Attachment 5: Indigenous Biodiversity Technical Advice

Date	16/06/2026
To	Dwayne Daly, Principal Consents Planner, Environment Canterbury CC Jeremy Ecker, Senior Consent Planner, Environment Canterbury
From	Jean Jack, Team Leader - Land Ecology Science, Environment Canterbury
Project advice provided for	Nova Energy Limited (Nova) – Twizel Solar Project
Documents reviewed / referred to:	• 'The application'. Nova Energy Twizel Solar Project - FTAA Substantive Application. Dated 05.06.2026. Authored by Trent Lynch. • 'Proposed Conditions'. Attachment 3.2 - Proposed Conditions of Consent. Authored by BTW Company. • 'The AEE'. Attachment 2.14 - Assessment of Potential Ecological Effects of the proposed Nova Energy Solar Farm Near Twizel. Wildland Consultants Ltd. Contract Report No.6620a. (No change to previously reviewed version.) • Attachment 2.15 - Integrated Framework_Summary of Approach to Management of Ecological Effects at a Solar Farm Near Twizel. Wildland Consultants Ltd. Contract Report No.7414e. April, 2026. • Attachment 3.17 - Schedules of Management Plan Conditions and Adaptive Management Conditions. • Attachment 3.9 - **Biosecurity and Vegetation Management Plan**. Dated March 2026. Authored by Lydia Metcalfe, Wildland Consultants Ltd. (Despite date, document not seen or reviewed previously). • Attachment 3.13 - **Avifauna Management Plan**. Dated March 2026 (Although dated as previous version reviewed, there were some edits – limited to additional detail to section 6.14). • Attachment 3.12 - **Lizard Management Plan** Dated March 2026. (No change to previously reviewed version). • Attachment 3.11 - **Terrestrial Invertebrate Management Plan**. (No change to previously reviewed version). • Attachment 3.10 - **Pest Mammal Management Plan**. (No change to previously reviewed version).
Documents previously reviewed:	• Wildlands 2026. (Draft) Assessment of Potential Ecological Effects of the Proposed Nova Energy Solar Farm near Twizel. Authored by Lloyd et al. and dated March 2026. Contract Report No.6620a. • Wildlands (2023 (revised March 2025)). An **AEE** - C25C/102804-12 RMA254670 - Fast Track - Twizel Solar Project - Attachment 5 - Assessment of Ecological Effects • Wildlands (2026a) Draft Terrestrial **Invertebrate** Management Plan for Nova Energy Twizel Solar Farm. Prepared March 2026. • Wildlands (2026b) Draft **Lizard** Management Plan for Proposed Nova Energy Twizel Solar Farm. Prepared March 2026. • Wildlands (2026c) DRAFT **Avifauna** Management Plan for Proposed Nova Energy Solar Farm at Twizel, Canterbury. Prepared March 2026.

	• Wildlands (2026d) **Pest Mammal** Management Plan for Nova Energy Proposed Solar Farm, Twizel. Prepared March 2026
Qualifications	My role at the Canterbury Regional Council (CRC) is Team Leader of Land Ecology within the Science Group. I have been working at the Council since 2011. My principal qualifications include PhD (Ecology) and a Post-graduate Certificate in Environmental Management from Lincoln University. I have over 15 years of experience within the field of ecology; most of my expertise relates to Canterbury habitats including braided rivers, wetlands, drylands, and effects management within the RMA context. I have led multiple river bird and lizard surveys across many of Canterbury's braided river environments, principally within the lower Canterbury Plains. With regards to avifauna experience, I note I have no experience in avian-mortality monitoring. I have not visited the site of this proposal, however, am familiar with the surrounding area and habitats.
Code of Conduct	I confirm that I have read and agree to comply with the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2023. This technical report has been prepared in accordance with that Code. In particular, unless I state otherwise, the opinions I express are within my area of expertise, and I have not omitted to consider material facts that might alter or detract from the opinions that I express. I am also a member of the Environment Institute of Australia and New Zealand (EIANZ) and am bound by the EIANZ's code of ethics.

Executive summary

1. I have reviewed the documents associated with the Nova Solar Farm application, as listed above. I previously provided advice on the draft application prior to lodgement. I have now reviewed that advice in light of the submitted application and provide annotated comments within that advice within Attachment A.

2. The application now includes a more complete suite of ecological management plans and proposed consent conditions. Some matters I previously raised have been partly addressed, particularly in relation to indigenous vegetation management, for which I had not previously reviewed a management plan.

3. Having reviewed the application documents, my main areas of concern however remain broadly consistent with my pre-application advice. The proposal still relies heavily on uncertain or unproven management responses to address residual effects on avifauna and terrestrial invertebrates. In particular, the proposal does not address the loss of habitat extent that will result from this development.

4. Uncertainty remains regarding bird strike risk, the adequacy and timing of compensation, the efficacy of invertebrate salvage/translocation and habitat enhancement, the long-term protection of 'enhancement areas', the feasibility of pest mammal control, cumulative effects, and the assessment of effects on the outwash plain ecosystems.

5. The most effective way to avoid potentially significant effects on terrestrial ecology would be to locate solar farms outside the Mackenzie Basin, within less sensitive habitats. Given the context of this proposal with other nearby solar farm developments, consideration for cumulative effects on terrestrial ecology (and other matters) is warranted.

6. My key concerns:

    I. **Concern regarding bird strike.** Multiple solar farms are now proposed within the Lake Benmore area. I would recommend a precautionary approach towards the potential for cumulative effects of multiple solar farms being constructed simultaneously – i.e. to determine the impacts of one solar farm on avifauna before building another.

    The proposed approach for evidence-based compensation should bird strike risk occur raises some questions. A worked example would assist my understanding of how this approach might play out. I have drafted up a worked example for kaki using the provided description of the approach and would like to get comment from the applicant's expert(s) on this and, more importantly, an example of their own.

II. **Concern regarding invertebrate effects management**. It is unclear whether the AEE has appreciated the level of disturbance to the site the proposal will have[1], and therefore the level of effects on invertebrates. Nor if the habitat areas proposed for invertebrate enhancement are sufficient, and whether limiting their protection to the duration of the consent is appropriate. These areas may need to be secured in perpetuity to provide an enduring ecological outcome.

Regardless of successful mitigations, the AEE considers residual effects on invertebrates will remain. For this, I recommend upfront offsetting or compensatory provisions. This is in light of uncertain and delayed effects management outcomes.

Please also refer to advice from expert entomologist Barbarra Barratt who has been engaged to provide further review of the proposal's potential effects on invertebrate values.

III. **Concern regarding cumulative effects.** The cumulative and interlinked consequences of ongoing indigenous biodiversity losses in the Mackenzie Basin compounds adverse effects on remaining indigenous biodiversity. Arguably, incremental loss or decline of naturally uncommon habitats, for which there are few proven restoration tools and limited experience or success in achieving restoration, should be avoided (Walker et al., 2021).

IV. **Concern regarding uncertainty.** Proposed management plans recognise the difficulty of predicting the level of effects with mitigation in place. This is due to many ecological mitigations yet to be proven in practice. Or the uncertainty that mitigations will be implemented properly. To address this issue, more certain offset or compensation actions with proven outcomes is advisable.

7. Proposed Conditions are generally aligned with the application and its associated management plans regarding management of effects on ecology. However, they need further review to address errors, and refinement, including additional provisions, before they can be said to provide a coherent and enforceable condition set.

[1] Refer to Figure 4.10 of the Application which illustrates the majority of the site may be subject to 'minor or nil' earthworks.

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Agreement with the Applicant

8. The application and associated reports conclude, and I agree based on the descriptions provided, that the site including most vegetation types and habitats are ecologically significant under various Canterbury Regional Policy Statement criteria, including pasture areas that provide habitat for rare invertebrates.

9. Ecologically significant features include those related to indigenous avifauna, lizards, invertebrates and vegetation and their context within a naturally uncommon ecosystem.

10. Attachment 2.15, the Integrated Framework Summary provides a helpful summary of ecological values present at the site and I broadly agree with the assessments regarding how those ecological values might be affected by the proposal. However, further clarification is required regarding some effects on ecological values. And I remain concerned regarding the efficacy, adequacy and appropriateness of proposed effects management.

Benefits of the project

11. Monitoring of ecological values as proposed by the Application and associated management plans could provide insights into how solar farms affect terrestrial ecology, thereby informing future development decisions and management approaches.

Discussions with Applicant

12. I have had no discussion with the Applicant or their experts to date.

Outstanding areas of contention and significance of these

13. I have summarised outstanding areas of contention within Table 2. My previous advice history (Attachment A) provides the background context to these areas of contention and their significance.

14. I have also reviewed the proposed conditions and provided recommended changes to these within the lower section of Table 2.

Solutions and/or Conditions sought

15. Refer to Table 2

Table 2: Solutions				
Issue Area	**Issue & explanation**	**Solution**	**Condition wording**	**Consideration against FTAA**
Management plan structure and content requirements	The proposed conditions create a broadly similar structure for each ecological management plan, but they do not impose a consistent content requirement across all plans, particularly in relation to performance standards, measurable objectives, audit criteria, and adaptive management triggers. Doing so would aid management plan effects management efficacy, enforceability and alignment with the proposed conditions. Table 11 of the AEE (Attachment 2.14) provides a useful summary table that identifies each flora/fauna management plan, its outcome/objective, matters covered (a selection only), and performance standards that trigger adaptive management. This Table 11 recognises that the LMP, BVMP, TIMP, AMP and PMMP each have some form of performance standard or trigger. However, the proposed conditions do not consistently translate that structure into enforceable plan requirements.	Apply consistent terminology and structure across management plans. Each ecological management plan condition should require, as a minimum: • clear objectives and ecological outcomes; • measurable performance standards; • monitoring methods linked to those standards; • trigger levels or thresholds; • adaptive management responses; • roles & responsibilities; • timeframes; • reporting requirements; • audit criteria; and • compensation requirements, where relevant (avifauna, lizards & invertebrates).		

Enforceability of management plans	While the proposed conditions require management plans be certified and the solar farm be operated in accordance with these plans, plans often use “should” rather than “must/will” language. Regardless, management plans in my experience are difficult to enforce, making it important that their provisions are reflected directly within the condition set.	Where relevant, edit management plans to adopt “must/will” language rather than “should” directives. This will improve the clarity and enforceability of the proposed consent conditions. Ensure condition set reflect essential details of the management plans.		
Effects management - Avifauna	Bird strike risk.	Locate solar farm away from important bird habitat and known flyways. Consultation with the Department of Conservation to inform the management of this potential effect and any proposed Avifauna monitoring plan, or compensation, is important.		
Effects management - Avifauna	The quantum of compensation for any eventual bird strike deaths of kaki. Neither the AMP nor the AEE determines the quantum of compensation for kakī deaths in a concrete way. They describe a future process for calculating compensation	Provide a worked example for kaki death compensation. Adopt an agreed compensation currency, i.e., number of additional fledglings, surviving adults, predator controlled areas per year etc. that has		

	("evidence-based compensation"), but they do not provide a worked formula, dollar amount, replacement ratio, or identify a decision-maker.	equivalency with the modelled PVA impact. If modelling is not possible, establish a minimum compensation package. Identify a clear decision pathway, including DOC consultation, or independent expert review, and decision-maker(s).		
Effects management - Invertebrates	The AEE has not considered the extent of invertebrate habitat loss due to site disturbance from minor earthworks and other construction activities (vehicle movements and array piling activities). Further survey of invertebrates across the site may be necessary to fully determine the level of effects and residual effects.	(re)consider the extent of habitat loss within the AEE for invertebrates due to site disturbance[2]. And the implications of this for the adequacy of the proposed effects management including the extent of the enhancement areas relative to the area lost and salvage effort.	n/a	
Effects management - Invertebrates	The proposed invertebrate effects-management package is intended to balance habitat loss and modification through avoidance, salvage/translocation, habitat enhancement, pest mammal control, managed grazing, monitoring and adaptive management. However, I do not consider that the documents clearly demonstrate that the extent and quality of	As above.		

[2] Refer to Figure 4.10 of the Application which illustrates the majority of the site may be subject to 'minor or nil' earthworks (Attachment B). And consider alongside Figure 11, which indicates invertebrate habitat might also occur across most of the site.

	Tekapo ground wētā habitat affected by the proposal is commensurate with the extent, quality, and likely functional gain of the proposed enhancement areas. The proposal appears to assume that enhancement of modified habitats around the site margins will increase carrying capacity for notable invertebrates, but this is not supported by a clear quantitative habitat-loss / habitat-gain assessment for Tekapo ground wētā. Given uncertainty about TGW distribution and habitat requirements, the enhancement package remains inadequate.			
Effects management - Invertebrates	Consideration of alternative effects management. The efficacy of the proposed site-wide pest mammal control and monitoring may have some benefit, however a more targeted approach to a fenced enhancement area may have better outcomes for indigenous biodiversity.	Consider bang-for-buck outcomes for invertebrates from mammalian exclusion fencing options compared to the suite of currently proposed effects management actions, particularly pest mammal control proposals.	n/a	
AEE – indigenous vegetation	Potential data deficiencies exist for indigenous vegetation values at the site. A spring survey might inform the site's indigenous vegetation values & thereby inform effects management. Might *Lepidium solandri* occur at the site?	Undertake a spring botanical survey to address potential data deficiencies for indigenous vegetation values at the site.		

	The UAV-mapped invertebrate habitat patches, particularly areas of short-stature vegetation mixed with bare ground and/or stones, may provide finer-scale habitat information than the broad vegetation mapping. Aligning these mapped habitat patches with vegetation mapping could improve the understanding of dryland plant values and potential effects.			
Eco-sourcing planting material	The lizard management plan states that *Every effort will be made to source the plants in the lists provided but the final plantings undertaken will depend on the availability of plants at nurseries*. This approach is repeated in the BVMP (section 6.3). It is understandable that not all plant material might be available at any time. However, it is better to either wait or forgo the planting altogether than plant inappropriate plant material or species.	Only eco-sourced indigenous plant material is to be used.	Edit Condition 34(b)iii Edit where referred to in management plan(s)	

Table 2 continued.

Proposed condition review and recommendations				
Proposed condition number	**Issue**	**Solution**	**Condition wording**	**Consideration against FTAA**
Condition 8	Management plan submission timeframes. Most management plans are only required 30 working days before construction, but the plans themselves require baseline monitoring or preparatory actions much earlier — for example, six months of baseline bird monitoring, a 12-month pest mammal baseline survey, and invertebrate release-site preparation.	Submit management plans earlier / prior to pre-construction activities detailed by the draft management plans. • AMP: submit/certify before the six-month baseline avifauna monitoring commences. • PMMP: submit/certify before the 12-month baseline pest mammal survey commences. • TIMP: submit/certify early enough to implement release-site preparation, enhancement planting(?), pest control, and salvage timing.(?) • BVMP: submit/certify before pre-construction vegetation plots, transects, photo-points, or biosecurity controls are implemented.	*tbc*	
n/a	Management Plans. Lack a consistent content requirement, particularly identifying 'performance standards'. These can then link to condition 79 & 80 regarding management plan audit.	Apply consistent terminology and structure across management plans. Each ecological management plan condition should require, as a minimum: • clear objectives and ecological outcomes;	*tbc*	

		• measurable performance standards; • monitoring methods linked to those standards; • trigger levels or thresholds; • adaptive management responses; • roles & responsibilities; • timeframes; • reporting requirements; • audit criteria; and • compensation requirements, where relevant (avifauna, lizards and invertebrates).		
Condition 12 & 13	BVMP does not align to proposed condition. Conditions require further pre-construction botanical survey to *confirm no Threatened and At Risk flora will be shaded by the panels.* This survey effort is not apparent within the BVMP which currently only describes post-construction monitoring survey plots & transects.	Edit BVMP to include provision for botanical survey requirements of proposed conditions 12 & 13. And include non-vascular plants and lichens.	*tbc*	
Condition 16	Clarification required. The proposed condition requires salvage and translocation of invertebrates from areas that overlap with potential or confirmed habitat as per AEE figures 10 & 11. Salvage areas are unclear. Given minor earthworks (Application, Attachment 1) and disturbance might occur across the entire site, salvage areas may well be far	Clarify salvage areas; (re)consider whether Figures 10 and 11 are comprehensive in their depiction of habitat extent.	*tbc*	

	greater in extent than depicted within Figures 10 & 11.			
Condition 23	The provision for Consent Holder amendments to management plans via conditions 19-22 does not provide for any comment from DOC or ecological expert on matters relating to ecology.	Edit to require some form of check by DOC and or suitably qualified and experienced ecologist (as per changes to the BCMP condition 74.	*tbc*	
Condition 34(a)(iii)	Eco-sourcing issue. The condition requires eco-sourcing of native plant material but only '*where practicable'*.	Edit to require eco-sourcing of plant material.	*tbc*	
Condition 34	In order to achieve the objective stated in Condition 32, the BVMP must include requirement for measures for the monitoring and surveillance of Threatened and At Risk indigenous plant species. Subclause (e) directs for steps should declines in these species be observed. But not the actual monitoring detailed in the BVMP. These should include for rare native plants both quantitative survey methods including permanent plots (minimum 30) and transect surveys (see section 5.1 of the BVMP).	Add a sub clause for an additional matter the BVMP needs to address - Measures for the monitoring and surveillance of Threatened and At Risk indigenous plant species throughout the life of the project including quantitative survey methods - permanent plots (minimum 30) and transect surveys.	*tbc*	

Condition 37(g)(i)	Incorrect condition number cross-reference. Presumably meant to read as (f) - the performance standards- rather than (e).	Edit condition 37 to cross-reference the performance standards clause (f).	*tbc*	
Condition 41	Condition 41 for the Lizard Management Plan contains the wrong objective — it refers to “indigenous avifauna” and “collision-risk mitigation”, which belongs to the Avifauna Management Plan, not the LMP.	Edit Condition 41 for the Lizard Management Plan to refer to lizard rather than avifauna objectives.	*tbc*	
Condition 43	Lizard compensation. In the event that adaptive management is not successful and monitoring does not show an increase in lizard capture rates (inferring successful habitat / survival increases) condition 43 requires compensation. Compensation is in accordance with the draft LMP, section 9.6. Should this be tagged to a draft document? And compensation is to be provided to SRARNZ, but no guidance is provided as to the appropriate quantum of such funding to match the ecological impact.	Require the LMP to provide for compensation within its adaptive management approach. And require compensation to be of an appropriate quantum i.e. equitable to the ecological impact in terms of extent and quality.	*tbc*	
Condition 46(e)(i)	Does not align with AMP. Commencement timing of the Avifauna Carcass Monitoring Programme is for a minimum timing duration of 36 months from *commencement of installation of solar panels and ancillary infrastructure within the site.* The AMP starts the	Edit Condition 46(e)(i) to align with AMP – minimum duration for 36 months from post-construction.	*tbc*	

	minimum 36 months from post-construction (see AMP, Table 2).			
Condition 46(f)	In order to achieve the objective in condition 44, the Avifauna Management Plan must, as a minimum, address the following matters…(f) Details of how compensation will be calculated in the event that bird mortalities exceed the thresholds of unacceptable adverse effect in Table 2 **and** adaptive management responses are not fully effective, in accordance with section 6.14.6 of the Draft Avifauna Management Plan. The AMP suggests a kakī strike should trigger compensation immediately, alongside adaptive management. I.e, The AMP states that *Compensation would also be necessary in addition to on-site management if a strike of high-value Threatened species, including kakī/black stilt, occurred*.	Recommend edit to: 46 (f) Details of how compensation will be calculated in the event that bird mortalities exceed the thresholds of unacceptable adverse effect in Table 2 and**, where relevant,** adaptive management responses are not fully effective, in accordance with section**s 6.14.5 &** 6.14.6 of the Draft Avifauna Management Plan.	*tbc*	
Condition 51	Does not align with AMP. Set-backs section 6.4 of AMP apply to nests of protected ground-nesting avifauna – not just Threatened or At Risk (Appendix 3 species include kahu, pied stilt and	Edit Condition 51 to include: …*Threatened, At Risk and protected ground-nesting avifauna*…	*tbc*	

	pukeko). This will be to align with Wildlife Act provisions.			
Condition 72, 74, 75	Inconsistency / incompatibility of timing regarding the submission of the Bird Collision Management Plan.	Edit timeframes within condition 71 to allow time for condition 74 provisions (mana whenua and DOC comment on a draft BCMP). Perhaps: • immediate notification and interim response within five working days; • a draft BCMP provided to DOC and mana whenua rūnaka for comment; • a realistic timeframe for final BCMP certification after that feedback period.	*tbc*	
Condition 79 & 80	Conditions 79 and 80 require an annual ecological compliance report and an independent ecological audit every three years. This is helpful and broadly consistent with the monitoring-based framework, but the audit should explicitly assess whether each management plan's performance standards, adaptive management triggers and reporting requirements have been met.	Edit to require audits to assess whether each management plan's performance standards, adaptive management triggers and reporting requirements have been met. (Referring to my above recommendation for all management plans to include these minimum plan requirements).	*tbc*	
Condition 81	Glare mitigation is specified to address glare risk to people / drivers.	Edit Condition 81 to adopt AMP recommendations for solar panel night rest time position(s).	*tbc*	

	This condition has no timeframes and does not take into account the recommendations of the AMP for solar panel rest positions under certain conditions and at night – see AMP section 6.7. The AMP recommends *the panels will have a 55-degree night rest position to minimise reflectivity at night. After the proposed Glint and Glare mitigation stow position (≥5° angle), the tracker will orient to this angle just before sunrise and sunset to avoid glare to nearby receivers. After the sunset holding period, the tracks will move to the night resting position until sunrise. Tracking arrays reduce the frequency of waterbird fatalities compared to fixed arrays (Kosciuch et al. 2025).* *If practicable, the panels will be positioned in directions away from sources of polarised moonlight.*			

Attachment A: Advice history; Previous advice to May 2026

Advice on the Nova Solar farm application has previously been provided to Consents staff in April and May 2026. Annotations within this previous advice are shown in [blue] within parentheses. These are provided in the context of this current advice dated June 15th, 2026. Annotations in [red] relate to advice provided in May 2026.

Fast Track Approvals Act 2024 (FTAA) Technical Advice Twizel Solar Project – Land Ecology

Date	11/05/2026
To	Dwayne Daly, Principal Consents Planner, Environment Canterbury, cc Jeremy Ecker, Consents Planner, Environment Canterbury
From	Jean Jack, Team Leader - Land Ecology Science, Environment Canterbury
Project advice provided for	Nova Energy Limited (Nova) – Twizel Solar Project
Documents referred to	• Wildlands 2026. (Draft) Assessment of Potential Ecological Effects of the Proposed Nova Energy Solar Farm near Twizel. Authored by Lloyd et al. and dated March 2026.
Documents previously referred to	• Wildlands (2023 (revised March 2025)). An **AEE** - C25C/102804-12 RMA254670 - Fast Track - Twizel Solar Project - Attachment 5 - Assessment of Ecological Effects • Wildlands (2026a) Draft Terrestrial **Invertebrate** Management Plan for Nova Energy Twizel Solar Farm. Prepared March 2026. • Wildlands (2026b) Draft **Lizard** Management Plan for Proposed Nova Energy Twizel Solar Farm. Prepared March 2026. • Wildlands (2026c) DRAFT **Avifauna** Management Plan for Proposed Nova Energy Solar Farm at Twizel, Canterbury. Prepared March 2026. • Wildlands (2026d) **Pest Mammal** Management Plan for Nova Energy Proposed Solar Farm, Twizel. Prepared March 2026.
Qualifications	My role at the Canterbury Regional Council (CRC) is Team Leader of Land Ecology within the Science Group. I have been working at the Council since 2011. My principal qualifications include PhD (Ecology) and a Post-graduate Certificate in Environmental Management from Lincoln University. I have over 15 years of experience within the field of ecology; most of my expertise relates to Canterbury habitats including braided rivers, wetlands, drylands, and effects management within the RMA context. I have led multiple river bird and lizard surveys across many of Canterbury's braided river environments, principally within the lower Canterbury Plains. With regards to avifauna experience, I note I have no experience in avian-mortality monitoring. I have not visited the site of this proposal, however, am familiar with the surrounding area and habitats.
Code of Conduct	I confirm that I have read and agree to comply with the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2023. This technical report has been prepared in accordance with that Code. In particular, unless I state otherwise, the opinions I express are within my area of expertise, and I have not omitted to consider material facts that might alter or detract from the opinions that I express.

RE RMA251694 - Nova Energy, Twizel Solar Fast-track Project - Review of Draft Application

I have been asked to review the most recent draft assessment of effects document (Wildlands, 2026).

I have reviewed the document and where relevant have annotated both the document and my previous advice below (Attachment 1). Annotations within my previous advice are shown in [red] within parentheses. If helpful, the annotated AEE document may be provided to the applicant / their experts – as well as the attached example for bird strike compensation estimation.

My main areas of concern remain as per my previous advice. Concerns relate to the residual ecological effects regarding avifauna and invertebrates and the efficacy of management plans. The best way to avoid the potentially significant effects on terrestrial ecology is to locate solar farms outside the Mackenzie Basin, within less sensitive habitats.

Specifically:

Regarding bird strike. The proposed approach for evidence-based compensation should bird strike risk occur raises some questions. A worked example would assist my understanding of how this approach might play out. I have drafted up a worked example for kaki using the provided description of the approach and would like to get comment from the applicant's expert on this and an example of their own. [Concern maintained – June 2026]. [The application now includes mortality thresholds, carcass monitoring, adaptive management, and a Bird Collision Management Plan pathway. However, this does not remove the underlying uncertainty about actual collision risk for high-value species in this location. The proposed response remains largely reactive: detect mortality, investigate, model, then adapt. The proposed condition schedule is stronger than earlier drafts - injury or mortality of one Nationally Critical or Nationally Endangered species triggers adaptive management, and a Bird Collision Management Plan must be prepared within five working days of threshold exceedance. I would still recommend clarifying that a single kakī/black stilt or tarapirohe/black-fronted tern mortality triggers both immediate mitigation review and a compensation assessment pathway.]

Regarding invertebrate effects management. Some clarifications on effects management methodology including proposed salvage and translocation would be helpful (see my notes regarding timing of salvage). As well as consideration of whether habitat areas enhanced for invertebrates (or lizards) as part of the effects management package need to be enduring – i.e. the proposal links duration to the duration of the consent. Should these areas be afforded some protections into perpetuity? [Concern maintained – June 2026].
[The proposed invertebrate effects-management package is intended to balance habitat loss and modification through avoidance, salvage/translocation, habitat enhancement, pest mammal control, managed grazing, monitoring and adaptive management. However, I do

not consider that the documents clearly demonstrate that the extent and quality of Tekapo ground wētā habitat affected by the proposal is commensurate with the extent, quality, and likely functional gain of the proposed enhancement areas. The proposal appears to assume that enhancement of modified habitats around the site margins will increase carrying capacity for notable invertebrates, but this is not supported by a clear quantitative habitat-loss / habitat-gain assessment for Tekapo ground wētā. Given uncertainty about TGW distribution and habitat requirements, the adequacy of the enhancement package remains uncertain.]
When the application is submitted I recommend that an expert entomologist such as Barbarra Barratt be engaged to provide further review of the proposal's potential effects on invertebrate values. [maintained].

Regarding indigenous vegetation values – I still have questions about methods and offer a suggestion regarding the vegetation type mapping. Additionally, it is unclear why a vegetation management plan is not proposed alongside the other management plan suite. [appears that it was prepared in March 2026, but I did not receive/review it]. This would provide a 'home' for the proposed effects management actions described by the AEE for indigenous vegetation (see recent AEE Table 12 which includes effects management of indigenous vegetation including regular monitoring and adaptive management. The document also refers to pre-work surveys to locate additional Threatened plants to avoid). [Concern addressed by the prepared Attachment 3.9 Biosecurity and Vegetation Management Plan dated March 2026 – June 2026].

Attachment 1: Land Ecology advice, April 2026

RE RMA251694 - Nova Energy, Twizel Solar Fast-track Project - Review of Draft Application

I have been asked to review the documents listed above and comment on my agreement with the report's conclusions and identify outstanding areas of contention or concern. During review I have also made several comments and recommendations to assist with better understanding and addressing the potential effects on terrestrial ecology.

I generally agree with the description of the environment provided by the AEE and agree that ecologically significant values relating to vegetation, avifauna, herpetofauna and invertebrates will be adversely affected by the proposal.

Assuming the solar farm layout is as per Attachment 1 [maintained as such in recent AEE], key areas of concern relate to the residual ecological effects regarding avifauna and invertebrates and the efficacy of management plans. Data deficiencies regarding vegetation values also need to be resolved.

Specifically:

- Regarding avifauna, potential residual effects include bird strike and loss of feeding and breeding habitat. The site is located at a hot spot for Nationally Threatened and At-Risk bird species which frequent the Ohau-Tekapo river delta at Lake Benmore[3].

  The best way to avoid the impacts is to locate solar farms outside the Mackenzie Basin, within less sensitive habitats, and to undertake research to ascertain the risks these solar developments pose to avifauna. In lieu of this, given the uncertainties and the requirement to achieve a net gain in biodiversity outcomes, offsetting or compensatory measures should be secured upfront.

  Multiple solar farms are now proposed within the Lake Benmore area. I would recommend a precautionary approach towards the potential for cumulative effects of multiple solar farms being constructed simultaneously – i.e. to determine the impacts of one solar farm on avifauna before building another.

- Regarding effects on invertebrates. As for avifauna, there is uncertainty regarding the likely success of mitigation actions including proposed salvage and translocation. Regardless of successful mitigations the AEE considers residual effects on invertebrates will remain. For this, I recommend upfront compensatory provisions. This is in light of uncertain and delayed effects management outcomes, and the requirement for net-gain effects management.

- Consideration of alternatives. Potential residual effects, particularly on avifauna and invertebrate values, might be avoided by locating the solar farm within already developed areas of land. It is difficult to ascertain to what degree this option has been explored. [The Application details alternative site considerations]. Several areas of already developed land within the Basin have been identified and should be considered as alternatives to avoid some of the potential adverse effects on ecology (see Attachment 2 – a map of developed land). Noting that to reduce the likelihood of effects on avifauna relating to bird strike, the proposal would need to be located away from known important avifauna habitats and flyways. [there may be a limitation to do this due to there not being another substation that coincides with developed land area that is away from the kaki breeding facility and black-fronted tern roosts (i.e. the important bird areas around Lake Benmore. This

[3] Flight paths of these birds are known to traverse directly across the proposed solar farm site. This is known for at least one species – black fronted tern - from recent research[3] which placed transmitters on birds revealing their flight routes between Lake Ohau, the canal and roosting sites at the Tekapo delta.

(whether putting in another substation is a real constraint) could be confirmed.]

- Management plans recognise the difficulty of predicting the level of effects with mitigation in place. This is due to many ecological mitigations yet to be proven in practice. Or the uncertainty that mitigations will be implemented properly.

Specific review comments

I understand from the AEE (Wildlands 2023 (revised 2025)) the proposal is for a solar farm to be established between the Ohau River and Twizel River, south of Twizel in the Mackenzie Basin (Attachment 1 map). And that *the site has largely been cultivated and mostly supports improved pasture or exotic vegetation, but small areas of uncultivated outwash plain support indigenous vegetation, which have been excluded from the proposed development area. Scarps run across the north and down each side of the site, and these are critical habitats for indigenous biodiversity values including populations of Threatened and At Risk plants, lizards, and invertebrates*.

The summary of the AEE states:

Important biodiversity values at the site include:
- *Seven plant species classified as At Risk or Threatened.*
- *Eight Threatened and nine At Risk avifauna species may be present at the site.*
- *Three lizard species have been confirmed at the site, including two At Risk species and one Not Threatened species.*
- *Four notable terrestrial invertebrate species occur at the site.*
- *An ephemeral wetland is located in the north of the site, and other wetlands are located on an alluvial terrace on the eastern side of the site.*

In general, these biodiversity values are located on the margins of the site.

The report concludes, and I agree based on the descriptions provided, that most vegetation types and habitats meet the CRPS significance criteria, including pasture areas[4] that provide habitat for rare invertebrates.
[The recent AEE provides a comprehensive significance assessment against CRPS criteria at Appendix 2]

<u>Methods of ecological surveys</u>

Vegetation – the survey effort or coverage is not well described by the AEE. No track log is provided, no plot-based surveys/recce plots appear to have been used, nor any surveys conducted in spring to identify spring-annuals. Potential data deficiencies. What additional species may occur at this site? Could *Lepidium solandri* occur within proposed disturbance footprints?

[4] AEE figure 12

[The recent AEE provides further details explaining how the wider area was searched with a zig zag search pattern. No track log of survey effort was provided, so presumably not recorded. Would plot based recce method provide further information? And consider if Spring annuals were potentially missed due to survey timing (Dec-Jan) – although I note some orchids were recorded.

There is an apparent opportunity to align the invertebrate drone (UAV-survey) mapped habitat patches with the vegetation mapping. i.e. The UAV-surveys mapped habitat more finely, identifying discrete areas of 'short-stature vegetation mixed with bare ground and/or stones' (Figure 11) which would seem to provide better resolution to the mapping of vegetation types shown in Figure 6].

Lizards – survey effort / known information is adequate to inform effects assessment. While survey searches were not conducted across the wider low-quality habitats including the brown top-grassland and hare's trefoil herbfield, the report acknowledges these are likely occupied by very low numbers of animals (McCann's skinks).

Avifauna – survey effort / known information is adequate to inform effects assessment. [Albeit expert estimations or information from DOC would better inform bird strike risk and consequent population viability analysis assessments to inform proposed compensatory actions and or adaptive management provisions].

Invertebrates - surveys confirmed notable invertebrate species occur throughout the site. Survey effort may be adequate to inform a precautionary-effects assessment. Noting that the management plan (Wildlands, 2026b) considers additional notable species may be present, particularly moths and beetles. [However, the extent of habitat loss may have not been taken into account].

Effects & effects management

General comments

I agree with the AEE's identification of the types of potential ecological effects that may arise from the proposal (Attachment 3).

The panel layout avoids areas of indigenous vegetation[5] and areas of higher invertebrate and lizard habitat value – generally these higher value areas are located within the southern river terrace and site perimeter. Recommend confirmation that while these areas are outside the proposed panel footprint that proposed construction activity will be able to avoid these areas (i.e. not used for vehicle roading or equipment / construction laydown areas).

[5] Although noting the AEE recommended confirmation of this through further field survey following confirmation of final panel layout design.

Management plans recognise the difficulty of predicting the level of effects with mitigation in place. This is due to many ecological mitigations yet to be proven in practice. Or the uncertainty that mitigations will be implemented properly.

Management plans often read as recommendations i.e., an action 'should' occur. These would need to be revised to be directive following confirmation by the Applicant i.e., an action 'will' occur. Alignment between plans is also important to ensure actions do not work at cross purposes.

Outwash plains habitat

The effects of the proposal on outwash plain ecosystems as a whole have not been considered. While assessment of individual taxa groups provides useful information on how each may be affected by the proposal, it is also important to consider the effects on the ecosystem as a whole. Ultimately, the proposal will result in the loss of an area of irreplaceable habitat within a naturally uncommon ecosystem [or rather a loss of ecosystem intactness/function]. Such loss in the context of ongoing biodiversity loss should be avoided[6]. Particularly where alternative sites for solar farms exist.

[While the AEE identifies inland outwash gravels / outwash plains as a historically rare ecosystem and assesses effects on component ecological values, it does not appear to separately assess the effects of the proposal on the outwash plain ecosystem as an integrated ecological unit. The outwash plain landform would remain beneath the solar farm; however, construction, earthworks, panel shading, altered microclimate, stormwater effects, vehicle movements, pest plant risks, and changes in grazing management may result in further modification and partial functional loss of the ecosystem values associated with that landform. This is relevant because the ecological value of outwash plains is not limited to mapped indigenous vegetation or confirmed records of Threatened and At Risk fauna, but also includes the physical habitat mosaic, sparse dryland vegetation structure, bare gravels, thermal environment, connectivity, and habitat function for specialist dryland species.]

Vegetation

The AEE states that *based on the layout design provided to Wildland Consultants in November 2024, indigenous vegetation is excluded from the panel area*[7]. Nevertheless, the AEE appears to imply that changes to vegetation might occur due to panel shading altering microclimates near indigenous vegetation – this requires clarification [Clarified by vegetation management plan; provision of set-backs; condition 12 & 13 preconstruction surveys for threatened plants for avoidance].

[6] See Walker et al. 2021. What effects must be avoided, remediated or mitigated to maintain indigenous biodiversity? New Zealand Journal of Ecology. 45(2): 3445.

[7] AEE Section 12.2

Rare plants including mat daisy and dwarf broom located within the panel area may be lost, the AEE recommends further survey to conducted once panel layout/construction details are confirmed to better inform what is currently considered a 'minor' adverse effect[8]. [Condition 12 & 13 preconstruction surveys for threatened plants to enable avoidance – although pre-construction surveys not apparent in BVMP].

No vegetation or rare plant management plan is proposed (or I have not seen one to review). [Resolved - now reviewed].

Lizards

The section on remediation refers to remediation contributing a significant proportion of the mitigation for effects on lizards. Recommend avoid this confusion of terms. Only use remedy and mitigate in their RMA sense of the word. I.e., Mitigation - reducing an actual effect; Remediation - fixing something up that was affected).

The management plan describes enhancement of some off-site areas[9]. If off-site, beyond disturbance footprints, this is better referred to as an offset or compensatory action. As such the adequacy of the proposed effects management action should be considered against offsetting principles[10], including those of equivalency and additionality, and the need for a net-gain under the CRPS. [Considered a remedial action as onsite/within property boundary].

Regarding enhancement plantings and ecosourcing of plant material. The plan states that *Every effort will be made to source the plants in the lists provided but the final plantings undertaken will depend on the availability of plants at nurseries*. It is understandable that not all plant material might be available at any time. However, it is better to either wait or forgo the planting altogether than plant inappropriate plant material or species. In my experience, plantings (if successful in such challenging environments as this) will take several years to provide any meaningful habitat to lizards. Structural habitat complexity from rock piles or other refuge material, rank grass and predator control will more likely provide habitat enhancement in the short-term (initial 5 years).

The plan describes rock piles to be a minimum of 0.5m high. Reconsider / confirm if this will be high enough to avoid rank grass over topping the piles (might well be in dryland environment, or if grazed).

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[8] AEE Section 12.2

[9] Wildlands (2026b) Lizard management plan (draft), section 7.3, Figure 4

[10] Refer to the LGNZ offsetting guidelines.

Confirm with developer / applicant that the required volume of rock will be available. Might warrant a pilot exercise.

[Note to confirm that no lizard salvage is proposed, albeit through a Discovery Protocol. I agree with the rationale (section 7.1, Attachment 3.12, LMP)].

Avifauna

The effects management proposed by Wildlands (2026c) adopts mitigations which may reduce the risk of bird fatalities from bird strike collisions with solar infrastructure. However, the effectiveness of these mitigations for reducing bird collisions is not tested in New Zealand and are considered experimental. Given the high value of the site and areas directly adjacent, a precautionary approach is warranted, particularly as the effects of the proposal are uncertain but potentially significantly adverse, resulting in the loss of nationally critical species.

The management plan proposes compensation triggers. Please confirm compensation triggers[11] would occur if two instances of a Nationally Critical or Nationally Endangered species are injured or killed due to collision with the infrastructure.

[the recent AEE notes the proposed consent conditions specify threshold mortality rates which trigger adaptive mgmt. (review/investigation and mitigations) (section 13.2.6). And if these adaptive mgmt. actions fail (i.e. - but tbc – the following (three?) years monitoring detects further carcass detection exceedances) then 'evidence based compensation' occurs. Although, if strike of a 'high value Threatened species' such as kaki occurs then jumps straight to this evidence based compensation while also undertaking the adaptive mgmt. mitigation actions.

Evidence-based compensation – determining the quantum of compensation through the quantification of ecological risk. Ecological risk is determined by calculating a CRM (collision risk, expressed as a birds per year figure) and factoring that into three scenarios for a species PVA (population dynamics). The scenarios would, presumably, be of without the CRM deaths, with the deaths, and with the deaths plus compensation. I have drafted an example of this for kaki and would like the applicants' experts to review and or offer their own example(s)]

The management plan proposes pre-works nest avoidance surveys. Consider undertaking additional or primary pre-works site nesting surveys during peak nesting season (likely Oct-Nov) rather than an 8-day prior to works approach. Having the survey period from July is less likely to detect nesting birds, and initial construction may have little risk if it's not widespread in nature i.e., consider when pre-work survey might have best utility for effect

[11] Wildlands 2026c, section 6.14.4

management. I note that the proposed avifauna on-site monitoring[12] might well provide multiple pre-works nest/chick surveys.

Invertebrates

Targeted grasshopper and wētā surveys revealed populations of At Risk and Threatened invertebrates over large portions of the site that will be covered with solar panels. Consequently, the AEE considered the potential effect on invertebrate values to be 'significant' due to shading causing reduced habitat quality[13].

The invertebrate management plan (Wildlands, 2026a) considered the proposal with regards to direct disturbance will have a 'minor' impact on invertebrates. However, the same report notes that all earthworks will cause removal and destruction of notable invertebrates. As the extent of earthworks associated with the proposal is unclear, I would recommend this assessment is reviewed following confirmation of earthwork footprints – including, importantly, areas to be tracked by machinery that might impact invertebrates.

The management plan considers the proposal will have a significant effect on notable invertebrates due to habitat modification arising from the solar panels altering climatic conditions. Grazing is recommended; however, whether grazing is proposed requires confirmation.

[The recent AEE states that Seasonal, managed grazing will occur throughout the panel area to keep the exotic grasses short. (page 71).]

The management plan describes 'remediation' for three enhancement areas[14]. This is better referred to as an offset or compensatory action. As such the appropriateness and adequacy of the proposed effects management action should be considered against offsetting principles[15], including those of equivalency and additionality, and the need for a net-gain under the CRPS.

The management plan notes that *notable invertebrates such as those found on site grow slowly and trends in population size can be difficult to detect, but over 12 years trends are likely to become apparent despite other confounding factors such as climate patterns*. This reiterates the uncertainty associated with the proposed effects management actions and the significant delay before benefits from effects management could be confirmed.

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[12] Wildlands 2026c, section 6.13.2

[13] AEE section 12.5

[14] Wildlands (2026c) Invertebrate management plan (draft), section 5.3.2 & Figure 5

[15] Refer to the LGNZ offsetting guidelines.

In my opinion the proposed contingency for a party funded student study is not appropriate and has a high risk of not delivering outcomes (student not completing course). While student research might have value, this should be considered alongside and additional to other compensatory provisions. Sufficient funds to additionally support either an independent consultant or a DOC led conservation programme (complementing or extending existing projects) would present less risk.

Pest mammal management plan

I support the focus on high value areas.

I agree that an integrated pest management and co-ordination with surrounding landowners/managers is more likely to achieve outcomes than an isolated site-focussed programme (sections 9 & 10).

I understand the plan adopts adaptive management actions where monitoring detects a consecutive two-year-seasonal increase in any monitored pest mammal abundance or activity.

Regarding rabbit control via hunting with dogs & night shoots. I recommend these proposed methods are reviewed for feasibility and efficacy. Apart from augmenting eradication attempts within predator free areas this method is questionable for the scale of application considered here. Due to reinvasion rates, consider co-ordination of landscape scale control operations with DOC, LINZ and surrounding landowners.

Overall the conclusions are not convincing. The report itself noting significant uncertainty and limitations given the context of the site. I strongly recommend the proposed mammalian control approach is reviewed and a bang-for-buck comparison made of alternative investment in a comparably-costed option to fence a high value habitat area inwhich mammalian pests can be controlled (if not eradicated) with greater certainty of biodiversity outcomes.

Summary of recommendations to better understand the potential effects of the proposal:

AEE

- Confirm (current) proposed solar farm layout/associated works & confirm 2025 AEE findings are still relevant. [confirmed]

- Specifically, confirm earthworks and disturbance footprints (including heavy vehicle tracking, any cut and fill activities, and laydown areas) to inform effects assessments. Where necessary, update effects assessments. [not quantified – would inform effects assessment equivalency considerations].[Provided within Attachment 1. Minor or nil earthworks across whole site possible].

- Renew AEE taking into account confirmed proposal design details. Collate all potential effects (including outwash plain ecosystem) & associated proposed effects

management actions into a table illustrating before- and after- effects management level of effects. For residual effects consider offsetting and compensation – referring to the LGNZ offsetting guidelines. [partially provided now, albeit not for ecosystem scale].

[Table 12 could provide more clarity as to what effects are residual and being managed with compensation – alignment with LGNZ offset/compensation guidelines particularly around equivalency of habitat extent and condition]

Data deficiencies

- Potential data deficiencies exist for indigenous vegetation values at the site. Please describe survey methods and any limitations. What additional species may occur at this site? Would spring surveys inform on plant species occurrence at the site? Might *Lepidium solandri* occur at the site? Confirm AEE from confirmed proposal footprints. [The survey effort was improved and method more fully described, some limitations to explore – survey timing for spring-annuals. Further pre-construction search for rare plant species might occur in spring. The UAV-mapped invertebrate habitat patches, particularly areas of short-stature vegetation mixed with bare ground and/or stones, may provide finer-scale habitat information than the broad vegetation mapping. Aligning these mapped habitat patches with vegetation mapping could improve the understanding of dryland plant values and potential effects.]

Effects assessment

- Consider the level of effect on outwash plain ecosystems as a whole. [retained]
- Provided data deficiencies for indigenous vegetation / rare plants are addressed, and solar infrastructure footprints confirmed, update effects assessment on these values. [done]

Effects management

- Ensure effects management terms including mitigation and remediation are used according to their RMA meaning.
- Where residual effects remain despite proffered effects management, consider offsetting and compensation. Refer to offsetting principles and guidelines[16], including those of equivalency and additionality, and the need for a net-gain under the CRPS.
- Ensure any indigenous plantings adhere to eco-sourcing principles & avoid irrigation. [retained]
- For avifauna, confirm avifauna compensation triggers, reconsider timing of pre-work surveys [proposed PVA and CMP approach – request example]
- Confirm grazing management of the site. [confirmed as will occur 'managed' grazing]
- Consider bang-for-buck alternatives for the proposed pest mammal control [not yet considered]
- Consider alternative or additional compensation actions to a student grant as an adaptive management response for residual effects on invertebrate values. [no residual effects acknowledged in Table 12 – although assumed within adaptive management?]

Management plans

- Consider whether a rare plant / indigenous vegetation management plan is required.

[16] Refer to the LGNZ offsetting guidelines

[not apparently considered] [indigenous veg. mgmt. plan now reviewed].

- Revise management plans to be directive in form referring to actions that 'will' rather than 'should' happen (i.e., confirmed as proposed by the Applicant). [may come later in process?]

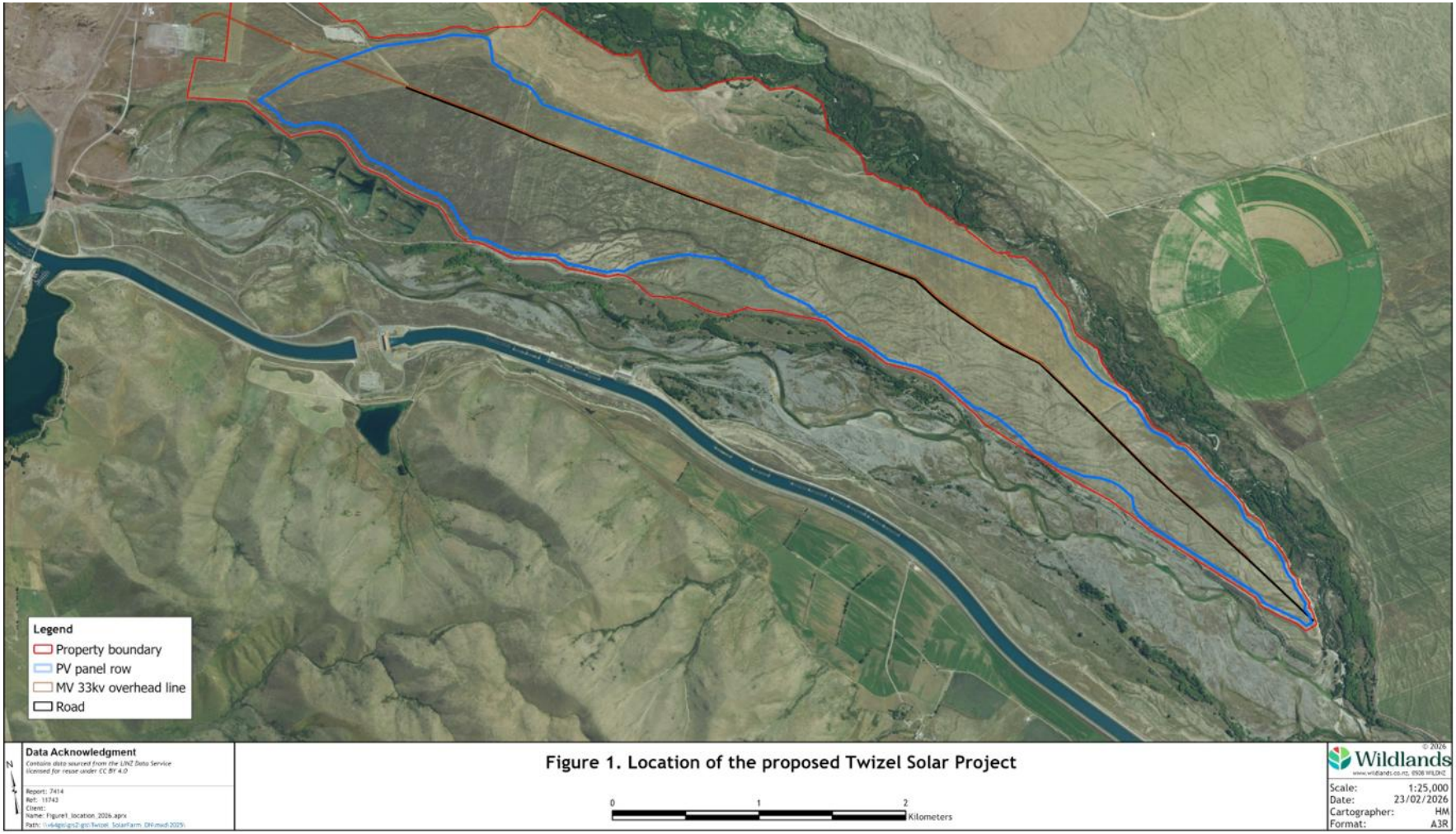
Further effects management details described in the more recent AEE include (mainly noted here for my later reference):

- *The design includes minimum setbacks from key ecological values. For example, a minimum setback of 35 metres* [later refined to 10-35m depending on context – see section 13.1.1] *will be applied to all indigenous vegetation and known locations of Threatened and At Risk plants that are subject to shading, while a 100-metre setback will be applied for wetland within and outside the site. A 20-metre setback will be applied to all property boundaries, so that the development will always be at least 20 metres away from the edge of the braided rivers, both of which are outside the property boundaries*. (Page 52).

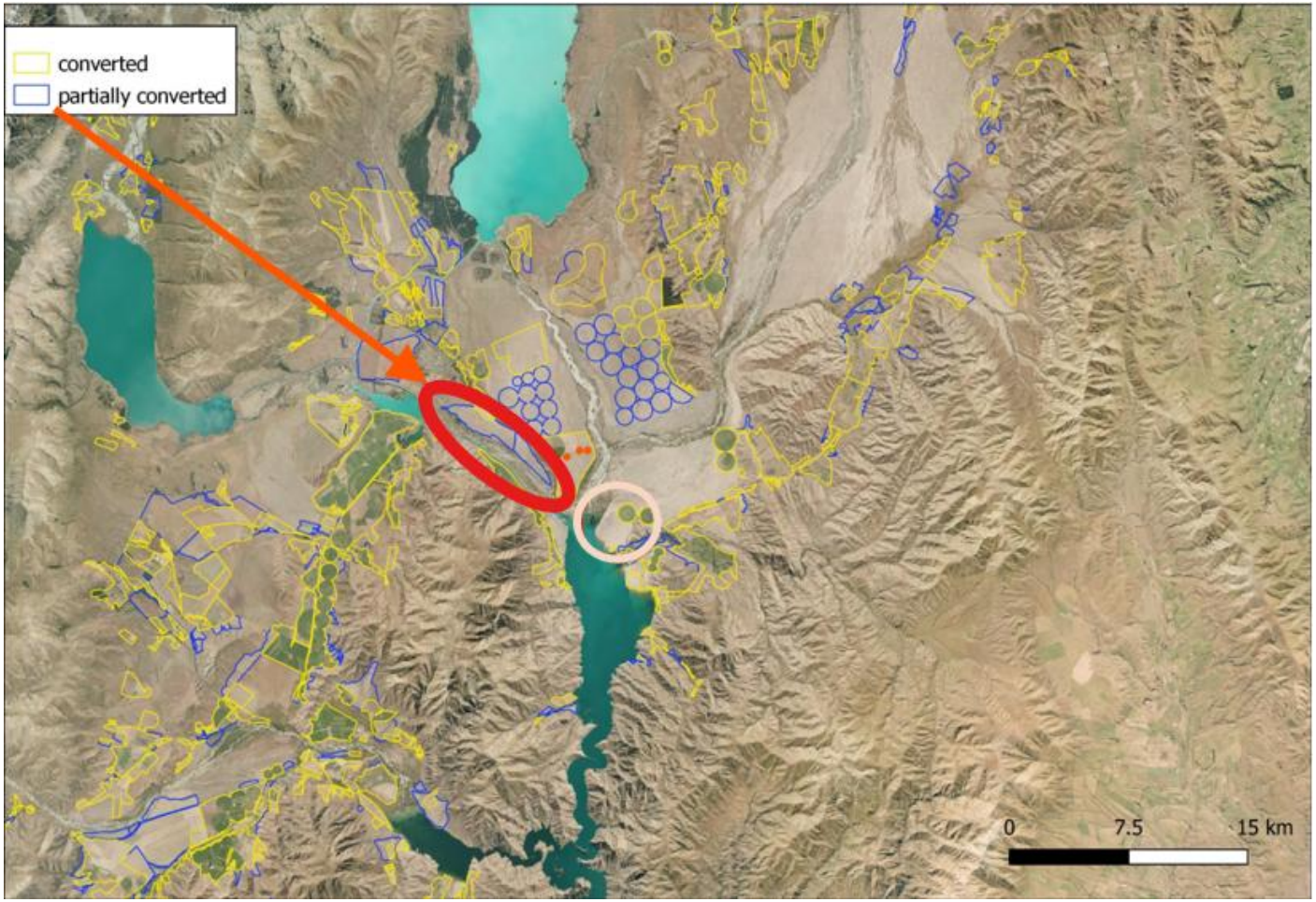
  I have commented on the AEE document that a 100m setback from the ephemeral wetland may not be necessary to manage potential effects.

Invertebrate *Monitoring should be undertaken annually for the first three years following the onset of construction, and once every three years thereafter for twelve years.* (Page 76).

Attachment 1: Proposed solar farm site and panel footprint



Attachment 2: Map of already developed land (converted) that may be considered as alternative locations for solar farm development to avoid some of the potential effects from such developments within undeveloped land. The project site is a partially converted area, circled in red.



Attachment 3: Potential ecological effects of the proposal - Page 43 of AEE

- Vegetation and flora:
  - Clearance of indigenous vegetation.
  - Microclimatic changes beneath solar panels, resulting in changes to vegetation.
  - Loss of At Risk or Threatened plants.
  - Modifications of wetland habitat.
  - Potential introduction of pest plants.

- Avifauna:
  - Loss of avifauna habitat.
  - Disturbance to indigenous breeding avifauna during construction.
  - Death or injury to indigenous breeding avifauna during construction.
  - Operational disturbance to avifauna.
  - Risk of bird strike with panel arrays.

- Lizards:
  - Disturbance (including death and injury) to lizards.
  - Loss of lizard habitat.
  - Fragmentation of lizard habitat.
  - Reduction of lizard habitat quality due to shading from panels.
  - Operational disturbance to lizards.
  - Disturbance to lizards during earthworks.
  - Breeding failure/displacement of lizards.

- Invertebrates:
  - Reduction in invertebrate habitat.
  - Mortality and disturbance of invertebrates.
  -
  - Reduction in invertebrate habitat quality due to shading.

Attachment B: Disturbance of site from earthworks as indicated by Attachment 1 of the Application (& as per Figure 4.10 of the Application).