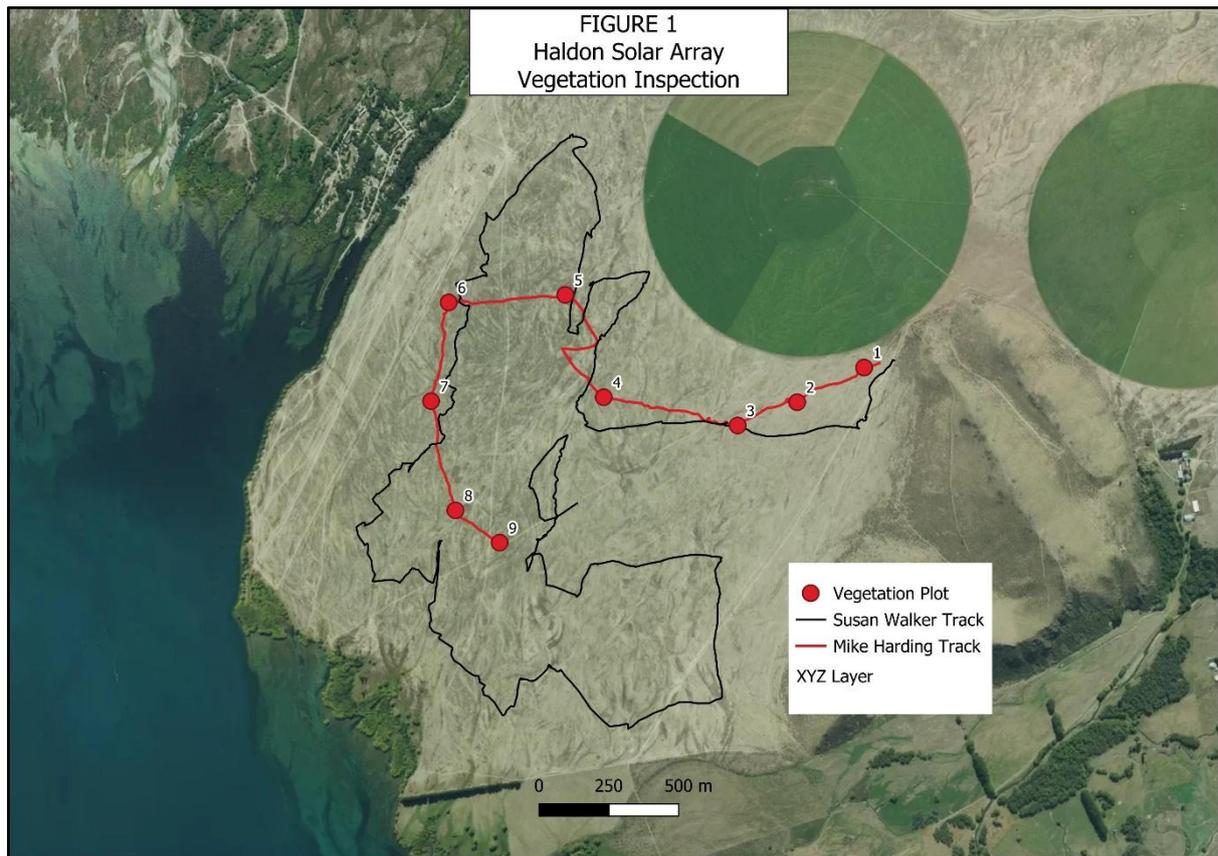
The solar array site supports vegetation typical of a degraded outwash surface at this part of the Mackenzie Basin. The vegetation is dominated by indigenous lichens, notably *Xanthoparmelia semiviridis* and *Cladia* species, and naturalised (exotic) species, notably mouse-ear hawkweed (*Pilosella officinarum*), sheep's sorrel (*Rumex acetosella*) and the grass *Festuca filiformis*. These five species are common at all parts of the site except at locations close to the pivot irrigator.

The respective dominance of these species is influenced by substrate. Silty sites support a higher percentage cover of exotic species; stony sites support a higher percentage cover of indigenous species, including a higher number of Threatened and At Risk species.

The plot data (Appendix 1) indicate the presence and dominance of plant species at each surveyed location. All the surveyed plots except plots 1 and 8 are dominated by the five species listed above. Other species commonly present are silvery hair grass (*Aira caryophyllea*), *Carex breviculmis*, grassland forget-me-not (*Myosotis discolor*), sun orchid (*Thelymitra* sp.), spring speedwell (*Veronica verna*), wire moss (*Polytrichum juniperinum*) and lichen species.

⁴⁹ Hurst, J.M.; Allen, R.B.; Fergus, A.J. 2022. The Recce Method for describing New Zealand vegetation – expanded manual, Version 5. Landcare Research-Manaaki Whenua, Lincoln, New Zealand.

Figure 1: Location of Vegetation Plots and Tracks, Site Inspection 20th November 2025



Plot 1, which is close to the pivot irrigator, supports several additional exotic species and fewer indigenous species (lichens are almost absent). Plot 8, which lies in a shallow swale at the lower (south-west) part of the site, is dominated by creeping pohuehue (*Muehlenbeckia axillaris*).

The applicant's ecological assessment describes Chewing's fescue (*Festuca rubra*) as common and widespread at the site, forming 5% cover and occurring in 91% of the surveyed plots.⁵⁰ The only *Festuca* species recorded during this survey was *Festuca filiformis*, which was common in all surveyed plots.⁵¹ *Festuca filiformis* is a naturalised species, common in dry inland basins.⁵² It is an unpalatable species, not a pasture grass.

4.0 Flora

Sixteen (16) indigenous vascular species and at least eight (8) indigenous non-vascular species (mosses & lichens) were recorded during this brief site survey. Twenty-two (22) naturalised (exotic) species were recorded.

⁵⁰ AgScience Limited, 31 July 2025. Haldon Solar Project Ecological Impact Assessment, 52p.

⁵¹ Species identity was confirmed at the Manaaki Whenua-Landcare Research Allan Herbarium (Kerry Ford).

⁵² Edgar, E.; Connor, H.E. 2000. Flora of New Zealand Volume V Gramineae. Manaaki Whenua Press, Lincon.

The following vascular species listed⁵³ as Threatened or At Risk were recorded during the site survey.

- *Carex resectans* At Risk (declining)
- *Convolvulus verecundus* At Risk (declining)
- *Lepidium solandri*..... Threatened (nationally critical)
- *Luzula ulophylla* At Risk (declining)
- *Muehlenbeckia ephedroides*..... At Risk (declining)
- *Poa maniototo*..... At Risk (declining)
- *Raoulia australis*..... At Risk (declining)
- *Raoulia parkii*..... At Risk (declining)

The lichen *Xanthoparmelia semiviridis*, which is an important component of the vegetation at the site, is also listed⁵⁴ as At Risk (declining).



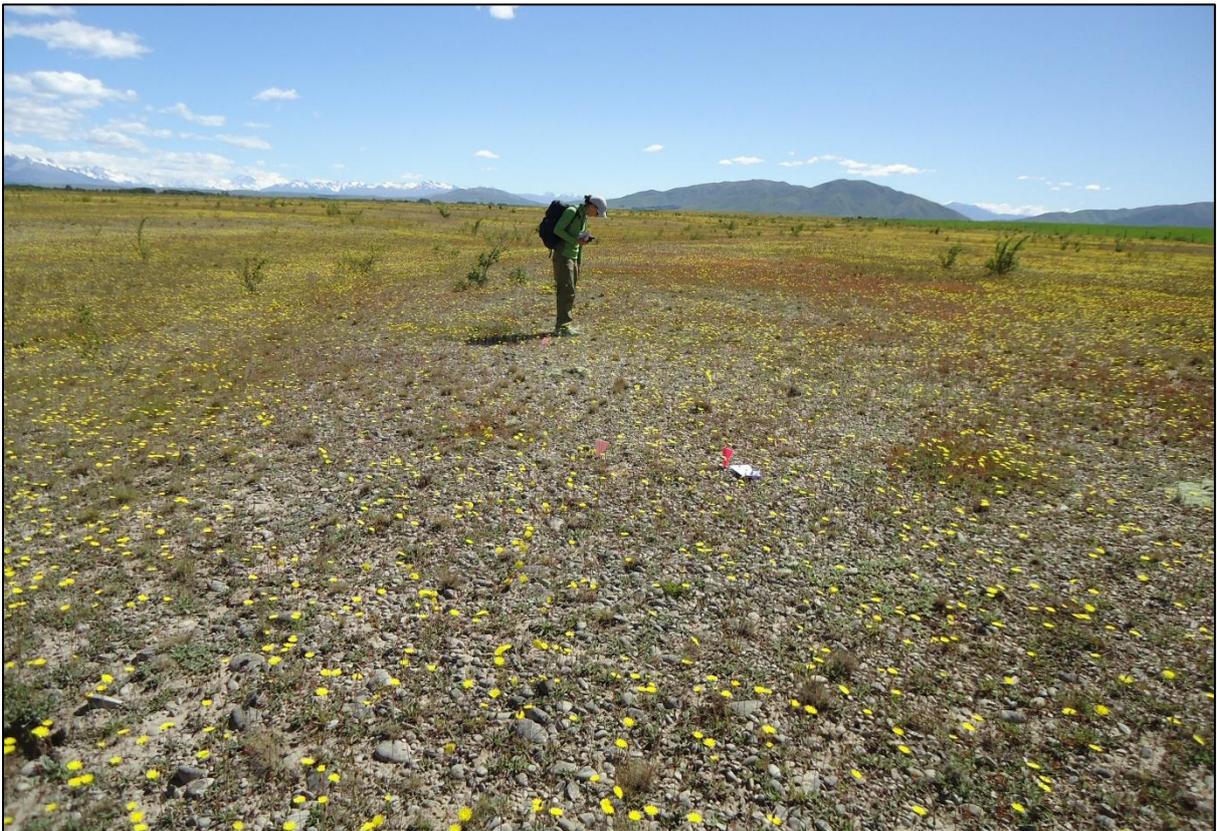
Lepidium solandri at the solar array site (Susan Walker photo).

⁵³ de Lange, P.J.; Gosden, J.; Courtney, S.P.; Fergus, A.J.; Barkla, J.W.; Beadel, S.M.; Champion, P.D.; Hindmarsh-Walls, R.; Makan, T.; Michel, P. 2024. Conservation status of vascular plants in Aotearoa New Zealand, 2023. *New Zealand Threat Classification Series 43*. Department of Conservation, Wellington, New Zealand.

⁵⁴ de Lange, P.J.; Blanchon, D.; Knight, A.; Elix, J.; Lücking, R.; Frogley, K.; Harris, A.; Cooper, J.; Rolfe, J.R. 2018. Conservation status of New Zealand indigenous lichens and lichenicolous fungi, 2018. *New Zealand Threat Classification Series 27*. Department of Conservation, Wellington, New Zealand.



A typical silty location at which the naturalised grass *Festuca filiformis* is common (Plot 6).



A typical stony site at which some of the notable indigenous plant species are typically present.

5.0 Ecological Assessment

5.1 Indigenous Vegetation

In the Mackenzie District Plan (MDP) definitions, ‘indigenous vegetation’ “*means a community of vascular plants, mosses and/or lichens that includes species native to the ecological district and many include exotic species.*”⁵⁵ Vegetation at the solar array site, except possibly at areas directly adjacent to the pivot irrigator, meets the MDP definition for indigenous vegetation as it comprises a community of species native to the ecological district (regardless of the presence/dominance of exotic species).

The applicant’s ecological assessment challenges the MDP definition for indigenous vegetation.⁵⁶ For completeness, vegetation at the solar array site also meets the earlier MDP definition for indigenous vegetation as the number of indigenous species exceeds 30% of the total number of species present: 52% of all species; 42% of vascular species.

5.2 Ecological Significance

In the Mackenzie District Plan definitions, ‘significant indigenous vegetation and significant habitats of indigenous fauna’ “*means areas of indigenous vegetation or habitats of indigenous fauna which: meet the criteria listed in the Canterbury Regional Policy Statement’s Policy 9.3.1 and Appendix 3; or are listed in Appendix I as a Site of Natural Significance.*”⁵⁷

The site meets the criteria for a significant natural area because it supports:

- Indigenous vegetation or habitat of indigenous fauna that is typical or characteristic of the ecological district (Criterion 1).
- Indigenous vegetation or habitat of indigenous fauna that is a relatively large example of its type within the ecological district (Criterion 2).
- Indigenous vegetation or habitat of indigenous fauna that supports an indigenous species that is threatened or at risk (Criterion 4). The site supports one Threatened and eight At Risk plant species; 50% of the indigenous vascular plant species recorded at the site are listed as Threatened or At Risk.
- Indigenous vegetation that occurs within an originally rare ecosystem (Criterion 6). The site is located on ‘inland outwash gravels’ which are listed as a rare ecosystem.⁵⁸

⁵⁵ Mackenzie District EPlan 14 November 2025.

⁵⁶ AgScience Limited, 31 July 2025. Haldon Solar Project Ecological Impact Assessment, p40-41.

⁵⁷ Mackenzie District EPlan 14 November 2025.

⁵⁸ Williams, P.A.; Wisser, S.; Clarkson, B.; Stanley, M.C. 2007. New Zealand’s historically rare terrestrial ecosystems set in a physical and physiognomic framework. NZ Journal of Ecology 31: 119-128.

Further survey would likely reveal that the site meets other significance criteria, such as important habitat for indigenous fauna (Criterion 10). An At Risk (declining) bird species, banded dotterel (*Charadrius bicinctus*)⁵⁹, and a Threatened (nationally vulnerable) grasshopper (*Sigaus minutus*)⁶⁰ were observed during the vegetation assessment.

Mike Harding

10 December 2025



Convolvulus verecundus at the solar array site.

⁵⁹ Robertson, H.A.; Baird, K.; Elliot, G.P.; Hitchmough, R.A.; McArthur, N.J.; Makan, T.D.; Miskelly, C.M.; O'Donnell, C.F.J.; Sagar, P.M.; Scofield, R.P.; Taylor, G.A.; Michel, P. 2021. Conservation status of birds in Aotearoa New Zealand, 2021. New Zealand Threat Classification Series 36. Department of Conservation, Wellington.

⁶⁰ Trewick, S.; Hegg, D.; Morgan-Richards, M.; Murray, T.; Watts, C.; Johns, P.; Michel, P. 2022. Conservation status of Orthoptera (wētā, crickets and grasshoppers) in Aotearoa New Zealand, 2022. New Zealand Threat Classification Series 39. Department of Conservation, Wellington.

Appendix 1 - RECCE Plot Data

Plant species recorded in the nine vegetation RECCE plots. Shaded rows indicate indigenous species. Percentage ground cover is indicated as follows:

- + = present but uncommon
- 1 = present
- 2 = 1-5% cover
- 3 = 5-25% cover
- 4 = 25-50% cover

Species name	Vegetation RECCE Plots (10m x 10m)								
	1	2	3	4	5	6	7	8	9
Vascular species									
<i>Acaena agnipila</i>	+								
<i>Aira caryophyllea</i>	3			3			1	3	
<i>Bromus diandrus</i>	2								
<i>Bromus</i> sp.	2							+	
<i>Carex breviculmis</i>	+		2	2				2	
<i>Cerastium fontanum</i>	3	2							
<i>Convolvulus verecundus</i>							1		
<i>Cuscuta</i> sp.								1	
<i>Echium vulgare</i>	+								
<i>Erodium cicutarium</i>	2								
<i>Erophila verna</i>	1	+							
<i>Festuca filiformis</i>	3	3	3	2	3	3	2	2	3
<i>Geranium brevicaule</i>						+			
<i>Hypericum perforatum</i>		+				2			
<i>Luzula rufa</i> var. <i>albicomans</i>				1					
<i>Microtis unifolia</i>						1		+	
<i>Muehlenbeckia axillaris</i>								4	
<i>Myosotis discolor</i>	2	2		1		1	+	+	
<i>Pilosella officinarum</i>	4	4	4	3	4	4	3	3	4
<i>Poa maniototo</i>	2	3							
<i>Raoulia parkii</i>						1	1	+	
<i>Rosa rubiginosa</i>	2	+				1	1	2	
<i>Rumex acetosella</i>	3	3	3	2	3	2	2	1	3
<i>Silene gallica</i>	2	+							1
<i>Thelymitra longifolia</i> (?)				1	1	2	1	1	1
<i>Trifolium arvense</i>	3	1						2	
<i>Veronica verna</i>	2	1	+	1	1		1	1	1
Non-vascular species									

<i>Cladia</i> species		+	3	3	3	3	3		4
lichen (crustose)		1		2	1	2	1		
lichen (foliose)		1			2		2	1	2
<i>Polytrichum juniperinum</i>		+	2	2	1			+	2
<i>Racomitrium ptychophyllum</i>		+	1	1					1
<i>Xanthoparmelia semiviridis</i>	1	+	2	3	3	3	2	2	3
Other Cover									
animal dung	1		1						
silt (% cover)	15	30	20	5	25	10	10	5	15
stones (% cover)	1	5	20	10	10	0	40	0	15

Appendix 2 – Species List

Plant species recorded at the parts of the site traversed by Mike Harding, Susan Walker and Marianne Marot. Abundance classes are:

- f = frequent
- c = common
- o = occasional
- r = rare

Scientific Name	Common Name	Abundance
Indigenous Vascular Species		
<i>Carex breviculmis</i>	a sedge	c
<i>Carex resectans</i>	a sedge	o
<i>Convolvulus verecundus</i>	a dryland convolvulus	r
<i>Geranium brevicaule</i>	native geranium	r
<i>Lepidium solandri</i>	a dryland cress	r
<i>Luzula rufa</i> var. <i>albicomans</i>	a woodrush	o
<i>Luzula ulophylla</i>	a woodrush	r
<i>Meliccytus alpinus</i> agg.	porcupine shrub	r
<i>Microtis unifolia</i>	grassland orchid	o
<i>Muehlenbeckia axillaris</i>	creeping pohuehue	o
<i>Muehlenbeckia ephedroides</i>	leafless pohuehue	r
<i>Poa maniototo</i>	a grass	o
<i>Prasophyllum colensoi</i>	onion-leaved orchid	r
<i>Raoulia australis</i>	scabweed (a mat daisy)	r
<i>Raoulia parkii</i>	a mat daisy	o
<i>Thelymitra longifolia</i> (?)	sun orchid	c
Indigenous Non-Vascular Species		
<i>Cladia</i> species	lichens	f

<i>Hypnum cupressiforme</i>	a moss	o
crustose lichen	an unidentified lichen	c
foliose lichen	an unidentified lichen	c
<i>Polytrichum juniperinum</i>	wire moss	c
<i>Racomitrium pruinosum</i>	woolly moss	r
<i>Racomitrium ptychophyllum</i>	a moss	o
<i>Xanthoparmelia semiviridis</i>	a lichen	f
Naturalised (Exotic) Species		
<i>Acaena agnipila</i>	Australian sheep's bur	r
<i>Aira caryophyllea</i>	silvery hair grass	c
<i>Anthoxanthum odoratum</i>	sweet vernal	r
<i>Bromus diandrus</i>	riggut brome	o
<i>Bromus</i> sp.	an unidentified brome	o
<i>Bromus tectorum</i>	downy brome	o
<i>Cerastium fontanum</i>	mouse-ear chickweed	c
<i>Cuscuta</i> sp.	dodder	r
<i>Echium vulgare</i>	viper's bugloss	r
<i>Erodium cicutarium</i>	storksbill	r
<i>Erophila verna</i>	whitlow grass	o
<i>Festuca filiformis</i>	a grass	f
<i>Hypericum perforatum</i>	St John's wort	o
<i>Myosotis discolor</i>	grassland forget-me-not	c
<i>Pilosella officinarum</i>	mouse-ear hawkweed	f
<i>Rosa rubiginosa</i>	sweet brier	o
<i>Rumex acetosella</i>	sheep's sorrel	f
<i>Silene gallica</i>	catchfly	o
<i>Trifolium arvense</i>	haresfoot trefoil	o
<i>Verbascum thapsus</i>	woolly mullein	r
<i>Verbascum virgatum</i>	moth mullein	r
<i>Veronica verna</i>	spring speedwell	f

Appendix 3 – *Lepidium solandri*

This appendix provides further information about the observed locations of a threatened (nationally critical) dryland cress, *Lepidium solandri*, at the request of Lodestone Energy.

It is important to understand that the recorded locations are only those observed during a brief (five-hour) and incomplete search of the solar array site. Advice from Manaaki Whenua-Landcare Research is that adequate survey of this type of dryland site requires at least 28 person-hours per 100 hectares. The solar array site is approximately 320 hectares. A full survey, adequate to provide robust data to inform an assessment of effects, would require approximately 90 hours searching by ecologists with experience in the identification of dryland species.

The locations at which populations of *Lepidium solandri* were observed are listed below. Waypoints are illustrated in Figure 2. The size of each population was not assessed. The survey method was a time-limited search for the presence of notable plant species (not population size) at pre-determined locations.

- Waypoint 002..... 1380068E-5085223N
- Waypoint 008..... 1379586E-5085895N
- Waypoint 024..... 1379043E-5084800N

Figure 2: Route and Waypoints from Notable Plant Search, 20th November 2025

