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DRAFT

Lizard Management Plan for 87 Upper Sefton Road, Ashley, Canterbury

Contract Report No. 7300b

Providing outstanding ecological services to sustain and improve our environments

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Contract Report No. 7300b

December 2024

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1.0 Introduction

McCracken & Associates Limited on behalf of Solar Bay Ltd, engaged Wildland Consultants Ltd (Wildlands) to undertake a lizard habitat assessment at a proposed solar farm site at 87 Upper Sefton Road, Ashley, Canterbury. As a part of a request for information (RFI) from Waimakariri District Council (WDC), the council's biodiversity team identified potential lizard and bird habitat within the site. Therefore, McCracken & Associates Ltd requested a lizard survey to be completed by a suitably qualified herpetologist to inform the potential impacts the proposed solar farm may have on lizards.

An initial habitat assessment was undertaken by Wildland Consultants Ltd (Wildlands) in July 2024 (Wildland Consultants, 2024), while targeted lizard surveys were carried out across the proposed solar farm site during October 2024, under Wildlife Act Authority 96003-FAU. One hundred and fifty-nine Canterbury grass skinks were observed over this survey (45 captured and 114 uncaptured), confirming the presence of a lizard population, and the requirement for a Lizard Management Plan (LMP, this document).

This LMP follows the principles outlined by the Department of Conservation in their guidelines (DOC, 2019) (Table 1). These principles describe steps to take and enable the outcome of successful lizard management (including salvage, if determined to be the right mitigation option). These include undertaking a thorough assessment of the lizard values and site significance, both at the site of impact and potential release sites, and an assessment of the actual and potential effects of the construction and solar panel installation impact on the lizards present.

1.1 Project site and context

The 87 Upper Sefton Road site is an 80-hectare property of rural land, comprising a mixture of grazed paddocks, unmaintained rank grass, mixed exotic tree shelterbelts, and areas of gorse scrub and blackberry, with two ephemeral streams running through the centre of the property.

Proposed works to complete the solar farm include the installation of between 58,928 and 88,624 solar panels, creation of gravel and access roads, security fencing, cable trenching, shelter belt planting and the construction of associated infrastructure.

2.0 Wildlife Act 1953

Due to the presence of indigenous lizards, the proposed works require a Wildlife Act Authority under the Wildlife Act (1953).

All indigenous lizards are protected under the Wildlife Act (1953) and a permit under the Wildlife Act must be obtained from the Department of Conservation (DOC) before any indigenous lizards can be disturbed (due to impacts from earthworks and vegetation clearance) or relocated. DOC will require that lizard mitigation work be undertaken by a DOC-approved ecologist who has been authorised to implement lizard management for the project through a DOC Wildlife Act Authorisation (WAA; permit) issued for the project.

A Lizard Management Plan (LMP) is a required supporting document to accompany the WAA application. The LMP and WAA application must be submitted to DOC and approved prior to undertaking any activities that potentially impact on lizard populations, and any lizard management proposed to mitigate these effects.

Table 1 – Key principles for lizard salvage and transfer in New Zealand and corresponding section in this LMP that details the application of each principle.

Key Principle	Summary	Section in this Document Which Addresses the Principle
Lizard species' values and site significance must be assessed at both the impact (development) and receiving sites	One At Risk – Declining species present at the development site. The same species is present at the receiving site.	Section 4.0 and 7.5.1
Actual and potential development-related effects and their significance must be assessed	Effects include but are not limited to: accidental Injury/death/displacement, disturbance to lizards during earthworks, loss and fragmentation of indigenous lizard habitat, breeding failure/behavioural effects, reduction of high-quality habitats due to shading from panels, reduction of high-quality habitats due to shading from shelterbelt planting, ongoing disturbance from vehicle traffic.	Section 6.0
Alternatives to moving lizards must be considered	Some lizard habitat can be avoided by the proposed solar farm and associated works.	Section 7.1
Threatened species require more careful consideration than less-threatened species	No Threatened species have been detected on site. While it is unlikely they will be encountered,the Incidental Discovery Protocol will address any unexpected discoveries, includingThreatened species.	Section 4.0 and 7.7
Lizard salvage, transfer and release must use the best available methodology	Use standard accepted procedures (DOC Toolbox for Herpetofauna; Hare, 2012a & Hare,2012b).	Section 7.4.2
Receiving sites and their carrying capacity must be suitable in the long term	The receiving site is suitable for the species likely to be released. It will be enhanced through the planting, pest control and the addition of rock piles (habitat units).	Section 7.2 and 7.5
Monitoring is required to evaluate the success of the salvage operation	Post release monitoring is required for this salvage due to the substantial number of lizards predicted to be salvaged. Monitoring will be conducted to determine the success of the salvageand enhancement of the release site.	Section 9.0
Reporting is required to communicate outcomes of salvage operations and facilitate process improvements	Standard reporting is required to Waimakariri District Council, Environment Canterbury, Department of Conservation and relevant iwi on the completion of works.	Section 10.0
Contingency actions are required when lizard salvage and transfer activities fail	Contingencies are accounted for throughout the lizard salvage process including additional pest control and compensation. The Incidental Discovery Protocol will also be followed throughout works.	Section 7.6

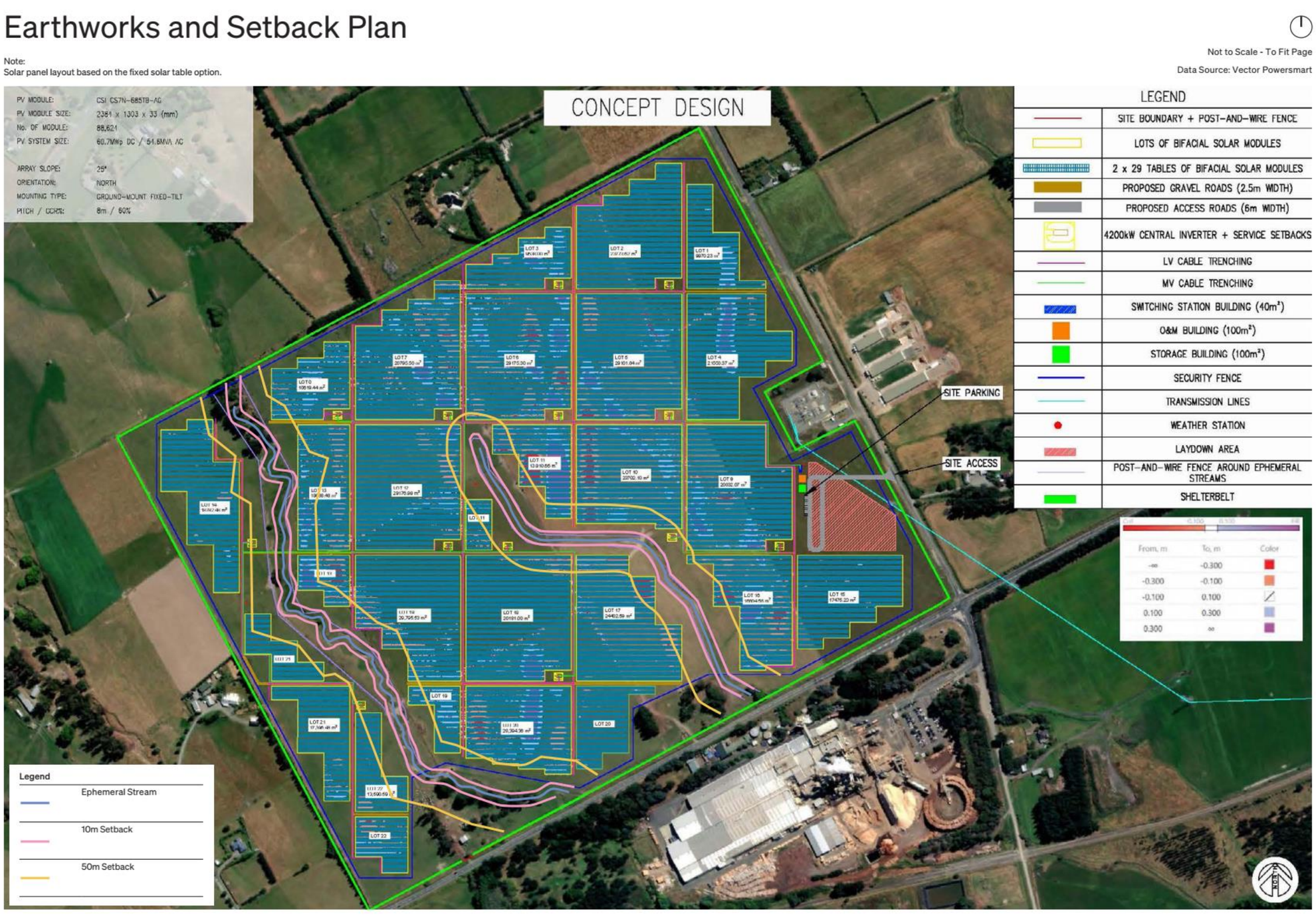

Figure 1 – Proposed solar farm plan for 87 Upper Sefton Road , provided by Rough Milne Mitchell Landscape Architects (RMM).

3.0 Summary of Lizard Management Implementation

3.1 General

Any lizard management must be carried out in consultation with DOC, appropriate iwi representatives, Waimakariri District Council, and Environment Canterbury (ECan) respectively. We consider a limited salvage and release a viable option for this site given most habitats are to be retained and enhanced.

3.2 Roles and responsibilities

The table below identifies the roles and responsibilities for the implementation of actions identified in this Lizard Management Plan. Responsibilities for specific actions are also identified in the relevant sections of this document.

Table 2 – Identified project roles and responsibilities for LMP implementation.

Title	Responsibility	Timeline
Project Owner • McCracken & Associates Ltd/Solar Bay Ltd	Delivery of the Project, including overall compliance with resource consents, LMP and subsequent WAA conditions to be issued for the project.	July 2024 to project completion.
Project Engineer(s) • TBD	• Project engineering, project management, and delivery. • Liaison between contractors and ecologists. • Implementing actions where responsibility has been identified. • Confirm implementation of LMP and WAA requirements. • Confirm compliance with LMP and WAA.	TBD
Contractor/ Construction Site Manager (TBD)	• Compliance with LMP and subsequent WAA issued for the project. • Implementation of actions required by the LMP and WAA including the following: - Reading and understanding the LMP and WAA requirements. - Facilitating a project start-up meeting with the Project Engineers, Project Herpetologist and Contractors before vegetation clearance for construction commences. - Maintaining clear lines of communication with both the Project Engineer, Project Herpetologist and Contractors regarding changes to the works schedule. - Implementing actions where responsibility has been identified. - Briefing new personnel about the contractor's responsibilities under this LMP.	TBD
Project Herpetologist - Authorised Personnel on the WAA - Wildland Consultants Ltd	The Project Herpetologist has been engaged by the Project Owner to provide technical advice to the Project Engineer(s), and to assist Project Engineer with compliance checks against this LMP and WAA. The Project Herpetologist will: • Prepare and update the LMP as required. • Ensure any required WAA permits are attained and on hand during site works. • Where necessary, assist with contractor training. • Undertake salvage site and release site set up in accordance to the LMP. • Implement the salvage programme, capturing, handling, and transferring lizards. • Design and supervise the habitat enhancement project. • Design and undertake post-release monitoring • Complete the required compliance reporting.	LMP Preparation: November 2024 Lizard management implementation TBD – depending on site works commencement

Title	Responsibility	Timeline
Contractors • Various companies(s) TBD	The Contractor(s) will be engaged by the Project Owner to implement the Project. The Contractor(s) will report to the Project Engineer; but work daily with the Contractor/ Construction Site Manager. The Contractor(s) will: • Set up and operate a pest management regime for an initial period of one month before salvage • Undertake landscape/restoration planning • Implement habitat enhancement requirements. • Implement remediation requirements, such as rectifying plant establishment failure. • Assist the Project Herpetologist with compliance and monitoring reporting.	TBD

3.2.1 Pre-start meeting

Prior to any construction or earthworks on site, a pre-start meeting must be undertaken with the following personnel present on site:

- Site supervisor/Contractor representative.
- Project herpetologist.
- Client representative.

At this meeting the logistics and timings of mitigation techniques will be discussed, so that all parties understand their roles and responsibilities.

4.0 Lizard Values

4.1 Desktop assessment/literature review

Department of Conservation BioWeb Herpetofauna Database observations within 30 kilometres of the site and within the last 20 years, were assessed to provide context for lizard fauna recorded within the site and inform an assessment of ecological values for the project area (Table 3).

Table 3 - Results of the Department of Conservation Bioweb Herpetofauna Database search within a 30 kilometre radius of the site and an assessment of the likelihood of the presence of these species at the site. Conservation status as per Hitchmough *et al.* 2021. Records older than 20 years were excluded from the database search. The likelihood of occurrence for each species is given, based on their known habitat preferences and distribution in the area and surrounds.

Species	Common Name	Conservation Status	Nearest Record	Preferred Habitats	Likelihood of Occurrence
Oligosoma aff. *polychroma* Clade 4	Canterbury grass skink	At Risk – Declining	1.5km (2021)	Lowland/montane shrublands grasslands, screes, talus slopes and rocky or boulder areas.	Presence confirmed (through site survey)
Oligosoma maccanni	McCann's skink	Not Threatened	28.0km (2008)	Open habitats- dry rocky environments such as rock outcrops, and montane grassland.	Unlikely
Woodworthia cf. *brunnea*	Waitaha gecko	At Risk - Declining	7.7km (2021)	Scrubland, forest, creviced rock outcrops, rocky scrubland, boulder beaches, river terraces, scree, talus, and boulderfield.	Highly unlikely

Species	Common Name	Conservation Status	Nearest Record	Preferred Habitats	Likelihood of Occurrence
Oligosoma lineoocellatum	Canterbury spotted skink	Threatened - Nationally Vulnerable	25.2km (2005)	Grassland, duneland, boulder beaches, scrubland, tussockland, flaxland, edges of forest, rocky areas, scree, herbfield, fellfield, stony riverbeds and terraces.	Highly unlikely
Naultinus gemmeus	Jewelled gecko	At Risk – Declining	27.4km (2015)	Scrubland, forest and tussockland. Often trees and shrubs like beech, mānuka, kānuka, mingimingi, matagouri, snow tussock and other dense vegetation.	Highly unlikely
Oligosoma aff. *polychroma* Clade 5	Southern grass skink	At Risk-Declining	18.68km (2020)	Prefers damp or well vegetated habitats such as rank grasslands, wetlands, stream/river edges, and gullies. Widespread from Banks Peninsula south to Stewart Island.	Highly unlikely (beyond extent of known distribution)

The initial habitat assessment was undertaken in July 2024. Surveys within previously identified lizard habitats on site were undertaken in October 2024. Canterbury grass skinks were detected during these surveys. Canterbury grass skink are often found in modified environments where there is a complex of rank grass, scrub and woody debris.

It is unlikely that McCann's skink will be found within the site due to this species typically being found in more montane areas rather than the lower plains. It is highly unlikely that any other species of indigenous lizard typically found in Canterbury are present within the site. This is due to historic clearance and modification of habitats, in addition to the site being outside the extent of the known distribution for some species (i.e. southern grass skink).

4.2 Field survey

4.2.1 Field survey methods

One hundred and ninety Artificial Cover Objects (ACOs) were placed in selected representative habitats across the proposed solar farm site on 15 August 2024. The ACOs were left out for seven weeks before being checked. ACOs require a 'settling in period' in which they should be set up at least six weeks before the first check for lizards so that lizards become accustomed to them in the environment and start using them frequently (Lettink, 2012).

Ten Gee's minnow (funnel) traps were set out on October 7 with an additional funnel trap set out on October 8. On October 9 five of the funnel traps were relocated from the existing farm yard area present at the second accessway off Upper Sefton Road to the northern and eastern gorse fence lines.

Field surveys were undertaken over five days in fine, warm conditions (*c*. 9.5-25.0 degrees) from October 7 - October 11 2024.

4.2.2 Field survey results

One hundred and fifty-nine Canterbury grass skinks (Plate 1) were observed during the surveys (Table 4). Forty-five of the 159 were captured and confirmed as Canterbury grass skinks. Of the 45 captured, eight were recaptured in subsequent survey days (17.8% recapture rate). Uncaptured skinks were too active, disturbed on approach to the ACOs or unable to be captured due to the presence of stinging nettle (which had grown under the ACOs during the time between installation and survey). It is likely that some of the skinks that were not captured may have been seen on multiple occasions. Twelve ACOs were unable to be relocated due to the growth of long grass throughout the site.

Table 4 – Lizard survey effort and weather conditions at the site.

Date	Weather on Survey Date	Activity and Effort	Species Detected
15-Aug-24	Sunny, light NE breeze, 5.0°C, 100% r.h. – 10.0°C, 94% r.h.	Set 190 ACOs	Nothing detected.
7-Oct-24	Sunny, light SW breeze 17.2°C, 80.5% r.h. – 14.0°C, 90.0% r.h. (cool change came around 3pm).	178 ACOs checked, 10 funnel traps set	12 Canterbury grass skink captured.
			29 Canterbury grass skink sighted.
8-Oct-24	Overcast, light N breeze, 16.3°C, 63.2% r.h - 25.0°C, 37.0% r.h.	178 ACOs checked, 10 funnel traps checked, 1 additional funnel trap set, 0.5 p/h manual searching.	6 Canterbury grass skink captured (2 recaptures).
			19 Canterbury grass skink sighted.
9-Oct-24	Partly cloudy, light W breeze, 16.5°C, 41.5% r.h. – 23.0°C, 19.4% r.h.	178 ACOs checked, 11 funnel traps checked.	1 Canterbury grass skink captured (recapture).
			27 Canterbury grass skink sighted.
10-Oct-24	Overcast, moderate S breeze, 11.1°C, 53.6% r.h. - 17.8°C, 40% r.h.	178 ACOs checked, 11 funnel traps checked.	23 Canterbury grass skink captured (2 recaptures).
			24 Canterbury grass skink sighted.
11-Oct-24	Sunny, still, 9.5°C, 65.6% r.h. - 21.8°C, 36.3% r.h.	178 ACOs checked, 11 funnel traps checked.	3 Canterbury grass skink captured (3 recaptures).
			15 Canterbury grass skink sighted.
	Temperature range: 5°C -25 °C	**890 ACO checks, 43 funnel trap checks 1 p/h manual searching**	**159 lizards; 8 (17.8%)**

Lizard survey methods sometimes have poor detection rates because of typically low population densities, species' cryptic colouration, difficulty in surveying preferred habitats and behaviour/activity patterns. As such, even intensive lizard surveys are unlikely to detect all individuals in the population or, possibly, all species present.

Plate 1 – Canterbury grass skink found at 87 Upper Sefton Road (October 2024).

Data Acknowledgment

Contains data sourced from the LINZ Data Service licensed for reuse under CC BY 4.0

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Report: 7300
Ref: 11543
Client: McCracken & Associates Ltd.
Name: LizardSightings.aprx
Path: E:\gis\Ashley River Solar Farm\mxd\

Map rotation: -27°

Figure 2. Lizards detected within eastern side of 87 Upper Sefton Road, Ashley

0 100 200 m

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Scale:	1:2,500
Date:	13/11/2024
Cartographer:	LW
Format:	A3

Figure 3. Lizards detected within western side of 87 Upper Sefton Road, Ashley

4.3 Lizard habitat

Canterbury grass skink habitat is present throughout the proposed solar farm site. Habitats are highly fragmented and are largely confined to the site boundaries, which is likely due to the land use history of the site. The lizard habitat within 87 Upper Sefton Road primarily consists of existing farm yard and storage areas, unmaintained rank grass, mixed exotic tree shelterbelts, gorse fence lines and vegetated ephemeral stream areas. Canterbury grass skink are often found in highly modified environments including agricultural habitats where there is sufficient cover in the form of rank grass, rocks, scrub and/or woody debris.

Lizard habitat has been categorised as high quality and low-quality lizard habitat (Figure 4). High quality lizard habitats are areas where vegetation is most suitable and lizard captures and observations were relatively high, indicating a higher density of lizards. Low quality lizard habitats consist of areas where suitable vegetation is sparse and lizard captures or observations were considerably lower.

The site was previously well-maintained through grazing, which confined lizard habitat to discrete areas within the site as described above. However, this vegetation is beginning to establish and will, if left unmaintained, become lizard habitat.

4.3.1 High quality lizard habitat

Two existing farm yard areas are present within the site, immediately within the two accessways from Upper Sefton Road. The farm yard areas consist of dilapidated buildings (Plate 2), macrocarpa hedgerows (*Hesperocyparis macrocarpa*); numerous large woody debris piles (Plate 3); gorse (*Ulex europaeus*) and blackberry scrub along the fence line and within debris piles; and multiple tree stumps (Plate 4).

Plate 2 – Dilapidated building within the existing farmyard area within 87 Upper Sefton Road accessway.

Plate 3 – Wooden debris pile within the existing farmyard area within 87 Upper Sefton Road accessway.

Plate 4 – Tree stumps found within the existing farmyard area within second accessway off Upper Sefton Road.

Unmaintained rank grass and a mixed exotic tree shelterbelt are present along the western boundary of the site. The unmaintained grass area comprises of cocksfoot (*Dactylis glomerata*) with the occasional gorse bush and exotic shrub planting (**Plate 5**). The exotic tree shelterbelt comprises of macrocarpa, pine (*Pinus radiata*) and gum (*Eucalyptus* sp.) trees. Beneath the shelterbelt is a complex of gorse and unmaintained rank grass (**Plate 6**).

Plate 5 – Rank grass along western boundary of 87 Upper Sefton Road.

Plate 6 – Exotic tree shelterbelt along western boundary of 87 Upper Sefton Road.

The vegetated area at the north end of the large ephemeral stream comprises pine trees, fallen wood piles, blackberry, and gorse (Plate 7).

Plate 7 - Complex vegetated habitat at the northern end of the large ephemeral stream within 87 Upper Sefton Road.

4.3.2 Low quality lizard habitat

Gorse scrub is present along multiple fence lines throughout the site, including a portion of the northern (Plate 8) and southern boundaries and an internal fence. Where present along the property boundaries, the gorse scrub connects to less modified, higher quality lizard habitat outside the site. The connectivity to better habitat increases the likelihood of lizard presence.

Plate 8 – Gorse scrub fence line along portion of northern boundary of 87 Upper Sefton Road.

4.3.3 Establishing habitat

At the time of initial habitat assessment habitats were well maintained by grazing and were only confined to the areas described above (Wildlands 2024). However, during the survey the site had changed with long grass beginning to establish and many areas of previously identified lizard habitat becoming overgrown. The areas of non-lizard habitat, if left unmaintained, will likely become lizard habitat by September 2025, and will need to be managed as such (refer to Section 7.3.1 for more detail).

Plate 9 – Rank grass establishing along exotic tree shelterbelt along western boundary of 87 Upper Sefton Road.

Plate 10 – Overgrown complex vegetated habitat at the northern end of the large ephemeral stream within 87 Upper Sefton Road.

Plate 11 – Long grass beginning to establish along interior fence lines within 87 Upper Sefton Road.

Plate 12 – Long grass establishing in existing farmyard area of 87 Upper Sefton Road.

5.0 Ecological Significance

The habitats identified in Figures 2 and 3 do not meet the significance criteria under the Waimakariri District Plan. However, they do meet the ecological significance criterion for rarity/distinctiveness in the Canterbury Regional Policy Statement (Environment Canterbury, 2021) because of the presence of Canterbury grass skink, which are At Risk-Declining and found in less than three other regions.

Data Acknowledgment

"Contains data sourced from the LINZ Data Service licensed for reuse under CC BY 4.0"

Report: 7300
Ref: 11543
Client:
Name: Lizard Habitat.aprx
Path: E:\gis\Ashley River Solar Farm\mxd\

Figure 4. Quality of lizard habitat present in 87 Upper Sefton Road, Ashley

0 100 200 m

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Scale: 1:4,000
Date: 29/11/2024
Cartographer: BL/LW
Format: A3R

6.0 Effects on Lizards

Effects on lizards from the proposed solar farm have been assessed at a local population scale, using the Quality Planning Extent of Adverse Effects criteria (Quality Planning, 2017). Potential effects on lizards resulting from the proposed development are detailed below.

6.1 Potential effects

- Accidental Injury/death/displacement.
- Disturbance to lizards during earthworks.
- Loss and fragmentation of indigenous lizard habitat.
- Breeding failure/behavioural effects.
- Reduction of high-quality habitats due to shading from panels.
- Reduction of high-quality habitats due to shading from shelterbelt planting.
- Ongoing disturbance from vehicle traffic.

Accidental injury/death/displacement: The proposed solar farm may result in the permanent displacement, injury and death of individual lizards within the site footprint. Without mitigation, this effect is likely to be **more than minor.**

Disturbance during earthworks: Disturbance to lizards during construction includes dust, vibration, and noise. This disturbance is likely to disrupt normal behaviour, including social dynamics in lizard populations adjacent to the site footprint as a result of solar farm activity. Without mitigation, across the site, this effect is likely to be **more than minor**.

Habitat loss and fragmentation: Lizard habitat is found throughout the site and loss of some habitat at this site cannot be avoided. This will result in permanent, and cumulative ongoing habitat loss for indigenous lizards at this site and fragmentation of lizard habitats within the Canterbury region. Clearance of this habitat will result in fragmentation of lizard habitat within the Ashley area. This effect is likely to be **minor** without mitigation.

Breeding failure/behavioural effects: The proposed solar farm and associated earthworks may affect the behaviour of lizards, potentially altering social interactions, increase stress, leading to reduced population functionality, poor breeding and low population recruitment. Without mitigation, this effect is likely to be **minor**.

Reduction of high-quality habitats due to shading from panels: High quality habitats within the site could be shaded out due to the construction of the panels and panel placement, resulting in the gradual shift in vegetation and species composition. This could reduce habitats and therefore population abundance of Canterbury grass skink. Without mitigation, this effect is likely to be **more than minor**.

Reduction of high-quality habitats due to shading from shelterbelt: High quality habitats within the site could be shaded out due to the establishment of shelterbelts, resulting in reduced persistence of lower shrub species. This could reduce habitat and therefore population abundance of Canterbury grass skink at the site. Without mitigation, this effect is likely to be **minor.**

Ongoing disturbance: Current farm tracks within the site are proposed to be upgraded to gravel roads. Vehicle strikes, noise and dust may affect lizard populations along the newly-formed gravel roads and vehicle accessways. While there is limited published literature about the impacts of dust on lizards, it is likely that lizards would avoid this habitat if there was heavy dust deposition. Without mitigation, this effect is likely to be **minor**.

6.2 Significance of effects

The level of ecological effects on indigenous lizards without mitigation actions are taken are presented in (Table 5).

Table 5 - Potential significance of effects to lizards and their habitats without mitigation.

Effect	Level of Effect Without Mitigation
Accidental displacement and harm (injury/death) to lizards.	More than minor
Disturbance to lizards during earthworks.	Minor
Loss and fragmentation of habitat for indigenous lizards.	Minor
Breeding failure/behavioural effects to lizards.	Minor
Reduction of habitats due to shading from panels	More than minor
Reduction of habitats due to shading from shelterbelt	Minor
Ongoing disturbance through vehicle strikes	Minor

7.0 Management of effects

In the sections below we describe how effects may be avoided, remedied, or mitigated in the first instance.

7.1 Avoidance

7.1.1 Ephemeral stream and existing farmyard areas

Some lizard habitat can be avoided by the proposed solar farm and associated works. The lizard habitat identified around the ephemeral stream – complex vegetated habitat (at the northern end of western ephemeral stream area) and existing farmyard areas (Figure 2 and 4), will be avoided by development works (refer to development plans; Figure 1). The ephemeral streams will be fenced and include an offset of ten metres for landscape planting and a 50-metre offset from the nearest solar panels.).

Responsibility: Solar Bay Ltd, McCracken & Associates Ltd, Project Herpetologist.

7.1.2 Site boundaries

Before operation of the solar farm commences, landscape plantings will be undertaken around the boundaries of the site, as per proposed updated consent Condition 12 (Appendix 1). All plants will be installed by a suitably qualified contractor and must reach a maximum height of two metres tall before solar farm installation and security fencing can occur. Rough Milne Mitchell Landscape Architects (RMM) have provided a draft Landscape Plan for the boundary shelterbelt planting, this will be updated following detailed design and in collaboration with the Project Herpetologist.

The methods of shelter belt planting have not yet been finalised. Therefore, we recommend that this shelterbelt planting is undertaken in a manner which avoids direct disturbance to lizards. This includes:

- Planting without manually removing or using sprays on the pre-existing vegetation around the boundary of the site.
- Post-planting, plants are kept free of weeds by means of hand weeding only or weed eaters when absolutely necessary. Hand weeding around the plants will allow for better establishment of the plants and limits disturbance to skinks.

If the above recommendations cannot be followed, and the planting methods used will cause direct disturbance to lizards, then the site boundaries will need to be salvaged prior to planting. This is described in more detail in Section 7.7.3.

Responsibility: Solar Bay Ltd, McCracken & Associates Ltd, Project Herpetologist

7.2 Remediation

A significant portion of mitigation for the effects to Canterbury grass skink will be dealt with through remediation. The majority of remediation will be undertaken through the implementation of lizard friendly landscape plantings in the ephemeral stream areas and site boundaries.

7.2.1 Shelter belt planting

The shelterbelt planting required around the boundaries of the site include native species of plants that are appropriate for lizards including:

- *Coprosma crassifolia* – Thick leaved Mikimiki
- *Coprosma propinqua* – Mingimingi
- *Coprosma robusta* – Karamū
- *Cordyline australis* – Cabbage Tree
- *Olearia paniculata* – Golden akeake

These plants will provide resources such as cover, refuge, nectar, fruit and insects for lizards present within the boundaries of the site (Figure 2 and 3). The shelter belt planting will occur prior to the installation and construction of the solar farm, allowing additional lizard habitat to establish.

7.2.2 Ephemeral streams

Similarly, a planting plan for the two ephemeral streams will be provided to the council within six months of gaining Resource Consent. The plan will provide identification and staged removal of all exotic species within 20 metres of the ephemeral watercourses (and ways to do undertake this in a lizard friendly manner), the retention of any lizard habitat (excluding exotic plant species) or relocation of additional habitat to within the stream area (including logs and tree stumps). This enhancement will replace some of the habitat lost during development works, in addition to ensuring that the ephemeral stream areas (in conjunction with additional enhancement described in Section 7.5.2) are suitable for lizard salvage and release. Further details regarding what will be provided in this plan are described in Appendix 1. The planting plan will be finalised in collaboration with the Project Herpetologist.

7.2.3 Fencing

Once lizard friendly landscape planting has been completed in the above areas, all the remediated areas will be stock fenced with a two-metre minimum buffer to protect the remediated areas from future disturbance including development works and future grazing (pastoral grazing is proposed to continue to maintain the site). Prior to installation, investigations into the efficacy of rabbit proof fencing will be considered for this site, for the purpose of excluding hedgehogs (known predators of indigenous lizards) and rabbits (likely to graze plants).

Responsibility: Solar Bay Ltd, McCracken & Associates Ltd, RMM Landscape Architects, Project Herpetologist.

7.3 Minimise

7.3.1 Ongoing site maintenance

The majority of the solar farm site was previously used for stock grazing. However, the large pasture areas have been left unmaintained and long grass is beginning to establish. Temporary fencing and grazing will be implemented to prevent the area becoming additional suitable habitat and reduce the risk of lizards dispersing into the area. A two-metre minimum buffer will be kept between identified lizard habitat and pasture to ensure that no existing lizard habitat will be affected. The areas of pasture will continue to be maintained through grazing until the salvage has been completed. Temporary fencing between the lizard habitat and maintenance area will be required to ensure stock remains outside of lizard habitats.

Ongoing grazing is essential to preventing further lizard habitat from establishing. If it is not managed before September 2025 (spring), and consequently becomes lizard habitat, it will need to be managed through the same methods highlighted in the LMP (Section 7.4).

Responsibility: Solar Bay Ltd, McCracken & Associates Ltd

7.3.2 Manual habitat removal

Lizard habitat identified around the existing farmyard areas comprises a variety of debris including tin, corrugated iron and timber. This debris can provide refugia for lizards. Although these areas are being avoided by major development works, some debris is planned to be removed to 'clean up' the area. Therefore, before clean-up works of the existing farmyard areas commence, manual habitat removal will be undertaken.

Where possible, the debris present will be deconstructed by the Project Herpetologist and removed from the site. The clearance will occur until as much of the debris, as reasonably possible, has been removed.

Any lizards discovered during manual habitat removal will be subsequently caught (as per the DOC Herpetofauna Toolbox for Systematic Searches; Hare, 2012b) and moved to the ephemeral stream areas as per Section 7.5. Any lizards captured will be handled and held following best practice and released as soon as practical to the pre-selected lizard release area (ephemeral stream area; Section 7.5).

A two-metre minimum buffer will be maintained between the major wood piles and tree stumps within the existing farmyard areas to ensure disturbance to lizard populations during clean-up works is minimised.

Responsibility: Project Herpetologist

7.3.3 Panel placement

Shading of lizard habitat may occur due to the placement of solar panels which may result in the reduction of suitable lizard habitat within the site. To minimize the effect of shading on lizard habitats, there will be at least a ten-metre minimum buffer between solar panels and the shelterbelt area around the boundary of the site. In addition, set-backs of 50 metres are proposed around the ephemeral stream.

Responsibility: Solar Bay Ltd, McCracken & Associates Ltd

7.3.4 Shelterbelts

In areas where shelterbelts will be planted it is likely that their height persistence may result in the shading of lower shrubs reducing the extent of lizard habitat within these areas. To minimise the impact of this habitat reduction, shelter belts should be left unmaintained to allow rank grass to persist around the base of shelter belts and their buffer zone. This will help to increase the amount of suitable lizard habitat present within the site.

To ensure the establishment of rank grass lizard habitat in/around the shelterbelt areas, photos will be taken annually at specific photo points within the site overtime. These areas will also be monitored bi-annually with ACOs to determine lizard population persistence overtime. Further details of this monitoring is described in Section 9.0.

Responsibility: Solar Bay Ltd, McCracken & Associates Ltd, Project Herpetologist.

7.4 Minimise: Salvage and relocation

A salvage and relocation programme will be implemented within the lizard habitats where vegetation removal is intended to occur. These areas consist of both high and low quality habitats (Figure 4). All lizards will be trapped using live capture traps and will be relocated to established habitat around the ephemeral streams.

7.4.1 Salvage effort

The amount of salvage effort and range of methods proposed for use at the site is aimed to enable the removal of as many individuals as possible, representing a moderate to high proportion of the total number of Canterbury grass skinks present.

Earthworks will proceed into salvaged lizard habitats within a maximum of two weeks after the salvage has been completed. The lizard habitats that are to be worked are underlined in Table 6. The Project Herpetologist will be notified once the works commence. If works do not proceed in this time, it is possible that lizards from the surrounding areas may move into the works area. If this occurs, the salvage will need to recommence following the methods outlined below (Section 7.4.2).

Low-quality habitats

Salvage of the low quality habitats will consist of a seven-day intensive salvage effort, that will occur in all low-quality lizard habitat (Figure 4). Some areas of lizard habitat within the site have sparse areas of vegetation, such as the internal and northern gorse hedgerows where gorse bushes tend to be separated by a few metres. Therefore, in these low quality habitats, traps will be set in individual gorse shrubs, with no specific spacing requirements.

High quality habitats

Salvage of the high quality habitats will consist of a 14 day minimum intensive salvage effort. Here traps will be placed in all high-quality lizard habitats at spacing of five-ten metres.

Traps will be checked consecutively for the suggested period to detect and salvage Canterbury grass skinks from the predetermined habitat types (consecutive days inclusive of both normal working days and weekend days). Table 6 addresses the approximate number of traps that may be required for each habitat type, and the number of lizards estimated to be salvaged.

Table 6 - Estimated number of lizard live capture traps and the manual searching effort required for each pre-determined habitat type at the proposed solar farm, including estimated number of skinks caught.

Habitat Type	Approximate Number of Traps Required	Manual Searches Required?	Estimated Number of Lizards Salvaged
Low Quality Lizard Habitat			
Interior gorse scrub fence line along eastern boundary (Beaties Road)	15-20	No	20
			Total: 20
High Quality Lizard Habitat			
Existing farmyard area off first accessway from Upper Sefton Road (including stump fence line extending north of the farmyard area)*	160-165	Yes	50-70
Existing farmyard area off second accessway from Upper Sefton Road*	105-110	Yes	20-40
			Total: 70-110

*Although the existing farm yard areas are being avoided by major development works, some 'clean up' of the area is required. Therefore, salvage will be undertaken in conjunction with manual habitat removal and avoidance of major habitat (stumps and large piles; Section 7.3.2) to ensure clean up can occur with minimal disturbance to Canterbury grass skink.

7.4.2 Salvage methods

- Live-capture lizard traps (pitfall traps) will be placed at five-ten metre spacings, as outlined above in each lizard habitat prior to earthworks.
- Once active, live capture traps will be checked daily for seven consecutive days in low quality habitats and a 14 consecutive days in high quality habitats.
- If trapping reveals trends of decreasing numbers of skinks over the course of the salvage, seven days in low quality habitats and 14 days in high quality habitats, with no skinks captured after day 5 or 10 respectively, trapping will cease.
- If live capture traps continue to get the same or high numbers of skinks over the course of the salvage (≥3 individuals on the last day of salvage), trapping will continue for another three days, or until no more skinks are caught.
- The length of trapping past the minimum requirements will be at the discretion of the Project Herpetologist.
- If a discrete area of habitat (as described in Table 6) has caught no lizards for three consecutive days, trapping will cease in that area and traps removed.
- Hand-searching techniques will be used to capture additional basking/active skinks. This will involve manually searching through and destructing the debris piles (where possible) at the end of the salvage to locate and capture any additional lizards.
- Any lizards captured will be handled and held following best practice and released as soon as practical to the pre-selected lizard release area.

To prevent harm to lizards, pitfall traps will be closed when not in use (either with a sealed lid and/or by filling them with rocks). Traps will be checked at least every 24 hours when in use.

Pitfall traps consist of a plastic container (>2 litre depth) dug into the ground (typically baited with pear or berry bliss lollies, Natural Confectionary Co.™ (known lizard attractants)), which lizards may fall into and be unable to exit. The pitfalls will be covered with Onduline to provide additional thermoregulatory advantages and attract more lizards to the traps. Pitfall traps will be filled with grass

and a damp sponge, in addition to the Onduline artificial cover to provide shelter and prevent desiccation of skinks within the trap. Pitfall traps will be installed one week prior to habitat clearance and will be closed during this time to allow for lizards to become habituated to the traps and for the traps to weather in (as per the DOC Herpetofauna Toolbox for Pitfall Trapping; Hare, 2012).

Responsibility: Project Herpetologist

7.4.3 Data collection

Lizard capture data will include species identity, sex, length, and any tail regeneration. Each day of salvage will be recorded, including start/stop time, GPS coordinates and a habitat description for the capture location, date and time. Weather conditions will be recorded during and at the beginning and end of each salvage event.

Responsibility: Project Herpetologist

7.4.4 Temporary holding of lizards

All captured lizards will be temporarily placed in clean individual lizard cloth bags, and stored in ventilated, hard-sided containers (to prevent accidental crushing), in cool, full shade until release. A small amount of damp leaf litter or vegetation from the capture site will be placed inside the cloth bags with the lizard to provide cover and prevent dehydration. Lizards will be released within two hours of capture into the pre-selected release area.

Responsibility: Project Herpetologist

7.4.5 Constraints

There are inherent risks associated with lizard capture, salvage and relocation as a management tool for mitigation purposes. In particular, there is high risk of poor capture rates for lizards during salvage activities. This will be managed by maximising lead-in time for preclearance capture and using a range of tools suitable to the species in question.

Lizard salvage climatic constraints:

Many lizard species are inactive below 16°C. Hot summer temperatures (>25°C) also reduce lizard emergence and detectability. Lizards prefer relative humidity of 60% to 70%. They are less likely to be detected when humidity is below 50% over a long period, or above 90%. Because of these constraints, salvage will be undertaken between October – April (inclusive), when:

- The temperature is between 16°C and 25°C, and
- Rain is no heavier than 0.1 – 2.0 mm per hour

Relocation of lizards is a complex process, and many factors must be considered before animals are moved. Consideration will need to be given to assess whether the release site has sufficient habitat and resources to support lizards (or additional lizards if some lizards are already present).

When lizards are first translocated, they will be unfamiliar with the landscape and may be unable to find suitable refugia to hide from predators and competitors, and they may therefore potentially disperse away from the release site.

7.4.6 Habitat clearance following salvage

All vegetation found within the lizard habitat, will be removed post-salvage without supervision. All unsupervised vegetation clearance will occur within **two weeks** of the salvage to ensure any remaining lizards do not move back into the habitats. The Incidental Discovery Protocol (Section 7.7) must be followed.

Responsibility: Solar Bay Ltd, McCracken & Associates Ltd

7.5 Lizard release

7.5.1 Release site assessment

The release site will be located on site at 87 Upper Sefton Road, Ashley. The release site identified will be the two ephemeral stream areas as described above (Section 7.2.2).

Table 7 – Assessment of lizard release site based on Principle 6 of the lizard salvage guidelines (DOC, 2019).

Principle Relating to Salvage and Release	Description	Detail/Activity
1. The site must be ecologically appropriate and have long-term security	**Resident lizard communities must be understood** *Will released lizards increase viability of population, or be released in high enough numbers to start new population?*	Released lizards will be located in an area which has resident Canterbury grass skinks present (preference three of release site quality; DOC 2019). Lizards released will supplement a low-density population.
	The release site must be an appropriate distance from the impact site to prevent lizard homing, but close enough that it provides similar habitat	The release site will be established on site at 87 Upper Sefton Road. The release site is therefore within the known range of the Canterbury grass skink, but is also far enough away from the areas of impact on site, making it ecologically appropriate for the relocated population.
	The location must be within the species natural geographic range. *Ensure no mixing of potentially genetically structured populations.*	The location of the release site is within the species natural geographic range. The released animals should be genetically the same as the resident population at the release site.
2. The habitat at the site must be suitable for the salvaged species	**Vegetation composition and size:** predominantly indigenous vegetation and sufficiently large and continuous for residents, release lizards and allowing for population growth.	The release site is located within two ephemeral stream areas within the development site. The site has had minimal planting but will be supplemented with additional enhancement planting, pest control and creation of habitat units. It is approximately 1.9 hectares in area.
	Must contain sufficient resources for potential population. For example, food, cover, retreats. What enhancements are proposed for expanded population?	The habitat at the release site will contain sufficient habitat resources for the relocated population. Habitat enhancement is occurring as per section 7.2.

Principle Relating to Salvage and Release	Description	Detail/Activity
	Habitat enhancement – must be ongoing in an ecologically relevant timeframe	Habitat in rank grass covered areas will be improved using lizard appropriate plants. Predator control can be introduced to reduce pressures to population after release.
	Edge effects – The release site must be buffered from intermittent climatic extremes, such as drought.	The release site is within two ephemeral stream areas. Therefore, inundation from flooding is possible, inundation events will be monitored and reported on.
3. The site must provide protection from predators	*Habitat must protect from predators, or effective pest control must be in place. Must include full suite of predators including trapping for mice*	Predator control in the form of bait stations for rodents and DOC series traps for mustelids and hedgehogs will be introduced 1-2 months before salvage and release. This will be ongoing for 5 years.
4. The site must be protected from future human disturbance	*Land tenure must ensure long term protection from disturbance*	The release site is on private land and is therefore, protected from disturbance long term.

7.5.2 Release site enhancement

Due to the number of skinks predicted to be salvaged from the 87 Upper Sefton Road site, enhancement of the release site in required to increase carrying capacity of the site and ensure there is enough habitat and resources for both resident and salvaged lizards. Release site enhancement will include, enhancement planting, pest control and the construction of habitat units to provide additional refugia.

Site preparation – majority of site

Control of groundcover vegetation is required prior to planting as grasses and broadleaf weed species can smother young indigenous plants in the first season following planting and per proposed updated consent Condition 12 (Appendix 1). McCracken & Associates will commission a suitably qualified contractor to undertake preparation of the site for planting.

Site preparation – northern end of the western ephemeral stream

Although the majority of the ephemeral stream areas are not currently lizard habitat, due to previous grazing, an area at the northern end of the western ephemeral stream is. Therefore, groundcover vegetation in this area will be cleared in a lizard friendly manner (through use of hand weeding or use of a weed eater, on warm, fine weather days).

Spot-spraying may be used in areas outside of the identified lizard habitat (Figure 2 and 3), if determined necessary. This will be decided at the discretion of the contractor who will be preparing the site.

Responsibility: Solar Bay Ltd, McCracken & Associates Ltd, contractor

Enhancement plantings

The finalised enhancement planting list will be included in the proposed planting plan for the two ephemeral streams, which is required as per the proposed consent Condition 12 (Appendix 1). A wide variety of lizard friendly plants will be installed to increase the complexity of this habitat and provide a wide range of resources for lizards. Planting will be undertaken by a suitably qualified contractor

funded by Solar Bay Ltd. A full planting schedule will be provided in the planting plan, but a proposed species list is outlined below in Table 8.

Table 8 – Recommended planting for enhancement within the two ephemeral stream areas within 87 Upper Sefton Road.

Species	Benefits to Lizards	Currently present at site	Beneficiaries	Growth Habit
Silver tussock (*Poa cita*)	C, I	N	Terrestrial skinks	Tussock forming grass
Swamp sedge (*Carex virgata*)	C, I	N	Terrestrial skinks	Tussock forming grass
Pukio (*Carex secta*)	C, I	N	Terrestrial skinks	Tussock forming sedge
Flax (*Phormium tenax*)	C, R, N	Y	Terrestrial skinks	Herb
Creeping pōhuehue (*Muehlenbeckia axillaris*)	C, N, F, I	N	Terrestrial skink	Liane
Scrub pōhuehue (*Muehlenbeckia astonii*)	C, R, N, F	Y	Terrestrial skinks	Liane
Mingimingi (*Coprosma propinqua*)	C, N, F, I	N	Terrestrial skinks	Shrub
South Island toetoe (*Cortaderia richardii*)	C, R, I	N	Terrestrial skinks	Tussock forming grass
Cabbage tree (*Cordyline australis*)	R, F	N	Terrestrial skinks	Tree
Matagouri (*Discaria toumatou*)	C	N	Terrestrial skinks	Shrub
Coprosma rotundafolia	C, N, F, I	N	Terrestrial skinks	Shrub

Key to known benefits to lizards: C = Cover, R = Retreats, N = Nectar, F = Fruit, I = Invertebrates

Responsibility: Solar Bay Ltd, McCracken & Associates Ltd, contractor.

Plant maintenance and monitoring

A plant maintenance schedule, including a two-year defects liability period, is a requirement of the planting plan that has been proposed as per updated consent Condition 12 (Appendix 1). This plant maintenance schedule will include monitoring visits every one to two months over spring and summer to unsure the uptake and survival of plantings and determine what maintenance is required. Post-planting maintenance will include:

- Plants kept free of weeds by means of hand weeding only or weed eaters when absolutely necessary. Weeding will be undertaken three to four times a year to ensure that weeds do not compromise plant growth.
- Hand weeding around the plants will allow for better establishment of the plants and limits disturbance to skinks.
- Where plant losses exceed 10 percent, these will also be replaced.

Maintenance will take place on warm, sunny days when the daily temperature exceeds 16 degrees as this is when skinks are most active. Contractors will also refrain from using sprays in and around lizard habitats, as the effects herbicides and insecticides have on lizards are largely unknown.

Planting maintenance and monitoring will be commissioned by McCracken & Associates Ltd and implemented by a suitably qualified contractor.

Responsibility: Solar Bay Ltd, McCracken & Associates Ltd

Additional habitat units (aggregate rock piles)

To increase the amount of suitable lizard habitat and increase carrying capacity within the site, the release site will also be enhanced through the deposition of rock piles. Aggregate piles up to 1 metre

in height and 2 metres wide and spaced 10-20 metres apart will be deposited throughout the release sites.

In order to ensure enough habitat units are provide for the expected number of lizards salvaged, a minimum of 50 rock piles should be deposited across the two ephemeral stream areas, with the site having capacity to have approximately 80 rock piles in total. All rock piles should be placed at least 5 metres away from the ephemeral streams.

The aggregate will be a 50-200 mm grade to provide optimal interstitial spaces amongst the piles for lizard occupation. Rocks will be sourced from a landscape supplier or local quarry prior to the salvage and release site remediation. All rocks will be washed and free from soil to avoid unwanted grasses/invasive plants growing in the spaces. Rocks will be transported on site by a small trailer or similar. The placement of the rock piles will be supervised by the Project Herpetologist, to ensure they are placed correctly and ensure that disturbance to the site is minimised. DOC provides guidance on habitat enhancement that can be used to assist with rock placement (DOC, 2023).

Responsibility: Solar Bay Ltd, McCracken & Associates Ltd, Project Herpetologist

Predator control

McCracken & Associates Ltd will undertake pest control across the solar farm site to reduce the impact of predation on released lizards. Contingencies will be applied if monitoring indicated pest control is not being effective, including review and further intensification of the pest control. Predator control will be undertaken by a suitably qualified predator control operator (with a controlled substances license) contracted by McCracken & Associates Ltd. Predator control contractors will abide by all local and national regulations. The equipment required to undertake pest control are highlighted in Table 9 below.

Table 9 – Types and numbers of traps required to undertake pest monitoring and control at 87 Upper Sefton Road.

Predator Type	Device/Bait	Supplier	Number of Units Needed per Servicing Round
Mustelids and hedgehogs	DOC series traps	Xcluder	12
	Tracking tunnels	Connovation	25
Mice	Run-through bait station	Connovation	75
	Tracking tunnels	Connovation	55

Invasive mammal monitoring

Mustelids and hedgehogs

Mustelid and hedgehog monitoring will be undertaken across the entire site to determine rat and hedgehog abundance. Tracking tunnels will be placed along one line at 50 metre spacings from the north eastern corner to the south west corner of the site (*c.*25 tracking tunnels). Tracking tunnels will be baited with peanut butter and left for three nights. Tracking cards will be checked on the fourth day to determine predator presence/abundance. Mustelid and hedgehog monitoring will be undertaken for two months prior to lizard release and for five years post-release to inform the efficacy of the mustelid and hedgehog control.

Mouse monitoring at release site

Additionally, tracking tunnels will be placed at 30 metre spacings (Norbury et al, 2014), within the ephemeral stream release site (*c.*55 tracking tunnels). Tracking tunnels will be baited with peanut butter and left for three nights. Tracking cards will be checked on the fourth day to determine whether mouse tracking is below 5% in the release area. If tracking is above 5% bait stations will be set for the subsequent month. Tracking tunnel monitoring will be undertaken two months prior to lizard release and for five years post-release.

Invasive mammal control

Mustelids and hedgehogs

DOC 150, DOC 200 and DOC 250 series traps will be set alternatively in three lines across the entire site, spaced 400m apart and baited with hens eggs. Each trap within these lines will be spaced at 200m apart (*c.*12 traps). Trapping will commence two months before lizards are released at the site in order to give the traps time to weather in and the predators time to get used to the traps. These traps will be checked once a month, except in summer when they will be checked fortnightly. Mustelid and hedgehog control will be implemented for five years post-release.

Hedgehogs get caught as bycatch in all DOC-series traps. There are no current best-practice methods of controlling hedgehogs. However, this is an area of significant interest and is currently the subject of ongoing research.

Mouse control

Run-through bait stations will be placed at 25 metre spacings within the ephemeral stream release site (*c.*75 bait stations). Two months prior to lizard release the bait stations will be set for three weeks with brodifacoum rodent blocks to initially knock-down mouse abundance. After the initial knockdown the bait stations will be emptied of brodifacoum and refilled with diphacinone blocks, if required. If the above monitoring determines that mouse tracking is above 5% then the bait stations will be set with diphacinone for the subsequent month. If monitoring determines that mouse tracking is below 5% then all bait will be removed from the stations until the next month. Mouse control will be implemented (when necessary) for five years post-release.

The ephemeral stream release areas will be fenced (to avoid disturbance to lizard habitat), therefore, there will be no risk to grazing livestock. If sensitive bird populations are detected in bird surveys (required as a part of the RFI from WDC), the method of poison baiting may need to be reassessed based on recommendations from a suitably qualified avifauna ecologist.

Responsibility: Solar Bay Ltd, McCracken & Associates Ltd, suitably qualified pest control contractor

7.5.3 Release methods

Canterbury grass skink will be transported by car to the release site within the ephemeral streams at 87 Upper Sefton Road. The hard sided containers that skinks are temporarily held in should be placed in larger bins (fish bins) securely in the car (seat belted) so movement is limited. The most direct route should be taken to the release site to limit the amount of time the lizards spend in the car. Lizards should be checked on release for any signs of stress or illness.

Canterbury grass skinks will be released into the pre-constructed aggregate piles. Five to ten Canterbury grass skink (depending on the numbers caught) will be released into each aggregate pile, so as to not create unnecessary competition. Where any lizards are found together or in an aggregation (i.e. multiple captures in one trap), they will be released in groups together.

Responsibility: Project Herpetologist

7.6 Contingencies and risks associated with proposed management

7.6.1 Risks associated with salvage

Potential risks to lizards as a result of the proposed salvage, and management actions to reduce these risks, include:

- **Overheating**
  - Issue: Overheating may occur when captured lizards are temporarily held in containers during ongoing salvage activities.
  - Action: Lizards will be placed in individual containers and kept in a cool place until transported and released. Handling will be minimized to ensure they do not become stressed. All traps will be checked at least once daily.

- **Overcrowding, competition and displacement**
  - Issue: Lizards are already present in areas of the release site. The addition of supplementary lizards to the release site population may result in competition for resources and increased predation pressure and may result in displacement when released.
  - Action: Enhancement planting, predator control and creation of additional habitat units within the release site will allow for a greater carrying capacity of lizards. This will reduce the amount of competition and potential displacement of released skinks.

- **Injury/death**
  - Issue: Incorrect trapping or handling during salvage by untrained staff.
  - Action: All lizards will be captured or supervised by an appropriately qualified herpetologist, following best practice and full hygiene protocols, minimising the risk of injury, death and disease transmission through inappropriate handling and capture.

7.6.2 Contingencies

There is inherent uncertainty in the outcomes of lizard salvage and release as a result of the complexities of the process and long-term management of the release site for species conservation. In some cases, threatened species may be discovered during salvage, the release site is not viable in the long term, or predator control regime has been found ineffective.

The main risks and resulting contingencies relating to the proposed salvage include (see **Table 10** - Risks associated with salvage and proposed management.Table 10 for more details):

- Additional lizard species encountered other than those known to be on site (unexpected discovery).
- More than expected lizards (>370 individuals) are salvaged from the impact site (including the main salvage and contingency salvage described in Section7.73 below).
- Ephemeral stream release site does not establish.
- Predator control fails.

Table 10 - Risks associated with salvage and proposed management.

Risk associated with management	Detail	Contingency
Additional lizard species encountered	Although unlikely, if any other species is encountered during salvage.	Follow Incidental Discovery Protocol. Stop works, notify DOC, and develop further instructions (see Section 7.7)
More lizards than expected are salvaged	Each pre-determined habitat type has an estimated number of skinks to be salvaged, but this may be underestimated at some sites (number of lizards salvaged from sites is consistently underestimated for developments).	Salvage will continue for a seven or 14 days (depending on the habitat quality) until **three or less** skinks are captured, or until **no** skinks are captured during the latter stages of salvage (day 5 & 10) (see Section 7.4.2).
		If more than 340 lizards are salvaged, release site predator control and monitoring will be extended by five years, for a total of ten years of predator control.
		If more than 340 lizards are salvaged, additional compensation of $5,000.00 will be provided for every 25 additional skinks salvaged (see Section 7.6.3).
		If more than 400 lizards are salvaged. An additional release site (enhanced site boundaries) will be required (see Section 7.6.5).
Residual skink populations remaining after salvage completion	It is unlikely that all lizards will be removed from the impact site and may be displaced by earthworks.	Incidental Discovery Protocol (see Section 7.7).
		Compensation (see Section 7.7)
Release site failure	Predator control fails	If pest control monitoring detects consistently high tracking, pest control methods will be reassessed (see Section 7.5.2).
	Lizard population declines are detected	Post-release monitoring will determine population persistence. Any recommendations to address population declines will be recommended in annual reporting (see Section 9.6).
	Plant survival is not sustained	A plant maintenance schedule, including a two-year defects liability period, is a requirement of the planting plan that has been proposed as per updated consent Condition 12 (see Appendix 1 and Section 7.5.2)

7.6.3 Additional salvage of site boundaries

If pre-existing vegetation around the boundaries of the site are required to be manually cleared for the proposed shelterbelt planting, these areas will need to be salvaged following the methods outlined in Section 7.4.2. Section 7.4.1 addresses the approximate number of traps that may be required for each habitat type, and the number of lizards estimated to be salvaged for the site boundaries.

Table 11 - Estimated number of lizard live capture traps and the manual searching effort required for each pre-determined habitat type around the boundary of the proposed solar farm, including estimated number of skinks caught

Habitat Type	Approximate Number of Traps Required	Manual Searches Required?	Estimated Number of Lizards Salvaged
Low Quality Lizard Habitat			
Gorse scrub fence line along portion of northern boundary of 87 Upper Sefton Road	15-20	No	20
Gorse scrub fence line along southern boundary of 87 Upper Sefton Road	10-15	No	20
Small pump area to the left of the first existing farmyard area	5-10	No	10
			Total: 50
High Quality Lizard Habitat			
Rank grassland and gorse along western boundary	160-165	No	100-150

Rank grassland and gorse along northern boundary (connected to complex vegetated habitat at the northern end of the large ephemeral stream)	35-40	No	20-40
			Total: 120-190

If these areas are required to be salvaged the enhancement planting, aggregate rock pile creation and predator control (outlined in Section 7.5.2) will need to be undertaken prior to the salvage taking place to ensure that the release site is suitable for lizard occupation.

If salvage is required for the shelterbelt area, pest monitoring and control will need to be undertaken two months prior to the release of the lizards and continue for five years following the release. This is in addition to the pest control required for the salvage for the rest of the site before development commences. In the event that the pest control schedules for both salvages overlap, the pest control program will conclude five years after the second salvage programme.

7.6.4 Contingency compensation

For every additional 25 skinks salvaged following the estimated number (370), $5,000 will be provided to the SRARNZ fund above that orignally required and described in Section 7.7.1. The total payment will be arranged by Solar Bay Ltd directly with SRARNZ as described above.

7.6.5 Contingency release site

If more than 400 skinks are salvaged, the ephemeral stream is likely to reach carrying capacity. As a result, any skinks salvaged beyond 400 will be released into the enhanced site boundaries. The site boundaries will be enhanced through shelter belt planting, as per Section 7.2.1. These plantings must be established to a height of two metres before development works begin. Therefore, it will be suitable to receive salvaged skinks, if required. Skinks will be released at the base of dense vegetation to provide shelter and protection after release. Where any lizards are found together or in an aggregation (i.e. multiple captures in one trap), they will be released in groups together.

7.7 Compensation

7.7.1 SRARNZ fund

The site is likely to have a large population of lizards, it is therefore considered unlikely that salvage and relocation will rescue all lizards present. In addition, a portion of lizard habitat will be lost and not replaced elsewhere. Therefore, Solar Bay Ltd. have agreed to provide $5,000 to the Society for Research of Amphibians and Reptiles New Zealand (SRARNZ).

Wildlands have recently been notified by DOC that a funding pool for SRARNZ is being established. This pool will allow for funds to be combined from multiple projects, such as this one, which will then be allocated by SRARNZ towards research aimed at providing protective benefits to New Zealand herpetofauna.

A payment of $5,000 will be arranged by Solar Bay Ltd directly with SRARNZ secretary, Jacqui Wairepo, and SRARNZ Research Grants Officer, Anne Besson, by 31 October, following lizard salvage completion.

8.0 Incidental Discovery Protocol

8.1 Overview

Incidental discovery protocols are set out below for solar farm contractors, and are to be followed if any further lizards are discovered, post mitigation, during construction of the 87 Upper Sefton Road, Ashley solar farm.

Lizards could be present in and on vegetation such as within mixed exotic shrubland and grassland, or within debris. They may also bask in sunny exposed spots, such as in/on debris piles. They may be uncovered when disturbed by habitat clearance or earthworks.

8.2 Protocols for incidental discovery of a lizard

Following the incidental discovery of a lizard:

- Immediately (as soon as discovery of a lizard is made) restrict construction activities to beyond 25 metres of the place of discovery.
- If possible, capture the lizard and place in a container with grass. Ensure to create breathing holes in the container for the lizard. Hold in captivity in a cool, shady location out of sun until a decision is made.
- Immediately inform the environmental manager/operations manager on-site whom will then follow the protocol outlined in this management plan.
- Notify the project herpetologist within eight hours.
- Document:
  - Date and time.
  - Weather conditions.
  - Observer name(s).
  - Photographs of the animal and the location where it was found. Photograph the lizard from above trying to show the head and any markings on the upper body or back. A cell-phone picture is adequate for this and will help with identification of species.
  - Location (GPS coordinates).
  - Species.
  - Sex and age (where possible).
  - If injured:
  - What part of the animal is injured? (Photograph the injury).
  - Time since injury (if known).
  - Probable cause of injury (if known).
- Go to Section 8.2.1
- If a carcass is found:
  - Condition of carcass (see below).
  - Approximate time since death (if known).
  - Probable cause of death (if known).
- Go to Section 8.2.2
- Healthy lizards are to be released into the pre-determined release site at 87 Upper Sefton Road in the ephemeral stream areas, or at another suitable location as decided by the Project Herpetologist and Department of Conservation.

- If lizards are unable to be captured and/or photographed, note as much detail as possible: what colour was it; what colour patterns; how big was it; whether it was robust or slender; what habitat was it found in? You may need to describe these details to the Project Herpetologist and the Department of Conservation.
- If the species encountered has a Threat Classification status of 'Threatened' (a higher Conservation threat status than 'At Risk') then all works must cease immediately (as soon as the discovery is made), until an assessment is made of the works programme risk for that species, and any specific management identified, including avoidance.
- Should a nationally 'Threatened' lizard species be encountered during construction, the Project Herpetologist will immediately consult with the Department of Conservation to ask for advice on how to proceed. Further works may not proceed until approval has been granted to continue or a lizard management plan has been drafted for the relevant species.

8.2.1 Following the incidental discovery of an injured lizard:

- Follow the above procedures.
- Immediately (within one hour) contact a pre-identified local veterinarian, and arrange for the injured lizard to be delivered to the veterinarian. This may require a monetary contribution for care.

8.2.2 Following the incidental discovery of a lizard carcass:

- Notify the Project Herpetologist at Wildland Consultants within eight hours. The project herpetologist will notify the Department of Conservation and ask for advice on how to proceed.
- Arrange for the carcass to be sent to Wildbase (06 350 5329), Massey University, in Palmerston North, unless advised otherwise by the Department of Conservation.

9.0 Monitoring

9.1 Overview

The Department of Conservation's lizard mitigation guidelines (DOC, 2019) recommend monitoring to evaluate the success of the salvage operation. In addition, post release monitoring may not detect any changes in the population of any lizards in the short term and may need to be carried out for up to five to ten years. Therefore, monitoring will be established at the release site during the first lizard active season post salvage and will be undertaken annually for a minimum of five years. This post release monitoring will be commissioned by Solar Bay Ltd.

9.2 Goals and objectives

The purpose of long-term monitoring is to ensure the success of the salvage from high and low quailty habitats at 87 Upper Sefton Road (section 7.4) to the ephemeral stream areas.

The objectives of long-term monitoring at 87 Upper Sefton Road are:

- Objective 1: Ensure suvivial of plantings in ephemeral stream areas at 87 Upper Sefton Road.
  - Monitor plant growth and establishment, and connectivity between habitats.
  - Determine success of the plantings.
- Objective 2: Ensure Canterbury grass skink population persistance .

- Monitor Canterbury grass skink persistence within the release site, post-release.
- Monitor resident lizard persistence and/or lizard re-establishment within the shelterbelt planting area.

- Objective 3: Reduce mammalian pest presence within ephemeral stream areas of 87 Upper Sefton Road.
  - Monitor and control pest species within the 87 Upper Sefton Road site.

9.3 Objective 1 – Plant survival

9.3.1 Ephemeral stream release site

A plant maintenance schedule, including a two-year defects liability period, is a requirement of the planting plan that has been proposed for the ephemeral stream sites as per updated consent Condition 12 (Appendix 1). Wildlands have outlined in Section 7.5.2 what maintenance should be included in this plan and how it can be undertaken in a lizard friendly manner that will ensure the survival and establishment of the release site whilst limiting disturbance to lizards.

9.3.2 Shelterbelt planting

To ensure the establishment of rank grass lizard habitat in/around the shelterbelt areas, photos will be taken annually at specific photo points within the site overtime (Section7.2.1). Eight photo points will be chosen along the remediated shelterbelt areas. Photos will be taken at these points before planting, immediately after planting and then annually for a subsequent five years. These photos will illustrate the rate of establishment of the shelterbelt planting and rank grass lizard habitat overtime.

9.4 Objective 2 – Canterbury skink population persistence

9.4.1 Ephemeral stream post-release monitoring

Monitoring of translocated individuals for survivorship and establishment is not practical without toe-clipping for this species, as they cannot be reliably identified to an individual level from their natural markings. However, this method will not be used as it is widely considered as unethical.

Therefore, the design of the post-translocation monitoring work will be focussed on achieving population persistence at the site over five years following relocation. Pitfall trapping will be undertaken over five days of fine weather in the first lizard seasons following release (i.e. spring/summer) and for a subsequent five years. One to two pitfall traps will be dug around each of the rock aggregate piles used for release within the ephemeral stream areas. The pitfalls will be covered with Onduline to provide additional thermoregulatory advantages and attract more lizards to the traps. The pitfall traps will be left in place for the entire monitoring period (five years). However, the ACOs will be removed between each year of monitoring as not to influence population dynamics. All skinks captured will be measured (snout-vent length, tail-vent length, regen length), sexed, photographed and marked with an ID number.

9.4.2 Shelterbelt planting lizard monitoring

Once established, the shelterbelts and native plantings around the perimeter of the proposed solar farm are likely to become suitable lizard habitat. Therefore, these areas will be monitored to determine resident lizard persistence and/or lizard re-establishment into these areas overtime. Monitoring will consist of bi-annual lizard surveys (Section7.2.1). ACOs will be placed 10 metres apart along the length of the shelterbelt planting. The first round of monitoring will be undertaken in the first lizard season following shelterbelt planting. Two rounds of subsequent monitoring will be undertaken three- and

five-years following shelterbelt planting. ACOs will be removed between monitoring as not to influence population dynamics.

9.5 Objective 3 – Reduction of mammalian pest presence

Pest monitoring and control will be undertaken not only within the ephemeral stream release site but across the entire site (Section 7.5.2). Predator control will be undertaken before lizards are released and for five years post-release to reduce predation pressure whilst lizards establish within the new release site.

9.6 Adaptive management

If capture rates decline during the initial lizard monitoring period of the ephemeral stream or shelterbelt area, post-release monitoring will continue for another five years to determine if (any) management interventions are required. Management interventions may include increased predator control, or increased habitat enhancement. These interventions will be determined in consultation with Solar Bay Ltd, McCracken & Associates, Waimakariri District Council and DOC, on an as required basis, based on follow up monitoring in the shoulder season, and a review of predator control success, and habitat enhancement.

If pest control monitoring indicates that current pest control methods are not having an effect on predator abundance (despite trapping and baiting, pest tracking during monitoring is consistently high), pest control methods will be reassessed.

10.0 Reporting

10.1 Salvage report

A salvage report will be prepared, including details of the lizard species, capture locations, and number of individuals salvaged and released at the ephemeral streams release site. This report will also include details around the enhancement of the release site and compliance with the WAA issued. The report will contain information regarding the success of the lizard salvage and any adaptive management that was required.

Lizard species and location details will be provided to the Department of Conservation as part of the Wildlife Authorisation permit obligations. ARDS cards will be completed and submitted to DOC.

This report will be provided to Waimakariri District Council, Environment Canterbury, DOC, and Ngai Tahu on request, or per conditions stipulated in the Resouce Consent or WAA.

10.2 Annual monitoring report

An annual monitoring report will detail outcomes of the release site for five years post-salvage. The report will contain information regarding the success of the habitat enhancement (from photopoints and plant maintenance visits), the results of lizard monitoring (of both the release site and shelterbelt areas), and details of pest control. The report will suggest any adaptive management that may be required. This report will be provided to Waimakariri District Council, Environment Canterbury, DOC, and Ngai Tahu.

11.0 Significance of effects after management

Accurately predicting the level of effect with mitigation in place is difficult, but Table 12 gives a broad picture of how effects can be significantly reduced with mitigation measures in place. We consider that if the effects management outlined in this plan are properly implemented, the overall level of effect will be less than minor.

Table 12 - Potential significance of ecological effects if effective mitigation is implemented as recommended above.

Effect	Level of adverse effect without mitigation	Mitigation	Level of effect with mitigation
Accidental Injury/death/displacement	Minor	Lizard salvage and relocation (Section 7.4) Contingencies and risks with proposed management is considered (Section 7.6) Incidental Discovery Protocol (Section 7.7) Wildlife Act Authority	Less than minor
Disturbance to lizards during earthworks.	Minor	Lizard salvage and relocation (Section 7.4) Contingencies and risks with proposed management is considered (Section 7.6) Incidental Discovery Protocol (Section 7.7) Wildlife Act Authority	Less than minor
Loss and fragmentation of indigenous lizard habitat	Minor	Release site will be enhanced to create additional lizard habitat (Section 7.5.2)	Less than minor
Breeding failure/behavioural effects to lizards.	Minor	Lizard salvage and relocation (Section 7.4) Compensation will address residual effects to lizards left within the solar farm site (Section 7.7)	Less than minor
Reduction of high-quality habitats due to shading from panels	More than minor	Contingencies and risks with proposed management is considered (Section 7.6) Compensation will address residual effects to lizards left within the solar farm site (Section 7.7)	Minor
Reduction of high-quality habitats due to shading from shelter belts	Minor	Contingencies and risks with proposed management is considered (Section 7.6) Compensation will address residual effects to lizards left within the solar farm site (Section 7.7)	Less than minor

Acknowledgments

Paul Smith (Senior Landscape Architect) from Rough Milne Mitchell Landscape Architects and Kim McCracken (Director) from McCracken & Associates Ltd are thanked for their information regarding development plans, consent conditions and access to the site, in addition to, their cooperation with including lizard aspects into the planning of the solar farm.

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Appendix 1

RMM Landscape memo for 87 Upper Sefton Road

RMM

ROUGH MILNE MITCHELL
LANDSCAPE ARCHITECTS

Solar Farm – 87 Upper Sefton Road, Ashley

7 August 2024

Waimakariri District Council

Attention:
Nirosha Seelaratne
Resource Consents Planner
Waimakariri District Council

RE: Resource Consent Application 235259

Rough Milne Mitchell Landscape Architects (**RMM**) prepared a Landscape Assessment Report, dated 11 October 2023, that formed part of the Resource Consent Application for a solar farm at 87 Upper Sefton Road, Ashley.

RMM also prepared a S92 RFI Response to Waimakariri District Council's (**Council**) Request for Further information (**RFI**), dated 14 May 2024. The focus of the RFI Response was tidying up a number of inconsistencies in the Application.

Since preparing the RFI Response, Mr Jade McFarlane, Senior Landscape Architect at Eliot Sinclair has prepared a peer review of the Landscape Assessment, dated 8 July 2024. The peer review has recommended a number of changes to the landscape mitigation design and landscape related consent conditions for the proposed solar farm.

The purpose of this landscape memo is to outline the changes to the landscape mitigation design and landscape related consent conditions which adopt Mr McFarlane's recommendations. The updates are described below and are illustrated in the update Graphic Attachment, dated 7 August 2024.

Updates to the Landscape Mitigation Plan

The single row Leyland cypress shelterbelt has been replaced with an 8m wide strip of native shrub vegetation in the:

- Northeast, southeast and southwest corners of the site,
- Alongside the entranceway,
- Along localised areas of the site's boundary near neighbouring dwellings.

The native shrub vegetation will be planted at the same time as the shelterbelt, will consist of plant species that have a mature height in excess of 4m and 6m tall, and will be planted and maintained in the same manner as the shelterbelt.

There is a 3m wide area to accommodate the Leyland cypress shelterbelt, and there is an 8m wide area to accommodate the native shrub vegetation.

The planting in the southeast corner of the site will be setback from the southern boundary line to maintain sightlines to the west along Upper Sefton Road.

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The external fencing will consist of the existing 1.2m tall post and wire fence, and an internal fence will consist of a 2.0m tall chain link security fence. The security fence will be installed once the landscape mitigation planting reaches 2.0m tall.

Updates to the Landscape Related Conditions of Consent

Firstly, on reflection of the peer review, Condition 36 should be updated so the single row Leyland cypress shelterbelt has a minimum width of 2.0m, rather than 1.0m. This will allow it to have more dense foliage, providing better screening.

Also, further consideration has gone into the security fence condition, with the updated condition as follows:

> *The security fence will be located internally within the site behind the mitigation planting. It will be constructed once the landscape mitigation planting reaches 2m tall. It will be a chain link fence and may include barb wire along its top. It will have a maximum height of 2.0m.*

Condition 12 is proposed to be updated to capture the recommendations in Mr McFarlane's Peer Review and the Wildlands Lizard Habitat Assessment, dated 17 July.

Condition 12:

Before operation of the solar farm commences, the consent holder must ensure that the landscape planting is established as set out in the Proposed Landscape Mitigation Plan, Sheet 16 – Annexure D. Notably, all plants are to be 2m tall prior to the solar farm and security fence is constructed; The landscaping planting includes:

- *Planting of the boundaries of the Site will consist of:*
  - *Cupressus x Leylandii* - Leyland Cypress 'Leighton Green' or similar,
  - *Coprosma crassifolia* - Thick leaved Mikimiki
  - *Coprosma propinqua* - Mingimingi
  - *Coprosma robusta* - Karamū
  - *Cordyline australis* - Cabbage Tree
  - *Griselinia littoralis* - Broadleaf
  - *Hebe salicifolia* - Koromiko
  - *Olearia adenocarpa* - Canterbury shrub daisy
  - *Olearia paniculata* - Golden akeake

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- *Pittosporum tenuifolium* - Kōhūhū
- *Plagianthus regius* – Ribbonwood

- *All plants will be planted at 1m spacings.*
- *Plants will be implemented at a minimum height of 25cm tall.*
- *Plants will be planted within the first possible planting season once the resource consent is approved (May – September).*
- *All plants will be irrigated via an automatic irrigation system for the first 5 years following planting.*
- *All plants along the sites northwest boundary will be maintained at a minimum height of 6m.*
- *All plants along all other boundary lines will be maintained at a minimum height of 4m.*
- *All plants are fenced from stock. Stock proof fencing shall accord with the timeframes in the fencing condition.*
- *Evidence of the planting, including photos, must be submitted to WDC within one week of planting being completed.*
- *A maintenance schedule shall be prepared, including a 2-year defects liability period.*

A planting plan for the two ephemeral streams will be provided to Council within 6 months of obtaining Resource Consent. The preparation of this plan is to be undertaken by a suitably qualified landscape architect and ecologist. The ephemeral streams planting plan will outline:

- *The width of planting, that will be 7m from each edge of the ephemeral watercourse.*
- *The native riparian vegetation plant species.*
- *Their size at planting and spacings.*
- *The location and design of a stock proof fence.*
- *Planting alongside the two ephemeral streams will occur prior to the solar panels being installed, during the planting season (May – September) as specified on the mitigation plan, Sheet 8 – Annexure D.*
- *The identification and the staged removal of all exotic plant species within 20m of the ephemeral watercourses. Ensuring any potential Lizard's and their habitats can be appropriately relocated to the native planting along the ephemeral streams, or elsewhere on site.*
- *Evidence of the planting, including photos, must be submitted to WDC within one week of planting being completed.*
- *A maintenance schedule, including a 2-year defects liability period.*

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Yours sincerely,
RMM Landscape Architects

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4

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File No.: 44795

4 December 2024

McCracken and Associates
PO Box 2551
CHRISTCHURCH 8140

Attention: Kim McCracken

Email: office@rgmc.co.nz

Dear Kim,

[redacted]

[redacted]

Davis Ogilvie & Partners (DO) was requested by McCracken and Associates to respond to the request for information (RFI) received from Waimakariri District Council dated 7 December 2023, in regard to the Energy Bay Limited resource consent (RC235259) for a proposed solar farm. We had addressed RFI items 5 (stormwater) and 14 (firefighting and water supply) in an earlier revision of this letter memo dated 3 July 2024. We enclose further information in response to the RFI and subsequent questions.

[redacted]

Item 4.1 – Earthworks

Question

Please confirm the total earthworks will comply with rule 23.1.1.8 and please show the compliance on a site plan confirming the total m2 of earthworks within each 1ha.

Rule 23.1.1.8
Earthworks, including the extraction of minerals, in the Rural Zones, other than in the bed of any river, shall not involve the disturbance of more than 1000m2 of soil and/or rock per any 1ha.

Please note total earthworks within 1ha shall be of 1000m2 to be considered as a permitted activity regardless of the staging of the earthworks.

Response

The site comprises approximately 80 ha. As per tables pages 11 and 12 of Annexure J of the application for land use consent, the total land disturbance area is calculated as approximately 102,292 m^2. This exceeds the maximum permitted under rule 23.1.1.8. To mitigate, the exposed or open earthworks will be restricted to no greater than 8,000 m^2 at any time. As areas are completed, they will be stabilised, and pasture will be restored under solar tables.

Item 5.1 – Stormwater

Question

As the panel surfaces are impervious surfaces, please confirm how this affects the runoff generated post-development. Additionally, it is anticipated that rainfall that lands on the solar panels will concentrate and drip off the bottom edge of the panel onto the ground for soak away or to run on to adjacent areas and soak away. Due to the undulating nature of the site, and the steepness of some of these slopes as noted in Council's site visit, please address potential erosion risk from the concentrated drip line run off and whether this will cause off-site adverse effects.

Response

A solar table is similar to the roof of a garden shed or a hay barn that has no roof gutter system which discharges directly to ground. In this case stormwater is concentrated to the bottom edge of the panel where it drops to ground and dissipates to sheet flow across the grass surface between and under the next table. There is no concentration of flow under the tables that would be greater than normal rainfall.

Each solar table is 60 m long by 5 m wide (vertical tilt or fixed) equal to 300 m^2 area. The top of a solar panel is 4.45 m above ground level with the bottom edge 300 mm at maximum tilt. At horizontal tilt the panel is 2.45 m above ground level, a similar height to a garden shed.

The U.S. Department of Agriculture Conservation Considerations for Solar Farms Fact Sheet (March 2024) appended, outlines steps to be taken to conserve soil under the panels. This includes limiting disturbance and compaction from heavy machinery and preserving on-site topsoil and perennial vegetative cover of the soil under and between solar panel rows to encourage infiltration and prevent erosion coupled with vegetation management.

As per the application, other than the access roads, all other areas in and around the solar tables will be grazed.

Dispersity testing was undertaken across the site as shown on the geotechnical site plan and reported in the WSP test results as Class 6 soils that are generally described as non-dispersive and stable.

As the soil has not tested as dispersive, this suggests we should not expect rilling under the drip line. However, this does not preclude the requirement for timely re-establishment of good vegetation cover across the site after construction as described above.

Detailed design will assess and mitigate the concentration of stormwater flows throughout the Site. Stormwater controls may include:

- Construction in accordance with an Erosion and Sedimentation Control Plan.
- Maintaining adequate vegetation cover.
- The construction of clean water swales to capture and convey stormwater to existing outfalls.
- Low-level bunding, for example alongside access tracks to impound and slow stormwater flows.

Appropriate conditions could be:

1. *Before grazing or the installation of solar panels onsite, the consent holder shall ensure that exposed surfaces under the solar tables are fully reestablished with vegetation. Areas established with grass can be grazed provided that areas of the site under construction are fenced to exclude stock.*
2. *The consent holder shall maintain adequate vegetation cover under all solar tables. If any vegetated area is disturbed exposing soil, then the vegetation shall be reestablished to prevent erosion.*
3. *To prevent soil erosion the consent holder shall establish and maintain dense grass or vegetation cover under the solar table dripline whether the solar table is static or tilting,*

As for maintenance:

- *The following applies 12 months after, and again 24 months after commissioning of the solar farm:*
  - a. *The Consent Holder shall provide to WDC a report prepared by a SQEP that assesses scour and erosion effects associated with the discharge of stormwater from the solar panels from monitoring undertaken over each 12-month period, and any mitigation measures proposed to address such effects.*
  - b. *Where mitigation measures are identified as being required within the report provided, the Consent Holder must implement the recommended mitigation measures proposed within six months of the date of the report to the satisfaction of WDC*.

Item 14.1 – Water Supply

Question

Please confirm how is fire risk managed on the site, given there is no reticulated water supply in the area. Please provide details including but not limited to the water supply required for firefighting purposes, and emergency vehicle access requirements.

Please note, Consultation with Fire and Emergency NZ may be required to confirm the requirements.

Response

87 Upper Sefton Road is currently rated for 2 units of water equivalent to 3,600 l/day, from the Ashley Rural scheme. This is confirmed in an email dated 11 June 2024 from Hurunui District Council (HDC), as appended. A subsequent email from HDC confirmed that the existing connection to the north of the site can be relocated closer to the proposed buildings adjacent to Beatties Road.

Fire and Emergency New Zealand (FENZ) have been consulted and have confirmed that onsite fire supply of 180 m^3 is required for the two proposed 100 m^2 buildings. Storage tanks and two connection couplings are proposed to meet the assessed fire demand. Please see the attached FENZ acceptance letter.

Pasture fire risk will be managed by grazing.

Other Matters

Western Flow Path Culvert Design

Please find attached a triple culvert design for the proposed access across the watercourse. The sub-catchment area for the culvert is 128.6 ha. Assuming a 50-year design life, RCP of 8.5 to 2081-2100 and a 20-year ARI, the worst rainfall event is 1 hour which gives a maximum flow through the culvert of 13.152 m^3/s. We anticipate an excavation of 600 mm and replacement with AP40 and AP65 as bedding for the headwalls and pipes. Minor shaping of the channel upstream and downstream of the culvert including placement of scour protection rock will be required. Works can be completed in dry weather with a temporary diversion of the watercourse around the works provided. This will be captured in an approved erosion and sediment control plan.

An appropriate condition for the culvert could be:

1. *The consent holder shall install an access culvert across the Site drain at the approximate coordinates 5209870mN 1568561mE as shown on the approved plan (XXXX). The culvert shall pass a minimum flow derived from a 20-year ARI rainfall event to RCP 8.5, year 2081 to 2100.*

Yours faithfully,

DAVIS OGILVIE & PARTNERS LTD.

GARY STEVENSON
Principal Civil Engineer
BE Nat. Res. (Hons), CPEng CMEngNZ
Email: gary@do.nz

Attachments:

U.S. Department of Agriculture Conservation Considerations for Solar Farms Fact Sheet

Hurunui District Council Water Supply Emails

Fire and Emergency New Zealand Approval Letter

Geotechnical Site Plan

Geotechnical Log sheets

Proposed Culvert Design Drawings

WSP Pinhole Dispersion Test Results

WSP Emersion Class Test Results

USDA Natural Resources Conservation Service
U.S. DEPARTMENT OF AGRICULTURE

Conservation Considerations for Solar Farms

NRCS Fact Sheet

Introduction

Ground-based, utility-scale solar panel installations used for electricity generation of 1 MW or greater are commonly referred to as 'solar farms' (US Energy Information Administration, 2020). The purpose of the solar farm is to generate and sell electricity, therefore it is key that the collection, generation, and distribution of energy is not hampered by factors that reduce capacity. Management of natural resources on a facility's footprint is beneficial to enable it to maintain capacity. Natural resource concerns, such as soil erosion, dust, runoff, and damage from wildlife or livestock, frequently occur during construction and operation of solar farms.

The Natural Resources Conservation Service (NRCS) and its partners provide financial and technical assistance for producers and landowners to restore, enhance, and preserve the Nation's productive landscapes and natural resources. Producers, landowners and developers should consider the following natural resource conservation concerns regarding solar farms.

Soil Conservation

Healthy soils are critical for proper function of the water cycle and for providing habitat for a diversity of organisms. Soil conservation concerns include soil erosion by water and wind, compaction, water ponding, pollutants, and loss of organic matter. Four principles that guide land management to support healthy soil are: (1) maximize soil cover, (2) minimize soil disturbance, (3) maximize living roots, and (4) maximize biodiversity. These principles can apply to solar farms during planning, construction, operation, and even decommissioning activities.

Soil erosion, by water or wind, is a key resource concern that is often a consequence of construction and infrastructure projects. Erosion generally occurs where soils have been heavily disturbed or left uncovered as bare ground. With solar farms, wind erosion can cause problems when wind-blown soil ends up on the surface of panels, reducing their electricity output and possibly leading to permanent damage. Water erosion from runoff and concentrated flows can damage infrastructure, equipment, and facilities, leading to increased maintenance and repair costs. It can also lead to detrimental offsite environmental effects including gullies and the transport of sediment.

Steps to take during the construction and operation to conserve soil include:

- Limiting disturbance and compaction from heavy machinery to only the most necessary areas such as access roads and other areas with frequent or intense use.
- Preserving on-site topsoil; covering and preventing soil movement by applying mulches and erosion control mats or socks.
- Designing sites for optimal runoff flow with diversions, terraces, basins, and other earthworks.
- Maintaining a healthy perennial vegetative cover on the soil under and between solar panel rows to encourage infiltration and prevent erosion. Ideally, the vegetated distance between the rows of panels should be no less than the maximum horizontal width of the panel rows.
- Planting windbreaks perpendicular to the prevailing wind direction to reduce wind erosion.
- Utilizing dust control measures on unpaved roads and surfaces.

More Information

This fact sheet provides conservation considerations regarding solar farms for a general audience. For producers and landowners, there may be program-specific rules or requirements that could affect potential participation in USDA programs which are not included in this document. NRCS encourages producers and landowners to utilize the complete NRCS conservation planning process to address natural resource concerns through the implementation of conservation practices.

*The **Farmland Protection Policy Act** is intended to minimize the impact Federal programs have on the unnecessary and irreversible conversion of farmland to nonagricultural uses. If agricultural farmland (cropland, forest, pasture, or other land) will be converted to a non-agricultural use, producers, landowners, and developers should make every effort to minimize the impact and maintain the possibility for the land to be converted back to agricultural use. Limiting use of concrete and cement footing or pads; and if ground-mounted, considering use of driven-post structures to minimize use of concrete footings; will protect future agricultural suitability. Consider solar development using existing buildings, structures, idle or marginal lands, or water bodies such as irrigation ditches.*

Vegetation Management

Establishment and maintenance of perennial vegetation is paramount for ensuring the health and function of both the land and the solar farm. Sites are typically cleared of all vegetation and subjected to substantial land manipulation during construction. The bare, disturbed soil creates an environment favorable for undesirable species, including noxious and invasive species. Perennial herbaceous vegetation should be reestablished immediately following initial site preparation. Also, many tree and brush species will resprout from the base following top removal. Unmanaged vegetation can grow over and into electrical equipment and infrastructure, potentially causing damage, reducing performance and efficiency, and increasing maintenance costs.

Select plants that are adapted to the area and require minimal maintenance. An ideal species will be low-growing (short stature) or which can easily be maintained by mowing or grazing. Sod-forming or rhizomatous grasses (such as those found in a typical yard) are preferred, as is a mix of warm and cool-season plants, if the site and climate allow. When practical, include native forbs that attract pollinators, promote soil health, and offer aesthetic value.

Vegetation management plans should:

- Identify commercially available, locally adapted species. Consider using plants with drought, moisture, and shade tolerance. Solar panels can significantly affect ecohydrology by redistributing moisture from precipitation and casting a significant amount of shade.
- Account for potential threats from noxious and invasive species, prioritize the prevention of their establishment, and ensure effective treatment if discovered.
- Anticipate encroachment from woody species common to the area and include treatment thresholds and plans for treating both resprouting and emerging plants.
- Where vegetation isn't growing, and the ground is covered instead by a community of bacteria, lichens, or mosses (collectively referred to as a microbiotic soil crust), minimize disturbance to the crust as much as possible since these beneficial communities take much longer to establish than vegetation.
- Identify target minimum and maximum vegetation heights and prescribe regular mowing, grazing, or other similar maintenance treatments to manage vegetation height and prevent vegetation from growing into the equipment, casting shade or dropping pollen, leaves, limbs, mast, or other debris onto the solar panels or causing other damage to equipment and facilities.

Wildlife Considerations

Wildlife can interfere with solar farm operations by causing damage to equipment or injuring themselves. Identify management strategies to reduce the attractiveness of the site for nuisance species. Establishing food, water, and favorable habitat in alternative locations can draw troublesome species away from the solar farm and maintain the current level of wildlife habitat. Physical deterrents can also be used to discourage nesting by birds and to otherwise dissuade unwanted wildlife from using the site. Some wildlife, like aquatic habitat birds, may perceive the reflected light from solar panels as bodies of water and be drawn to the facility. Consider selecting panels that have a white outline or white grid lines to reduce this effect. Ensure perimeter fencing is constructed to exclude problem wildlife species. When practical, design fences to facilitate the movement of migrating animals around facilities. Nuisance wildlife species will vary by site. Two common examples of invasive species include feral swine and the European Starling (*Sturnus vulgaris*). Both can greatly reduce the efficiency and/or destroy equipment.

Other types of wildlife, including many pollinator species, are relatively low-impact and can coexist on solar farms without conflict. Incorporating locally adapted, pollinator-friendly forbs into seed mixes is an effective strategy for creating habitat for pollinators and promoting the environmental benefits provided by these species.

NRCS Conservation Practice Standards to consider when planning on solar farms: Critical Area Planting (Code 342), Conservation Cover (Code 327), Herbaceous Weed Management (Code 315), Range Planting (Code 550), Brush Management (Code 314), Windbreak-Shelterbelt Establishment and Renovation (Code 380), Diversion (Code 362), Terrace (Code 600), Heavy Use Area Protection (Code 561), Access Road (Code 560), Water and Sediment Control Basin (Code 638), Fence (Code 382), Prescribed Grazing (Code 528).

Contingency Planning

Anticipating and planning for unexpected disturbances, such as severe weather, vandalism, and wildfire, is crucial for maintaining equipment and ensuring the continuity of operations. Access to the site should be controlled with secure perimeter fencing to provide critical security and protection of assets and prevent unauthorized human access. Plan roads to provide dedicated travel ways for heavy equipment and vehicles and to allow easy access to facilities and infrastructure for maintenance and repairs. Regularly mowing or grazing can reduce the risk of fire. Firebreaks constructed both along the perimeter and inside the facility can help contain potential internal fires and protect the facility from external wildfires. Plan heavy use area protection for sites frequently used by vehicles, equipment, and machinery and for stockpiling supplies and spare parts, or discarded components.

To learn more about NRCS recommendations for conservation on solar farms and vegetation for a specific area, contact the local USDA Service Center at **farmers.gov/working-with-us/USDA-service-centers**.

Additional Resources:

1. Information on vegetation planting and establishment: **https://efotg.sc.egov.usda.gov/#/**
2. Controlling Soil Erosion: **Small Scale Solutions for your Farm**
3. **Introduction to Microbiotic Crusts**
4. **Web Soil Survey** soil interpretations are available for fencing and solar panels: **https://websoilsurvey.nrcs.usda.gov/app/**

Note the toxic African Rue (Peganum harmala) plants in the foreground.

Photo left. Side-view of an array of Photo-voltaic panels at a solar energy electricity generating station.

Photo right. Front-view of an array of Photo-voltaic panels at a solar energy electricity generating station.

These photos show sparse herbaceous vegetation under and around the photo-voltaic panels. This is not an ideal situation. A healthy cover of short-stature herbaceous grasses and forbs is preferred from both ecological and operational perspectives.

Gary Stevenson

From: Cynthia Otto <Cynthia.Otto@hurunui.govt.nz>
Sent: Tuesday, 11 June 2024 11:44 am
To: Gary Stevenson
Subject: RE: [#DO44795] 26106 - Ashley Solar Farm RFI

Hi Gary,

I can confirm that this property is supplied with 2 units of Ashley rural water, with 1 unit = 1800L per day.

I am meeting with the Engineer this afternoon and while we will not be able to move the supply without a water application, I can certainly find out if supplying the tank at a new location off of Beatties Road is viable. I am sure it will be a viable option, but it is always good to get the Engineers opinion from the outset.

Will get back in touch once our meeting is over.

Kind regards,

Cynthia Otto | *Customer Support Team Leader*
Phone: 027 808 9528

HURUNUI District Council
hurunui.govt.nz
"Making our district even better"

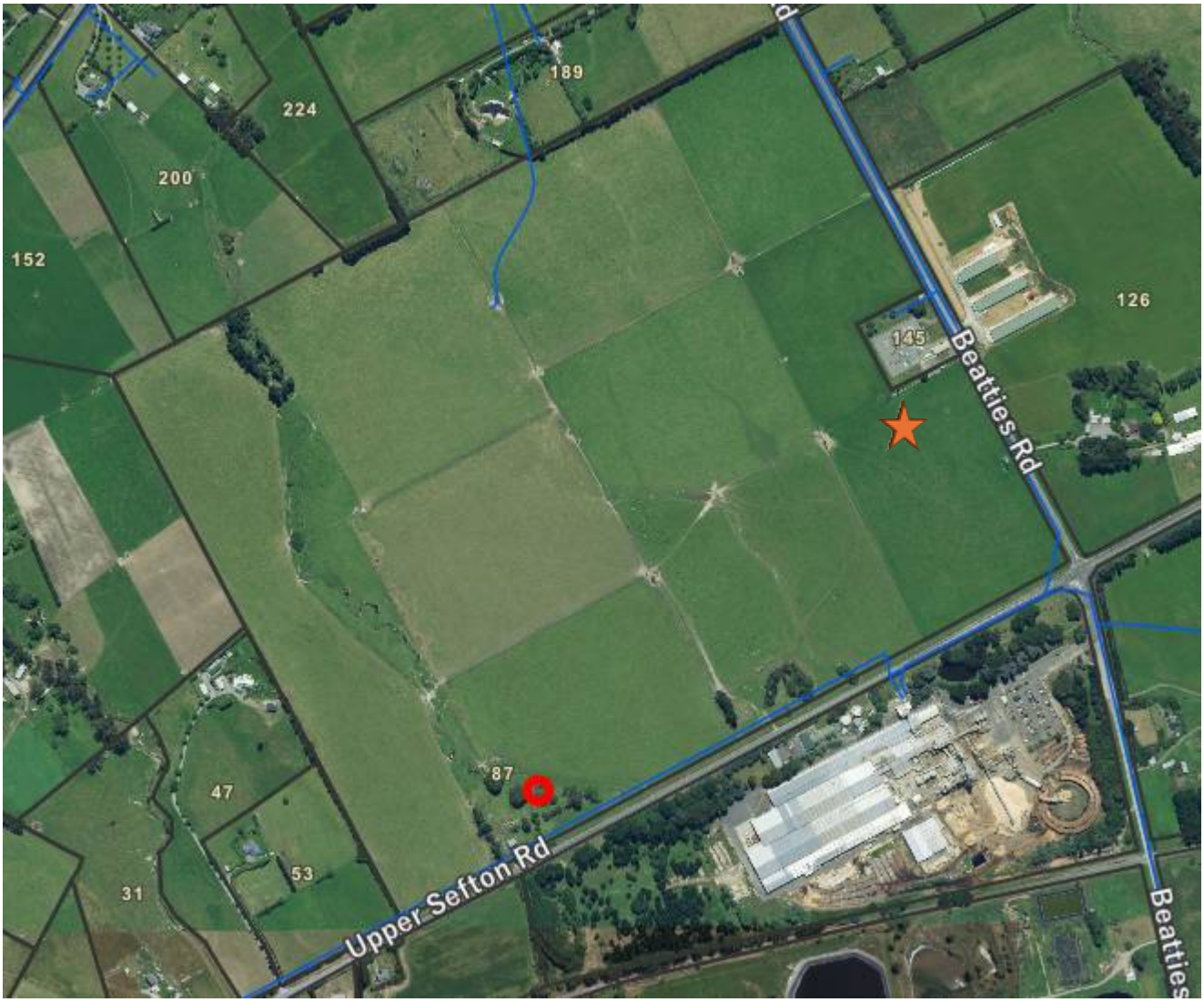
From: Gary Stevenson <gary@do.nz>
Sent: Tuesday, June 11, 2024 9:37 AM
To: Cynthia Otto <Cynthia.Otto@hurunui.govt.nz>
Cc: Ross Jennings <ross@do.nz>; Chris Hopper <Chris@do.nz>
Subject: [#DO44795] 26106 - Ashley Solar Farm RFI

Hi Cynthia

Our client is currently seeking resource consent from Waimakariri District Council for a proposed solar farm at 87 Upper Sefton Road, Ashley, Waimakariri District. Please see attached plan.

An RFI has been received asking for information on firefighting water supply. I am consulting FENZ and looking to install water tanks on the property with a restricted connection to the HDC supply to provide for firefighting.

I see on Canterbury Maps that there appears to be a service connection into the site from the northern boundary. I'm checking how many units the site is rated for and if this connection can be relocated to supply a new tanks at the approximate location shown by the star on the figure below?



If you could please confirm it would be appreciated.

Ngā mihi / Kind regards,

GARY STEVENSON / Principal Civil Engineer **/** BE Nat. Res. (Hons), CPEng, CMEngNZ

DAVIS OGILVIE & PARTNERS LTD

gary@do.nz **/** 021 973 587 **/** 0800 999 333

Please note that my working days are Mon-Wed and Fri.

Davis Ogilvie is proud to be carboNZero certified. Please don't print unless necessary.

Gary Stevenson

From: Cynthia Otto <Cynthia.Otto@hurunui.govt.nz>
Sent: Tuesday, 11 June 2024 5:19 pm
To: Gary Stevenson
Subject: RE: [#DO44795] 26106 - Ashley Solar Farm RFI
Attachments: Rural Water forms 2023.pdf

Hi Gary,

I have checked with the Engineer & there is absolutely no problem with moving the current supply to the location as indicated off of Beatties Road.

Hope you have all you need for your RFI.

Kind regards,

Cynthia Otto | *Customer Support Team Leader*
Phone: 027 808 9528

hurunui.govt.nz
"Making our district even better"

From: Gary Stevenson <gary@do.nz>
Sent: Tuesday, June 11, 2024 9:37 AM
To: Cynthia Otto <Cynthia.Otto@hurunui.govt.nz>
Cc: Ross Jennings <ross@do.nz>; Chris Hopper <Chris@do.nz>
Subject: [#DO44795] 26106 - Ashley Solar Farm RFI

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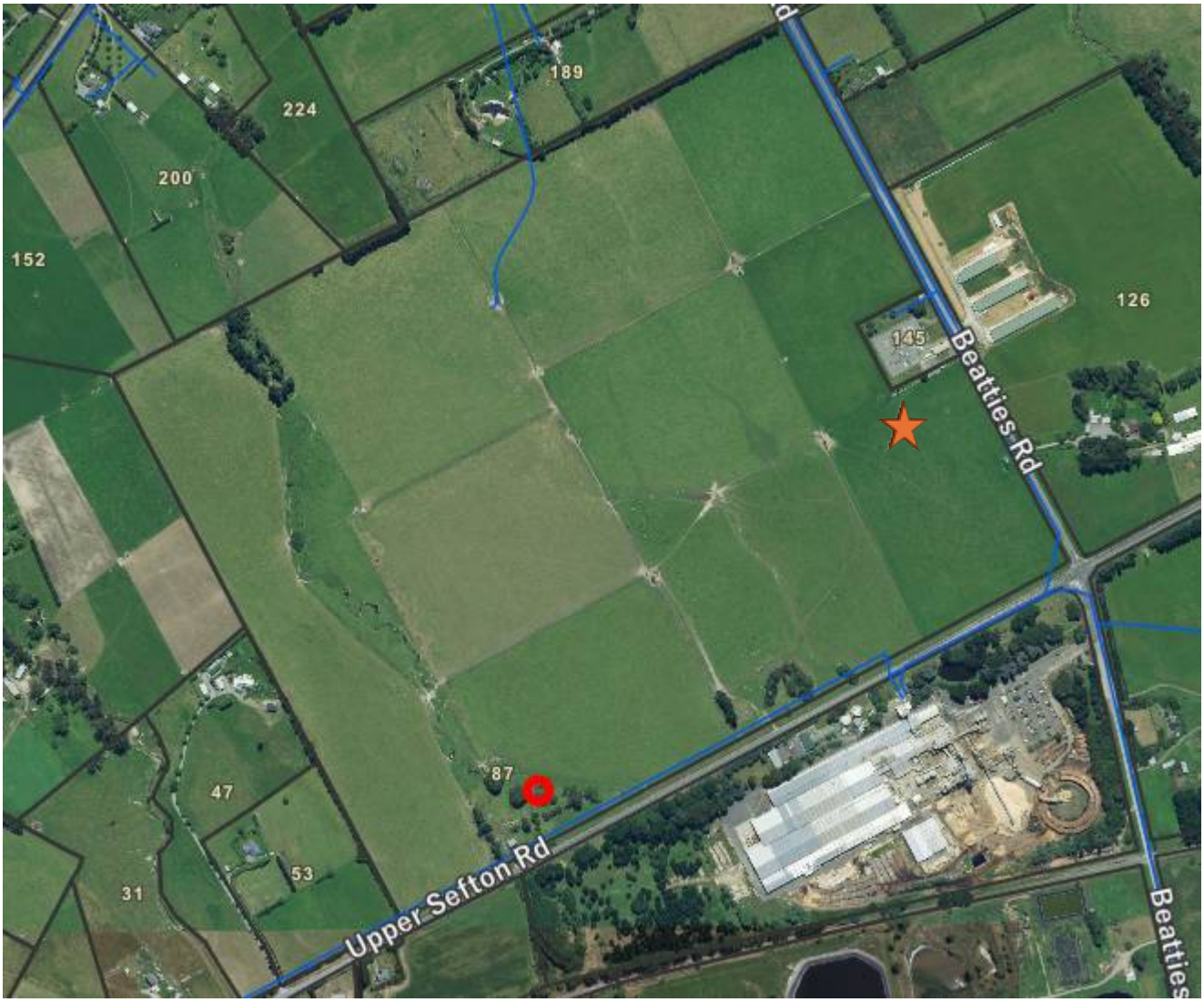

If you could please confirm it would be appreciated.

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13th June 2024

Gary Stevenson

Hi Gary

Fire and Emergency NZ are satisfied that the requirements of SNZ PAS 4509:2008 have been met for the proposed site at the intersection of Beatties Rd and Upper Sefton Rd, Ashley. The site being the proposed location of a solar farm with on site building. We are satisfied with the following conditions outlined in the email titled ***'[#DO44795] 26106 - Ashley Solar Farm RFI).***

The conditions include,

- The provision of 180,000L of dedicated firefighting water.
- The 6 tanks be interconnected.
- The provision of two 100mm British round thread couplings. Ideally placed at each end of the static supply.
- A suitable hard standing location for a fire appliance as marked on the plans.

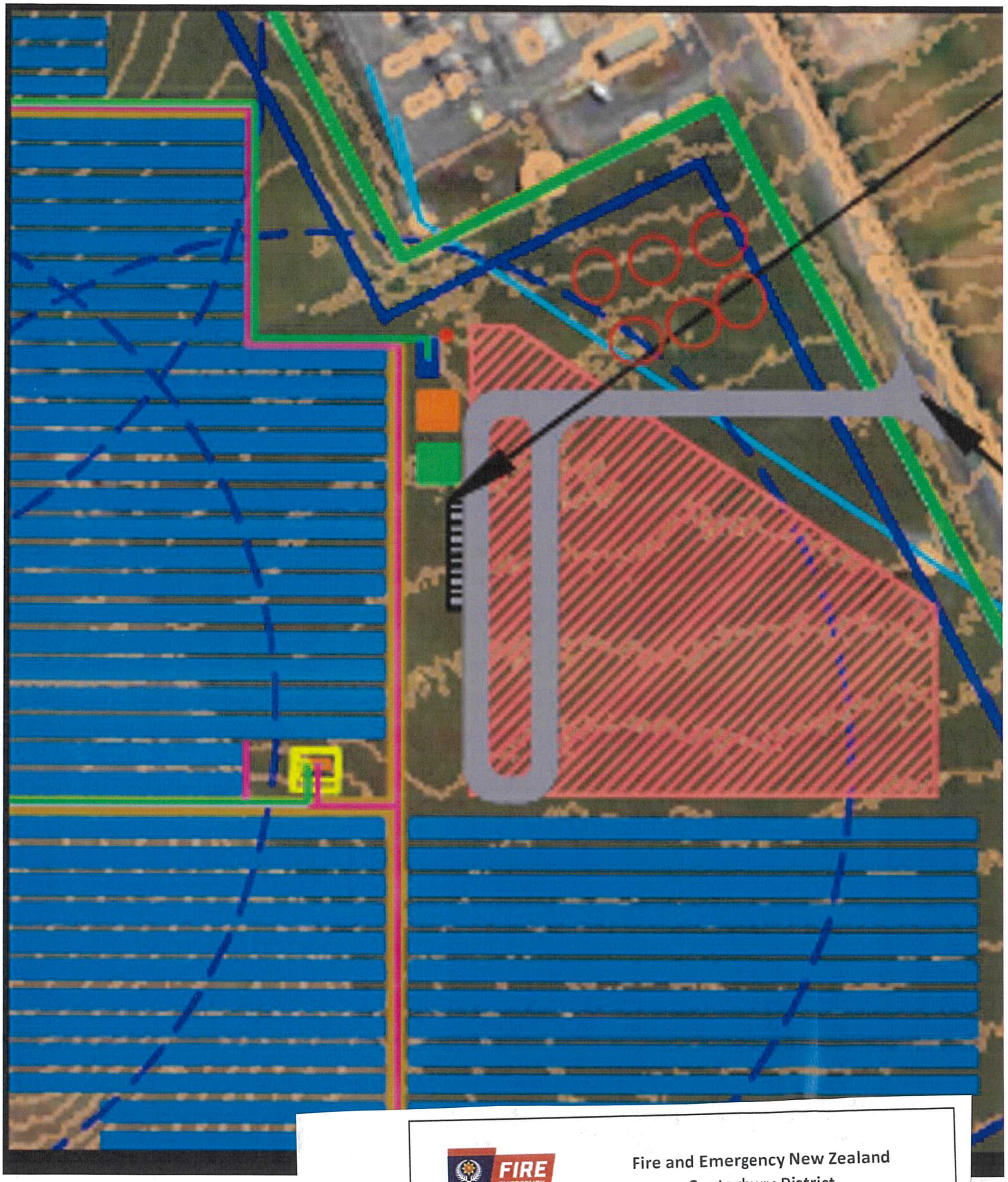
If you have any questions, please get in touch.

Regards,

Jonathan Ditmer
Advisor Risk Reduction
Specialist Fire Investigator / FENZ Inspector
Canterbury District
Justice & Emergency Services Precinct
40 Lichfield St, Central City, Christchurch
PO Box 136, Christchurch 8140

Supporting our commitment to Māori as tangata whenua.

Mobile: 027 282 1738
Email: jonathan.ditmer@fireandemergency.nz
Web: www.fireandemergency.nz



Fire and Emergency New Zealand
Canterbury District

Tank Location	YES/NO	APPROVED
Tank Size	YES/NO	YES/NO
Access	YES/NO	

Approved by: J Pitmer Signature:

Area: Canterbury Date: 13/06/24

Scale 1 : 20000

Key:

- : Site Boundary
- : Abuttal Boundary
- : Road Boundary
- ⊗ : Hand Auger (HA) + Dynamic Cone Penetrometer (DCP)
- × : Dynamic Cone Penetrometer (DCP)
- : Test Pit (TP)
- : Stream
- : Contour

Test and building locations are approximate (scaled and aligned using aerial imagery).
Shallow geotechnical testing undertaken --/--/2024.
Aerial image obtained from GRIP®, boundaries are indicative only.

0m 50m 100m 200m 300m 400m 500m

Scale 1:5000

CAD ref: 240910.44795.GeotechnicalSiteplan.dwg

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Office 0800 999 333 Email hello@do.nz
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Geotechnical Site Plan
87 and 121 Upper Sefton Road, Ashley, Rangiora
RS 2732 and Part RS 2588

/ design	/ drawn	/ QA check	/ dwg
KL	JV	KL	G01
/ scale @ A3	/ date	/ file	/ issue
1:5000	09/24	44795	A

Scale 1 : 20000

Key:

- : Site Boundary
- : Abuttal Boundary
- : Road Boundary
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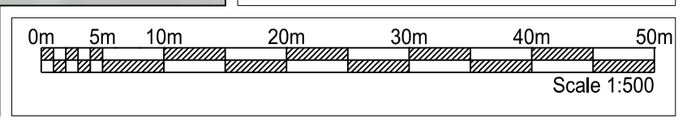

CAD ref: 240910.44795.GeotechnicalSiteplan.dwg

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Geotechnical Site Plan
87 and 121 Upper Sefton Road, Ashley, Rangiora
RS 2732 and Part RS 2588

/ design	/ drawn	/ QA check	/ dwg
KL	JV	KL	G02
/ scale @ A3	/ date	/ file	/ issue
1:5000	09/24	44795	A

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SHALLOW INVESTIGATION RESULTS

Job N° / **44795**
Test N° / **HA + DCP 01**

Project: 87 Upper Sefton Road, Rangiora (RS 2732)
Date: 09/09/24
Client: Energy Bay
Time: 9:30 am
Test Location: Refer to attached Geotechnical Site Plan (DWG G01A)
Excavation Method: Hand Auger

DEPTH (m)	SOIL DESCRIPTION	USCS	Graphic Log	Ground Water	DCP RESULTS: DCP 01 (Blows / 100mm)	RL (m)
	Soil description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005				1 2 3 4 5 6 7 8 9 10 11 12 13 14 15	
0.0	0.00 - 0.25m: SILT; dark brown. Moist (TOPSOIL).	TS		Groundwater Not Encountered	2	
0.2					2	
0.4					2	
0.5	0.25 - 1.65m: SILT; yellowish brown. Firm to very stiff, moist, low plasticity. 0.30m - 0.50m: Trace iron oxide staining.	ML			2	
0.6					3	
0.8					5	
1.0					5	
1.1					8	
1.3					9	
1.4					11	
1.5					10	
1.6					11	
1.7	1.65 - 1.70m: SILT with trace sand and gravel; yellowish brown. Hard, moist. Sand is fine. Gravel is fine.	ML			10	
1.8					10	
1.9					10	
2.0					30 >> Hammer bouncing	
2.5						
3.0						

Auger terminated at 1.70m - Refusal on inferred gravel.

Logged By: KL
Plotted By: CZM
Checked By: KL

Notes:

Dynamic Cone Penetrometer (DCP) tests and logs give an indication of the ground conditions at the location of the tests only. While they may be representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This log does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer tests are performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

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SHALLOW INVESTIGATION RESULTS

Job N° / **44795**
Test N° / **HA + DCP 02**

Project: 87 Upper Sefton Road, Rangiora (RS 2732)
Date: 09/09/24
Client: Energy Bay
Time: 10:00 am
Test Location: Refer to attached Geotechnical Site Plan (DWG G01A)
Excavation Method: Hand Auger

DEPTH (m)	SOIL DESCRIPTION (Soil description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005)	USCS	Graphic Log	Ground Water
0.0	0.00 - 0.35m: SILT; dark brown. Dry to moist (TOPSOIL).	TS		Groundwater Not Encountered
0.5	0.35 - 0.85m: SILT; yellowish brown. Firm to stiff, moist, low plasticity, trace iron oxide staining.	ML		
	0.85 - 1.00m: SILT; yellowish brown. Hard, dry, non-plastic.	ML		
1.0	Auger terminated at 1.00m - Refusal on hard silt.			
1.5				
2.0				
2.5				
3.0				

DCP RESULTS: DCP 02

(Blows / 100mm)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	RL (m)
3															
4															
2															
2															
2															
2															
3															
5															
20 >>															
26 >>															
30 >>															

Hammer bouncing

Logged By: KL
Plotted By: CZM
Checked By: KL

Notes:

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SHALLOW INVESTIGATION RESULTS

Job N° / **44795**
Test N° / **HA + DCP 03**

Project: 87 Upper Sefton Road, Rangiora (RS 2732)
Date: 09/09/24
Client: Energy Bay
Time: 10:30 am
Test Location: Refer to attached Geotechnical Site Plan (DWG G01A)
Excavation Method: Hand Auger

DEPTH (m)	SOIL DESCRIPTION (Soil description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005)	USCS	Graphic Log	Ground Water	DCP RESULTS: DCP 03 (Blows / 100mm)	RL (m)
0.5	0.00 - 0.80m: SILT; dark brown. Moist, contains trace roots and rootlets (TOPSOIL).	TS	TS	Groundwater Not Encountered	1, 1, 1, 1, 1, 3, 2, 4	
1.0	0.80 - 1.40m: SILT with trace sand; greyish brown. Stiff to very stiff, moist to wet, poor recovery. Sand is fine. 1.10m: Hole collapse.	ML			5, 7, 8, 9, 5, 9, 8	
1.5	Auger terminated at 1.40m - Hole collapse.				6, 7, 6, 4, 5	
2.0					14, 10, 16, 23 >>, 22 >>	
2.5					11, 9, 20 >>, 19 >>	
3.0						

Logged By: KL
Plotted By: CZM
Checked By: KL

Notes:

Dynamic Cone Penetrometer (DCP) tests and logs give an indication of the ground conditions at the location of the tests only. While they may be representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This log does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer tests are performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

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SHALLOW INVESTIGATION RESULTS

Job N° / **44795**
Test N° / **HA + DCP 04**

Project: 87 Upper Sefton Road, Rangiora (RS 2732)
Date: 09/09/24
Client: Energy Bay
Time: 11:00 am
Test Location: Refer to attached Geotechnical Site Plan (DWG G01A)
Excavation Method: Hand Auger

DEPTH (m)	SOIL DESCRIPTION	USCS	Graphic Log	Ground Water	DCP RESULTS: DCP 04 (Blows / 100mm)	RL (m)
0.5	0.00 - 0.70m: SILT; dark brown. Moist, contains trace rootlets (TOPSOIL). 0.30m - 0.70m: No recovery.	TS	TS	Groundwater Not Encountered	1, 1, 2, 1, 2, 4, 3	
1.0	0.70 - 0.80m: SILT with some sand and trace gravel; yellowish brown. Very stiff, moist, low plasticity. Sand is fine. Gravel is fine, subrounded to subangular. Auger terminated at 0.80m - Refusal on inferred gravel.	ML			10, 15, 17 >>, 9, 8, 7, 11, 12, 30 >> Hammer bouncing	
1.5						
2.0						
2.5						
3.0						

Logged By: KL
Plotted By: CZM
Checked By: KL

Notes:

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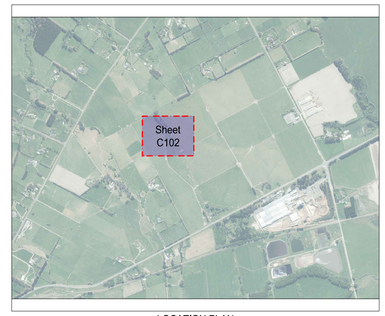
Dynamic Cone Penetrometer tests are performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

Contractor to locate all existing services & verify all dimensions before commencing work

Rev.	Date	Reason	Approved
A1	01/10/24	Issue to client for information	GS

FOR INFORMATION



LOCATION PLAN
Scale 1:20,000 (m)

GENERAL NOTES:

1. This drawing shall only be reproduced in full with approval from a Davis Ogilvie engineer.
2. Contractor to locate all existing services & verify all dimensions before commencing works.
3. Contractor is to have an approved Environmental Management Plan (EMP) and a Construction Traffic Management Plan (CTMP) from Waimakariri District Council prior to any works commence on site.
4. Plans are to be read in conjunction with the Specification, Schedule of Prices and any Waimakariri Code of Practice. Any conflicts are to be brought to the attention of the engineer prior to works proceeding. Engineer to advise contractor accordingly.
5. Prior to any works commencing, contractor is to engage a registered professional surveyor and/or licensed cadastral surveyor to supervise all set out & provide asbuilt plans for review.
6. Set out is not to be scaled off the plans. The engineer will provide electronic data for the contractor. Any variations are to be approved by the engineer.
7. All plan dimensions are in m. All detail dimensions are in mm.
8. All levels are in terms of the Lyttelton Vertical Datum 1937 (January 2018).

DRAWING NOTES:

1. All drainage work is to be carried out in accordance with Waimakariri District Council's Engineering Code of Practice: Section 5 & 6 & Davis Ogilvie's Specification.
2. Maximum depth of 1 m for all laterals at boundaries unless specifically stated otherwise.
3. Sewer laterals at all lots to be DN 100 uPVC SN16 laid at min grade of 1 in 80.
4. Stormwater laterals at all lots to be DN 100 uPVC SN16.
5. All stormwater laterals to kerb are to have kerb outlet.
6. All services such as power, telecom and water are to pass over all sewer and stormwater pipes where they cross unless stated otherwise.
7. Class of pipes as follows:
   DN 100 - DN 375 uPVC SN16
   DN 450 - DN 900 RCCRJ Concrete Class 4
   (Unless noted otherwise).
8. All uPVC pipes are to have min 0.75 m cover in roading areas and 0.75 m cover for construction traffic unless stated otherwise.
9. All RCCRJ concrete pipes to be of min. class 4 and to have minimum 0.44 cover for construction traffic.
10. All manholes for DN 600 pipes or larger to be DN 1500 min or 1200 x 1200 square min unless stated otherwise.
11. For angle of deviation of 0 - 60°, 10 mm minimum fall within manhole required. For angle of 60° - 90°, 20 mm minimum fall required.
12. Sumps have been designed 20 l/s and 40 l/s capacities for single sumps and double sumps respectively as per CCC IDS Part 5. NZS4404 allows 28 l/s for a single sump with back entry before blockage. This confirms that all sumps meet WDC 55/90 l/s capacity requirement.

CAD ref: T:\projects\44s\44795 - 87 Upper Sefton Road, Sefton\Civil\Dwg\Models & Aerials\44795.Concept

DAVIS OGILVIE
ENGINEERS / SURVEYORS / PLANNERS
0800 999 333
hello@do.nz
www.do.nz

PROPOSED CULVERT DESIGN
87 UPPER SEFTON ROAD, ASHLEY

ENGINEERING DESIGN
SITE PLAN

Design	Drawn	QA Check	Dwg No.
AL	AL	RJ	C101
Scale @ A1	Date Started	Job No.	Rev.
1:2,500 (m)	10/24	44795	A1

Contractor to locate all existing services & verify all dimensions before commencing work

Rev.	Date	Reason	Approved
A1	01/10/24	Issue to client for information	GS

FOR INFORMATION

LOCATION PLAN
Scale 1:5,000 (m)

GENERAL NOTES:

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8. All levels are in terms of the Lyttelton Vertical Datum 1937 (January 2018).

DRAWING NOTES:

1. All drainage work is to be carried out in accordance with Waimakariri District Council's Engineering Code of Practice: Section 5 & 6 & Davis Ogilvie's Specification.
2. Maximum depth of 1 m for all laterals at boundaries unless specifically stated otherwise.
3. Sewer laterals at all lots to be DN 100 uPVC SN16 laid at min grade of 1 in 80.
4. Stormwater laterals at all lots to be DN 100 uPVC SN16.
5. All stormwater laterals to kerb are to have kerb outlet.
6. All services such as power, telecom and water are to pass over all sewer and stormwater pipes where they cross unless stated otherwise.
7. Class of pipes as follows:
   DN 100 - DN 375 uPVC SN16
   DN 450 - DN 900 RCCRJ Concrete Class 4
   (Unless noted otherwise).
8. All uPVC pipes are to have min 0.75 m cover in roading areas and 0.75 m cover for construction traffic unless stated otherwise.
9. All RCCRJ concrete pipes to be of min. class 4 and to have minimum 0.44 cover for construction traffic.
10. All manholes for DN 600 pipes or larger to be DN 1500 min or 1200 x 1200 square min unless stated otherwise.
11. For angle of deviation of 0 - 60°, 10 mm minimum fall within manhole required. For angle of 60° - 90°, 20 mm minimum fall required.
12. Sumps have been designed 20 l/s and 40 l/s capacities for single sumps and double sumps respectively as per CCC IDS Part 5. NZS4404 allows 28 l/s for a single sump with back entry before blockage. This confirms that all sumps meet WDC 55/90 l/s capacity requirement.

CAD ref: T:\projects\44s\44795 - 87 Upper Sefton Road, Sefton\Civil\Dwg\Models & Aerials\44795.Concept

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PROPOSED CULVERT DESIGN
87 UPPER SEFTON ROAD, ASHLEY

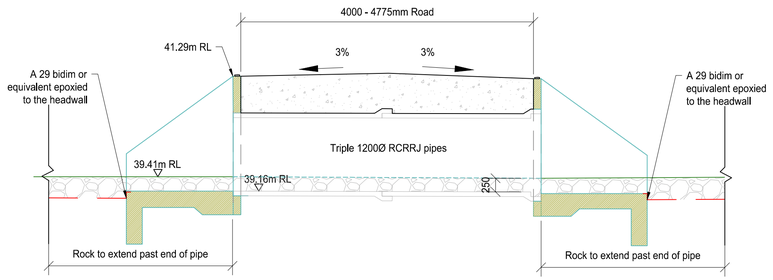
ENGINEERING DESIGN
PLAN VIEW OF PROPOSED CULVERT

Design	Drawn	QA Check	Dwg No.
AL	AL	RJ	C102
Scale @ A1	Date Started	Job No.	Rev.
1:100 (m)	10/24	44795	1

Contractor to locate all existing services & verify all dimensions before commencing work

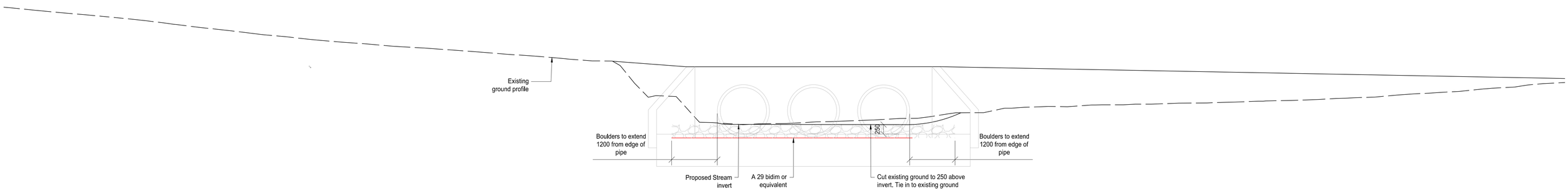
Rev.	Date	Reason	Approved
A1	01/10/24	Issue to client for information	GS

FOR INFORMATION



CROSS SECTION 87 UPPER SEFTON ROAD CULVERT

Scale: 1:50



CROSS SECTION 87 UPPER SEFTON ROAD CULVERT

Scale: 1:50

CAD ref: T:\projects\44s\44795 - 87 Upper Sefton Road, Sefton\Civil\Dwg\Models & Aerials\44795.Concept

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PROPOSED CULVERT DESIGN
87 UPPER SEFTON ROAD, ASHLEY

ENGINEERING DESGIN
CULVERT CROSS SECTION

Design	Drawn	QA Check	Dwg No.
AL	AL	RJ	C110
Scale @ A1	Date Started	Job No.	Rev.
1:50 (mm)	10/24	44795	1

PINHOLE DISPERSION TEST REPORT

Project :	Material Investigation
Location :	Upper Seefton Road
Client :	Davis Ogilvie & Partners Limited
Sample Location ID :	TP1
Sampled by :	Client
Date sampled :	Not Stated
Date received :	19/09/24
Sample description :	SILT
Sample condition :	As received
Sample compaction :	NZ Std Compaction

Project No :	6-JDOPL.16
Lab Ref No :	CH11710_1_PnH
Client Ref No :	DO47795

Test Results

Test Sample Condition at Test

Diameter of test specimen (mm)	33.10
Length of test specimen (mm)	37.37
Mass of compacted specimen (g)	65.82

	As Rec'd	Target	As Tested	Post Test
Wet Density (t/m^3)	-	2.02	2.05	-
Water Content (%)	19.1	19.1	18.6	19.9
Dry Density (t/m^3)	-	1.70	1.73	-

Pinhole Test Observations

Head (mm)	Flow rate (ml/s)	Colour of outflow (Cloudiness)	Falling Particles
50	0.46	Completely Clear/clear from top	None
180	0.74	Bearly Visable	None
380	1.06	Bearly Visable	None
1020	1.24	Bearly Visable	None

Pinhole dimensions

Hole Diameter at start of test (mm)	1.0
Hole Diameter at end of test (mm)	4.8

Note: Hole blocking/blowing out in final stage

PINHOLE TEST RESULT

ND2

Test Method	Notes
ASTM D4647/D4647M-13 Method A: The Pinhole Test NZS 4402:1986, Test 2.1 Determination of the water content	Soil tested : Whole Soil Fluid used : distilled water Sample cured for : 24 hours

Date tested : 10/10/24
Date reported : 15/10/24

Approved

Designation : *Senior Civil Engineering Technician*
Date : 15/10/24

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PINHOLE DISPERSION TEST REPORT

Project :	Material Investigation
Location :	Upper Seefton Road
Client :	Davis Ogilvie & Partners Limited
Sample Location ID :	TP2
Sampled by :	Client
Date sampled :	Not Stated
Date received :	19/09/24
Sample description :	SILT
Sample condition :	As received
Sample compaction :	NZ Std Compaction

Project No :	6-JDOPL.16
Lab Ref No :	CH11710_2_PnH
Client Ref No :	DO47795

Test Results

Test Sample Condition at Test

Diameter of test specimen (mm)	33.10
Length of test specimen (mm)	37.19
Mass of compacted specimen (g)	65.79

	As Rec'd	Target	As Tested	Post Test
Wet Density (t/m^3)	-	2.03	2.06	-
Water Content (%)	18.4	18.4	18.2	20.1
Dry Density (t/m^3)	-	1.71	1.74	-

Pinhole Test Observations

Head (mm)	Flow rate (ml/s)	Colour of outflow (Cloudiness)	Falling Particles
50	0.23	Completely Clear/clear from top	None
180	0.31	Completely Clear/clear from top	None
380	0.68	Completely Clear/clear from top	None
1020	1.24	Completely Clear/clear from top	None

Pinhole dimensions

Hole Diameter at start of test (mm)	1.0
Hole Diameter at end of test (mm)	1.0

Note : The pinhole when observed at the end of the test showed NO CHANGE in diameter.

PINHOLE TEST RESULT

ND1

Test Method	Notes
ASTM D4647/D4647M-13 Method A: The Pinhole Test NZS 4402:1986, Test 2.1 Determination of the water content	Soil tested : Whole Soil Fluid used : distilled water Sample cured for : 24 hours

Date tested : 10/10/24
Date reported : 15/10/24

Approved

Designation : *Senior Civil Engineering Technician*
Date : 15/10/24

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PINHOLE DISPERSION TEST REPORT

Project :	Material Investigation
Location :	Upper Seefton Road
Client :	Davis Ogilvie & Partners Limited
Sample Location ID :	TP3
Sampled by :	Client
Date sampled :	Not Stated
Date received :	19/09/24
Sample description :	SILT
Sample condition :	As received
Sample compaction :	NZ Std Compaction

Project No :	6-JDOPL.16
Lab Ref No :	CH11710_3_PnH
Client Ref No :	DO47795

Test Results

Test Sample Condition at Test

Diameter of test specimen (mm)	33.10
Length of test specimen (mm)	38.85
Mass of compacted specimen (g)	67.87

	As Rec'd	Target	As Tested	Post Test
Wet Density (t/m^3)	-	2.08	2.03	-
Water Content (%)	19.1	19.1	17.7	20.4
Dry Density (t/m^3)	-	1.74	1.72	-

Pinhole Test Observations

Head (mm)	Flow rate (ml/s)	Colour of outflow (Cloudiness)	Falling Particles
50	0.27	Completely Clear/clear from top	None
180	0.51	Bearly Visable	None
380	0.81	Slightly Dark	Few
1020	1.63	Slightly Dark	Few

Pinhole dimensions

Hole Diameter at start of test (mm)	1.0
Hole Diameter at end of test (mm)	5.0

Note: Large hole blow out

PINHOLE TEST RESULT

ND2

Test Method	Notes
ASTM D4647/D4647M-13 Method A: The Pinhole Test NZS 4402:1986, Test 2.1 Determination of the water content	Soil tested : Whole Soil Fluid used : distilled water Sample cured for : 24 hours

Date tested : 10/10/24
Date reported : 15/10/24

Approved

Designation : *Senior Civil Engineering Technician*
Date : 15/10/24

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PINHOLE DISPERSION TEST REPORT

Project :	Material Investigation
Location :	Upper Seefton Road
Client :	Davis Ogilvie & Partners Limited
Sample Location ID :	TP4
Sampled by :	Client
Date sampled :	Not Stated
Date received :	19/09/24
Sample description :	SILT
Sample condition :	As received
Sample compaction :	NZ Std Compaction

Project No :	6-JDOPL.16
Lab Ref No :	CH11710_4_PnH
Client Ref No :	DO47795

Test Results

Test Sample Condition at Test

Diameter of test specimen (mm)	33.10
Length of test specimen (mm)	38.85
Mass of compacted specimen (g)	67.20

	As Rec'd	Target	As Tested	Post Test
Wet Density (t/m^3)	-	2.06	2.01	-
Water Content (%)	18.7	18.7	17.7	21.1
Dry Density (t/m^3)	-	1.74	1.71	-

Pinhole Test Observations

Head (mm)	Flow rate (ml/s)	Colour of outflow (Cloudiness)	Falling Particles
50	0.35	Bearly Visable	None
180	0.58	Bearly Visable	None
380	0.80	Bearly Visable	None
1020	1.40	Bearly Visable	None

Pinhole dimensions

Hole Diameter at start of test (mm)	1.0
Hole Diameter at end of test (mm)	1.0

Note : The pinhole when observed at the end of the test showed NO CHANGE in diameter.

PINHOLE TEST RESULT

ND1

Test Method	Notes
ASTM D4647/D4647M-13 Method A: The Pinhole Test NZS 4402:1986, Test 2.1 Determination of the water content	Soil tested : Whole Soil Fluid used : distilled water Sample cured for : 24 hours

Date tested : 10/10/24
Date reported : 15/10/24

Approved

Designation : *Senior Civil Engineering Technician*
Date : 15/10/24

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PINHOLE DISPERSION TEST REPORT

Project :	Material Investigation
Location :	Upper Seefton Road
Client :	Davis Ogilvie & Partners Limited
Sample Location ID :	TP5
Sampled by :	Client
Date sampled :	Not Stated
Date received :	19/09/24
Sample description :	SILT
Sample condition :	As received
Sample compaction :	NZ Std Compaction

Project No :	6-JDOPL.16
Lab Ref No :	CH11710_5_PnH
Client Ref No :	DO47795

Test Results

Test Sample Condition at Test

Diameter of test specimen (mm)	33.10
Length of test specimen (mm)	38.86
Mass of compacted specimen (g)	67.08

	As Rec'd	Target	As Tested	Post Test
Wet Density (t/m^3)	-	2.06	2.01	-
Water Content (%)	18.5	18.5	18.2	20.9
Dry Density (t/m^3)	-	1.74	1.70	-

Pinhole Test Observations

Head (mm)	Flow rate (ml/s)	Colour of outflow (Cloudiness)	Falling Particles
50	0.28	Bearly Visable	None
180	0.49	Bearly Visable	None
380	0.86	Bearly Visable	None
1020	1.25	Bearly Visable	None

Pinhole dimensions

Hole Diameter at start of test (mm)	1.0
Hole Diameter at end of test (mm)	1.0

Note : The pinhole when observed at the end of the test showed NO CHANGE in diameter.

PINHOLE TEST RESULT

ND1

Test Method	Notes
ASTM D4647/D4647M-13 Method A: The Pinhole Test NZS 4402:1986, Test 2.1 Determination of the water content	Soil tested : Whole Soil Fluid used : distilled water Sample cured for : 24 hours

Date tested : 10/10/24
Date reported : 15/10/24

Approved

Designation : *Senior Civil Engineering Technician*
Date : 15/10/24

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PINHOLE DISPERSION TEST REPORT

Project :	Material Investigation
Location :	Upper Seefton Road
Client :	Davis Ogilvie & Partners Limited
Sample Location ID :	TP6
Sampled by :	Client
Date sampled :	Not Stated
Date received :	19/09/24
Sample description :	SILT
Sample condition :	As received
Sample compaction :	NZ Std Compaction

Project No :	6-JDOPL.16
Lab Ref No :	CH11710_6_PnH
Client Ref No :	DO47795

Test Results

Test Sample Condition at Test

Diameter of test specimen (mm)	33.10
Length of test specimen (mm)	38.04
Mass of compacted specimen (g)	66.69

	As Rec'd	Target	As Tested	Post Test
Wet Density (t/m^3)	-	2.05	2.04	-
Water Content (%)	18.6	18.6	17.2	20.3
Dry Density (t/m^3)	-	1.72	1.74	-

Pinhole Test Observations

Head (mm)	Flow rate (ml/s)	Colour of outflow (Cloudiness)	Falling Particles
50	0.34	Completely clear/Clear from top	None
180	0.51	Completely clear/Clear from top	None
380	0.91	Completely clear/Clear from top	None
1020	1.58	Completely clear/Clear from top	None

Pinhole dimensions

Hole Diameter at start of test (mm)	1.0
Hole Diameter at end of test (mm)	1.0

Note : The pinhole when observed at the end of the test showed NO CHANGE in diameter.

PINHOLE TEST RESULT

ND1

Test Method	Notes
ASTM D4647/D4647M-13 Method A: The Pinhole Test NZS 4402:1986, Test 2.1 Determination of the water content	Soil tested : Whole Soil Fluid used : distilled water Sample cured for : 24 hours

Date tested : 11/10/24
Date reported : 15/10/24

Approved

Designation : *Senior Civil Engineering Technician*
Date : 15/10/24

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PINHOLE DISPERSION TEST REPORT

Project :	Material Investigation
Location :	Upper Seefton Road
Client :	Davis Ogilvie & Partners Limited
Sample Location ID :	TP7
Sampled by :	Client
Date sampled :	Not Stated
Date received :	19/09/24
Sample description :	SILT
Sample condition :	As received
Sample compaction :	NZ Std Compaction

Project No :	6-JDOPL.16
Lab Ref No :	CH11710_7_PnH
Client Ref No :	DO47795

Test Results

Test Sample Condition at Test

Diameter of test specimen (mm)	33.10
Length of test specimen (mm)	39.49
Mass of compacted specimen (g)	66.84

	As Rec'd	Target	As Tested	Post Test
Wet Density (t/m^3)	-	2.06	1.97	-
Water Content (%)	18.3	18.3	17.0	21.3
Dry Density (t/m^3)	-	1.74	1.68	-

Pinhole Test Observations

Head (mm)	Flow rate (ml/s)	Colour of outflow (Cloudiness)	Falling Particles
50	0.28	Completely clear/Clear from top	None
180	0.55	Completely clear/Clear from top	None
380	0.92	Bearly Visable	None
1020	1.42	Bearly Visable	None

Pinhole dimensions

Hole Diameter at start of test (mm)	1.0
Hole Diameter at end of test (mm)	1.0

Note : The pinhole when observed at the end of the test showed NO CHANGE in diameter.

PINHOLE TEST RESULT

ND1

Test Method	Notes
ASTM D4647/D4647M-13 Method A: The Pinhole Test NZS 4402:1986, Test 2.1 Determination of the water content	Soil tested : Whole Soil Fluid used : distilled water Sample cured for : 24 hours

Date tested : 11/10/24
Date reported : 15/10/24

Approved

Designation : *Senior Civil Engineering Technician*
Date : 15/10/24

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PINHOLE DISPERSION TEST REPORT

Project :	Material Investigation
Location :	Upper Seefton Road
Client :	Davis Ogilvie & Partners Limited
Sample Location ID :	TP9
Sampled by :	Client
Date sampled :	Not Stated
Date received :	19/09/24
Sample description :	SILT
Sample condition :	As received
Sample compaction :	NZ Std Compaction

Project No :	6-JDOPL.16
Lab Ref No :	CH11710_8_PnH
Client Ref No :	DO47795

Test Results

Test Sample Condition at Test

Diameter of test specimen (mm)	33.10
Length of test specimen (mm)	38.20
Mass of compacted specimen (g)	66.24

	As Rec'd	Target	As Tested	Post Test
Wet Density (t/m^3)	-	2.05	2.02	-
Water Content (%)	19.4	19.4	18.8	20.7
Dry Density (t/m^3)	-	1.71	1.70	-

Pinhole Test Observations

Head (mm)	Flow rate (ml/s)	Colour of outflow (Cloudiness)	Falling Particles
50	0.29	Completely clear/Clear from top	None
180	0.56	Completely clear/Clear from top	None
380	0.78	Completely clear/Clear from top	None
1020	1.35	Completely clear/Clear from top	None

Pinhole dimensions

Hole Diameter at start of test (mm)	1.0
Hole Diameter at end of test (mm)	3.3

PINHOLE TEST RESULT

ND2

Test Method	Notes
ASTM D4647/D4647M-13 Method A: The Pinhole Test NZS 4402:1986, Test 2.1 Determination of the water content	Soil tested : Whole Soil Fluid used : distilled water Sample cured for : 24 hours

Date tested : 11/10/24
Date reported : 15/10/24

Approved

Designation : *Senior Civil Engineering Technician*
Date : 15/10/24

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PINHOLE DISPERSION TEST REPORT

Project :	Material Investigation
Location :	Upper Seefton Road
Client :	Davis Ogilvie & Partners Limited
Sample Location ID :	TP10
Sampled by :	Client
Date sampled :	Not Stated
Date received :	19/09/24
Sample description :	SILT
Sample condition :	As received
Sample compaction :	NZ Std Compaction

Project No :	6-JDOPL.16
Lab Ref No :	CH11710_9_PnH
Client Ref No :	DO47795

Test Results

Test Sample Condition at Test

Diameter of test specimen (mm)	33.10
Length of test specimen (mm)	39.27
Mass of compacted specimen (g)	67.13

	As Rec'd	Target	As Tested	Post Test
Wet Density (t/m^3)	-	2.05	1.99	-
Water Content (%)	19.1	19.1	18.3	21.7
Dry Density (t/m^3)	-	1.72	1.68	-

Pinhole Test Observations

Head (mm)	Flow rate (ml/s)	Colour of outflow (Cloudiness)	Falling Particles
50	0.29	Completely clear/Clear from top	None
180	0.54	Bearly Visable	None
380	1.03	Bearly Visable	None
1020	1.90	Bearly Visable	None

Pinhole dimensions

Hole Diameter at start of test (mm)	1.0
Hole Diameter at end of test (mm)	4.6

PINHOLE TEST RESULT

ND2

Test Method	Notes
ASTM D4647/D4647M-13 Method A: The Pinhole Test NZS 4402:1986, Test 2.1 Determination of the water content	Soil tested : Whole Soil Fluid used : distilled water Sample cured for : 24 hours

Date tested : 11/10/24
Date reported : 15/10/24

Approved

Designation : *Senior Civil Engineering Technician*
Date : 15/10/24

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EMERSON CLASS TEST
TEST REPORT

Project :	Material Investigation
Location :	Upper Seefton Road
Client :	Davis Ogilvie & Partners Limited
Contractor :	Davis Ogilvie & Partners Limited
Sampled by :	Davis Ogilvie & Partners
Date sampled :	9 September 2024
Sampling method :	NZS 4402:1986 (Fine)
Sample description :	SILT
Sample condition :	Damp as received
Source:	Test Pit 1

Project No :	6-JRILE.16/6LC
Lab Ref No :	CH11710/1
Client Ref No :	DO47795

Test Results

Water used:	Distilled
Slaking of air dried soil Evident after 10 minutes:	Yes
Dispersion of air dried soil evident after 10 minutes:	No
Slaking or swelling evident after 2 hours:	No
Slaking of remoulded sample:	Yes
Dispersion of remoulded samples:	No
Calcite or Gypsum present:	No
Following vigorous shaking does suspension remain dispersed after 10 minutes:	No
Emerson Class Number:	Class 6

Test Method: AS 1289.3.8.1: 2017 Determination of Emerson Class Number of Soill

Date tested : 8 October 2024
Date reported : 24 October 2024

Approved

Designation : *Laboratory Manager*
Date : 24 October 2024

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EMERSON CLASS TEST
TEST REPORT

Project :	Material Investigation
Location :	Upper Seefton Road
Client :	Davis Ogilvie & Partners Limited
Contractor :	Davis Ogilvie & Partners Limited
Sampled by :	Davis Ogilvie & Partners
Date sampled :	9 September 2024
Sampling method :	NZS 4402:1986 (Fine)
Sample description :	SILT
Sample condition :	Damp as received
Source:	Test Pit 2

Project No :	6-JRILE.16/6LC
Lab Ref No :	CH11710/1
Client Ref No :	DO47795

Test Results

Water used:	Distilled
Slaking of air dried soil Evident after 10 minutes:	Yes
Dispersion of air dried soil evident after 10 minutes:	No
Slaking or swelling evident after 2 hours:	No
Slaking of remoulded sample:	Yes
Dispersion of remoulded samples:	No
Calcite or Gypsum present:	No
Following vigorous shaking does suspension remain dispersed after 10 minutes:	No
Emerson Class Number:	Class 6

Test Method: AS 1289.3.8.1: 2017 Determination of Emerson Class Number of Soill

Date tested : 8 October 2024
Date reported : 24 October 2024

Approved

Designation : *Laboratory Manager*
Date : 24 October 2024

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EMERSON CLASS TEST
TEST REPORT

Project :	Material Investigation
Location :	Upper Seefton Road
Client :	Davis Ogilvie & Partners Limited
Contractor :	Davis Ogilvie & Partners Limited
Sampled by :	Davis Ogilvie & Partners
Date sampled :	9 September 2024
Sampling method :	NZS 4402:1986 (Fine)
Sample description :	SILT
Sample condition :	Damp as received
Source:	Test Pit 3

Project No :	6-JRILE.16/6LC
Lab Ref No :	CH11710/1
Client Ref No :	DO47795

Test Results

Water used:	Distilled
Slaking of air dried soil Evident after 10 minutes:	Yes
Dispersion of air dried soil evident after 10 minutes:	No
Slaking or swelling evident after 2 hours:	No
Slaking of remoulded sample:	Yes
Dispersion of remoulded samples:	Yes
Calcite or Gypsum present:	No
Following vigorous shaking does suspension remain dispersed after 10 minutes:	Yes
Emerson Class Number:	Class 3

Test Method: AS 1289.3.8.1: 2017 Determination of Emerson Class Number of Soill

Date tested : 8 October 2024
Date reported : 24 October 2024

Approved

Designation : *Laboratory Manager*
Date : 24 October 2024

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EMERSON CLASS TEST
TEST REPORT

Project :	Material Investigation
Location :	Upper Seefton Road
Client :	Davis Ogilvie & Partners Limited
Contractor :	Davis Ogilvie & Partners Limited
Sampled by :	Davis Ogilvie & Partners
Date sampled :	9 September 2024
Sampling method :	NZS 4402:1986 (Fine)
Sample description :	SILT
Sample condition :	Damp as received
Source:	Test Pit 4

Project No :	6-JRILE.16/6LC
Lab Ref No :	CH11710/1
Client Ref No :	DO47795

Test Results

Water used:	Distilled
Slaking of air dried soil Evident after 10 minutes:	Yes
Dispersion of air dried soil evident after 10 minutes:	No
Slaking or swelling evident after 2 hours:	No
Slaking of remoulded sample:	Yes
Dispersion of remoulded samples:	No
Calcite or Gypsum present:	No
Following vigorous shaking does suspension remain dispersed after 10 minutes:	No
Emerson Class Number:	Class 6

Test Method: AS 1289.3.8.1: 2017 Determination of Emerson Class Number of Soill

Date tested : 10 October 2024
Date reported : 24 October 2024

Approved

Designation : *Laboratory Manager*
Date : 24 October 2024

WSP
Christchurch (Hayton Rd)
Quality Management Systems Certified to ISO 9001

52C Hayton Rd
PO Box 1482, Christchurch Mail Centre, 8140,
Christchurch, New Zealand

Telephone 03 343 0739
Website www.wsp.com/nz

EMERSON CLASS TEST
TEST REPORT

Project :	Material Investigation
Location :	Upper Seefton Road
Client :	Davis Ogilvie & Partners Limited
Contractor :	Davis Ogilvie & Partners Limited
Sampled by :	Davis Ogilvie & Partners
Date sampled :	9 September 2024
Sampling method :	NZS 4402:1986 (Fine)
Sample description :	SILT
Sample condition :	Damp as received
Source:	Test Pit 5

Project No :	6-JRILE.16/6LC
Lab Ref No :	CH11710/1
Client Ref No :	DO47795

Test Results

Water used:	Distilled
Slaking of air dried soil Evident after 10 minutes:	Yes
Dispersion of air dried soil evident after 10 minutes:	No
Slaking or swelling evident after 2 hours:	No
Slaking of remoulded sample:	Yes
Dispersion of remoulded samples:	No
Calcite or Gypsum present:	No
Following vigorous shaking does suspension remain dispersed after 10 minutes:	No
Emerson Class Number:	Class 6

Test Method: AS 1289.3.8.1: 2017 Determination of Emerson Class Number of Soill

Date tested : 10 October 2024
Date reported : 24 October 2024

Approved

Designation : *Laboratory Manager*
Date : 24 October 2024

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EMERSON CLASS TEST
TEST REPORT

Project :	Material Investigation
Location :	Upper Seefton Road
Client :	Davis Ogilvie & Partners Limited
Contractor :	Davis Ogilvie & Partners Limited
Sampled by :	Davis Ogilvie & Partners
Date sampled :	9 September 2024
Sampling method :	NZS 4402:1986 (Fine)
Sample description :	SILT
Sample condition :	Damp as received
Source:	Test Pit 6

Project No :	6-JRILE.16/6LC
Lab Ref No :	CH11710/1
Client Ref No :	DO47795

Test Results

Water used:	Distilled
Slaking of air dried soil Evident after 10 minutes:	Yes
Dispersion of air dried soil evident after 10 minutes:	No
Slaking or swelling evident after 2 hours:	No
Slaking of remoulded sample:	Yes
Dispersion of remoulded samples:	No
Calcite or Gypsum present:	No
Following vigorous shaking does suspension remain dispersed after 10 minutes:	No
Emerson Class Number:	Class 6

Test Method: AS 1289.3.8.1: 2017 Determination of Emerson Class Number of Soill

Date tested : 10 October 2024
Date reported : 24 October 2024

Approved

Designation : *Laboratory Manager*
Date : 24 October 2024

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EMERSON CLASS TEST
TEST REPORT

Project :	Material Investigation
Location :	Upper Seefton Road
Client :	Davis Ogilvie & Partners Limited
Contractor :	Davis Ogilvie & Partners Limited
Sampled by :	Davis Ogilvie & Partners
Date sampled :	9 September 2024
Sampling method :	NZS 4402:1986 (Fine)
Sample description :	SILT
Sample condition :	Damp as received
Source:	Test Pit 7

Project No :	6-JRILE.16/6LC
Lab Ref No :	CH11710/1
Client Ref No :	DO47795

Test Results

Water used:	Distilled
Slaking of air dried soil Evident after 10 minutes:	Yes
Dispersion of air dried soil evident after 10 minutes:	No
Slaking or swelling evident after 2 hours:	No
Slaking of remoulded sample:	Yes
Dispersion of remoulded samples:	No
Calcite or Gypsum present:	No
Following vigorous shaking does suspension remain dispersed after 10 minutes:	No
Emerson Class Number:	Class 6

Test Method: AS 1289.3.8.1: 2017 Determination of Emerson Class Number of Soill

Date tested : 11 October 2024
Date reported : 24 October 2024

Approved

Designation : *Laboratory Manager*
Date : 24 October 2024

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EMERSON CLASS TEST
TEST REPORT

Project :	Material Investigation
Location :	Upper Seefton Road
Client :	Davis Ogilvie & Partners Limited
Contractor :	Davis Ogilvie & Partners Limited
Sampled by :	Davis Ogilvie & Partners
Date sampled :	9 September 2024
Sampling method :	NZS 4402:1986 (Fine)
Sample description :	SILT
Sample condition :	Damp as received
Source:	Test Pit 8

Project No :	6-JRILE.16/6LC
Lab Ref No :	CH11710/1
Client Ref No :	DO47795

Test Results

Water used:	Distilled
Slaking of air dried soil Evident after 10 minutes:	Yes
Dispersion of air dried soil evident after 10 minutes:	No
Slaking or swelling evident after 2 hours:	No
Slaking of remoulded sample:	Yes
Dispersion of remoulded samples:	No
Calcite or Gypsum present:	No
Following vigorous shaking does suspension remain dispersed after 10 minutes:	No
Emerson Class Number:	Class 6

Test Method: AS 1289.3.8.1: 2017 Determination of Emerson Class Number of Soill

Date tested : 11 October 2024
Date reported : 24 October 2024

Approved

Designation : *Laboratory Manager*
Date : 24 October 2024

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EMERSON CLASS TEST
TEST REPORT

Project :	Material Investigation
Location :	Upper Seefton Road
Client :	Davis Ogilvie & Partners Limited
Contractor :	Davis Ogilvie & Partners Limited
Sampled by :	Davis Ogilvie & Partners
Date sampled :	9 September 2024
Sampling method :	NZS 4402:1986 (Fine)
Sample description :	SILT
Sample condition :	Damp as received
Source:	Test Pit 9

Project No :	6-JRILE.16/6LC
Lab Ref No :	CH11710/1
Client Ref No :	DO47795

Test Results

Water used:	Distilled
Slaking of air dried soil Evident after 10 minutes:	Yes
Dispersion of air dried soil evident after 10 minutes:	No
Slaking or swelling evident after 2 hours:	No
Slaking of remoulded sample:	Yes
Dispersion of remoulded samples:	No
Calcite or Gypsum present:	No
Following vigorous shaking does suspension remain dispersed after 10 minutes:	No
Emerson Class Number:	Class 6

Test Method: AS 1289.3.8.1: 2017 Determination of Emerson Class Number of Soill

Date tested : 14 October 2024
Date reported : 24 October 2024

Approved

Designation : *Laboratory Manager*
Date : 24 October 2024

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Christchurch (Hayton Rd)
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EMERSON CLASS TEST
TEST REPORT

Project :	Material Investigation
Location :	Upper Seefton Road
Client :	Davis Ogilvie & Partners Limited
Contractor :	Davis Ogilvie & Partners Limited
Sampled by :	Davis Ogilvie & Partners
Date sampled :	9 September 2024
Sampling method :	NZS 4402:1986 (Fine)
Sample description :	SILT
Sample condition :	Damp as received
Source:	Test Pit 10

Project No :	6-JRILE.16/6LC
Lab Ref No :	CH11710/1
Client Ref No :	DO47795

Test Results

Water used:	Distilled
Slaking of air dried soil Evident after 10 minutes:	Yes
Dispersion of air dried soil evident after 10 minutes:	No
Slaking or swelling evident after 2 hours:	No
Slaking of remoulded sample:	Yes
Dispersion of remoulded samples:	No
Calcite or Gypsum present:	No
Following vigorous shaking does suspension remain dispersed after 10 minutes:	No
Emerson Class Number:	Class 6

Test Method: AS 1289.3.8.1: 2017 Determination of Emerson Class Number of Soill

Date tested : 14 October 2024
Date reported : 24 October 2024

Approved

Designation : *Laboratory Manager*
Date : 24 October 2024

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TAX INVOICE

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Customer Services
P. 03 353 9007 or 0800 324 636

PO Box 345
Christchurch 8140

www.ecan.govt.nz/contact

Harbour Infrastructure LimitedC/- Nexia New Zealand
Level 1
5 William Laurie Place
AUCKLAND Albany 0632
New Zealand

GST Number 52-493-773

Customer No.	EC445156
Invoice No.	CSI00600
Invoice Date	19 December 2024
Due Date	20 January 2025

Description	Quantity	Amount
Land use for earthworks (Low) CRC252624 - 87 Upper Sefton Road, Ashley, Rangiora	1	$2,782.61
Discharge of stormwater to land (High) CRC252625 - 87 Upper Sefton Road, Ashley, Rangiora	1	$8,173.91
Discharge of stormwater to land (High) CRC252626 - 87 Upper Sefton Road, Ashley, Rangiora	1	$8,173.91

Note: Deposit (also called an initial fixed fee) is an upfront payment for processing a resource consent application. It is a minimum amount payable and non-refundable. A deposit is based on projected minimum actual and reasonable cost for an application, no breakdown is available for this invoice. Should processing costs exceed the deposit a further invoice will follow after the decision has been made. This is to recover the total actual and reasonable costs incurred. A breakdown can then be provided on request.

Total Excl. GST	**$19,130.43**
15% GST	$2,869.56
Total Incl. GST	**$21,999.99**

Payment Options:
Internet Bill payment: Search for "Environment Canterbury"
Direct payment to ASB 12-3151-0059468-00 quote EC445156 as reference

For other payment options refer www.ecan.govt.nz/payments
Please send remittance advices to ar@ecan.govt.nz