Haldon Solar Project
Integrated Transport Assessment

Prepared for:
Lodestone Energy Limited

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1 Introduction

Lodestone Energy Limited is proposing to construct, operate and maintain a solar farm on an approximately 340ha rural site adjacent to the northern end of Lake Benmore. The proposed solar farm requires a land use consent in accordance with the Mackenzie District Plan.

The solar farm will result in short-term construction-related and longer-term maintenance-related increases in traffic volumes on the Haldon Road / Haldon Arm Road route to the proposed solar farm site from State Highway 8. Accordingly, potential effects of the solar farm on the safety and efficiency of the surrounding road network have been considered and are described and assessed in this Integrated Transport Assessment.

2 Site Location

The proposed solar farm site (the Site) is part of Haldon Station, which is located approximately 14km southeast of Twizel (as a “crow fly distance”), adjacent to Lake Benmore. Figure 2-1 shows the location of the Site in the context of the wider area.

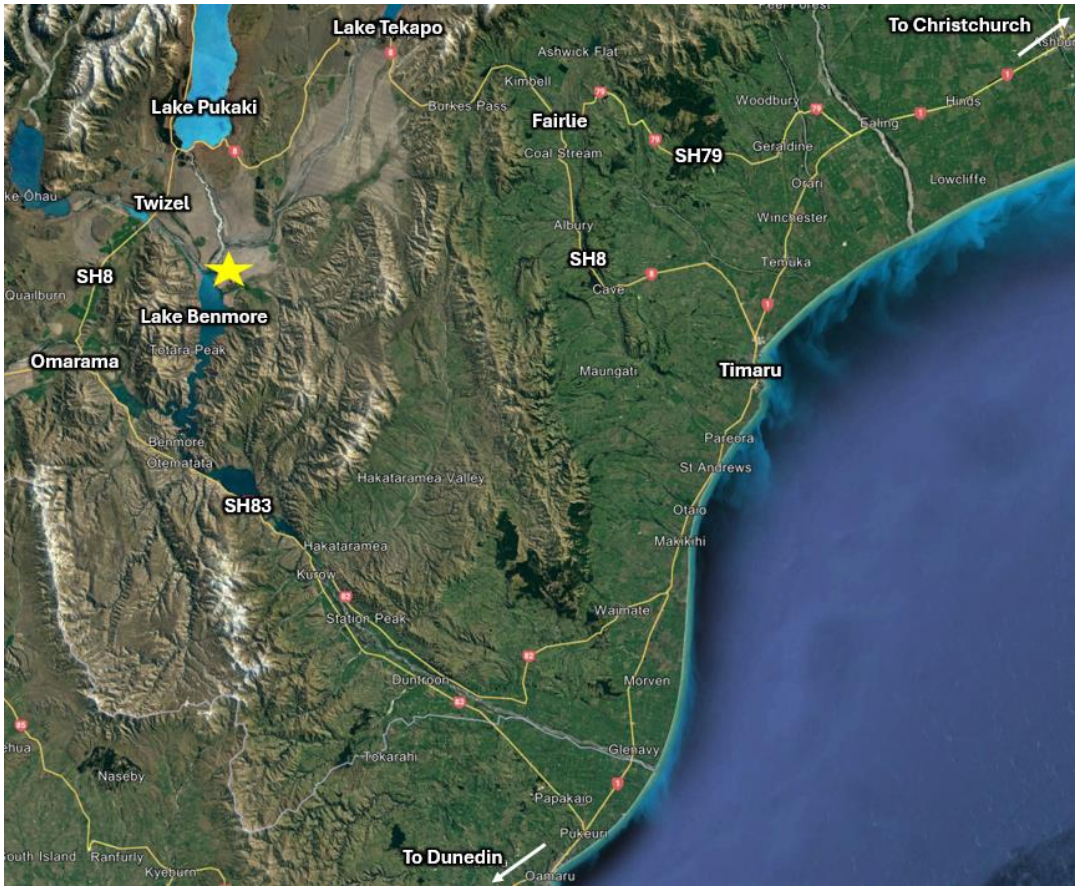

Figure 2-1: Site Location (Yellow Star) in Wide Area Context (Aerial Image Source: Google Earth)

The Site is zoned Rural in the District Plan as shown in Figure 2-2.

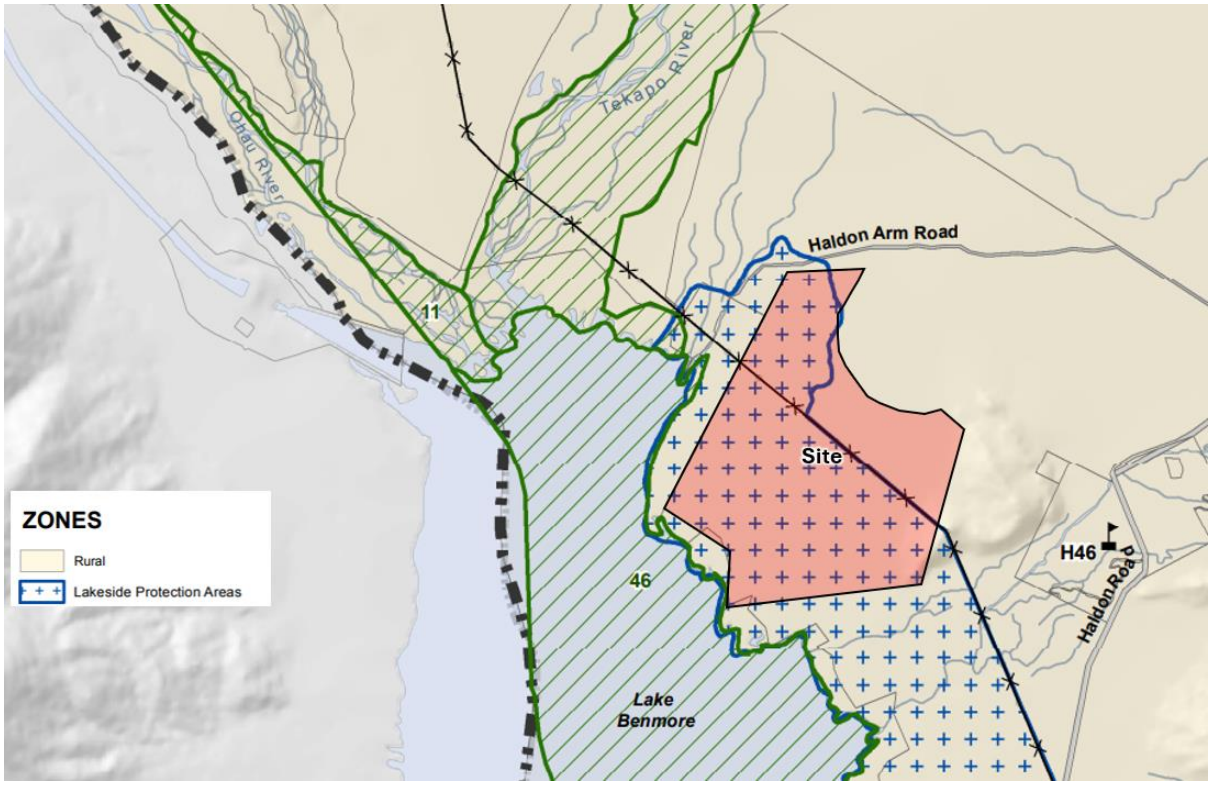

Figure 2-2: Site Zoning (Source: Mackenzie District Council)

3 Location in Road Network

3.1 Location Relative to State Highway Network

Figure 2-1 shows the Site's location relative to the State Highway (SH) network. SH8 runs from SH1 in Washdyke (north of Timaru), through Fairlie, Lake Tekapo, and Twizel in the Mackenzie District, and further south through Omarama and into Central Otago. SH79 runs from SH1 at Rangitata through Geraldine to SH8 at Fairlie. SH83 runs up the Waitaki Valley, from SH1 at Pukeuri to SH8 at Omarama.

3.2 Location in Local Road Network

The location of the Site in relation to the local road network is shown in Figure 3-1. The Site is located approximately 40km south-west of Dog Kennel Corner on SH8, which is between Lake Tekapo and Burkes Pass. Vehicle access to the Site is via Haldon Road and Haldon Arm Road.

The Haldon Arm Camping Ground is at the end of Haldon Arm Road, west of the Site. The figure also highlights Mcaughtries Road which provides access to the Ohau C power station and camping ground. There are boat ramps at both Ohau C and the Haldon Arm camping ground.

All roads in the Mackenzie District, except for the State Highways, are classified as local roads in the Operative District Plan road hierarchy.

Figure 3-1: Site Location (Yellow Star) in Local Road Network (Aerial Image Source: Google Earth)

3.3 Location in Over-Weight Transport Network

The below shows State Highway high productivity motor vehicle (HPMV) routes. These are routes that have been approved to carry 'Full HPMVs', which are trucks able to operate above the current 45/46T weight limit under permit. According to NZTA, this map can be used to plan routes and apply for a higher mass HPMV permit. The section of SH8 between Pleasant Valley and Fairlie is not included, however there are routes from the north (SH79 via Geraldine) and the south (SH83 via Waitaki Valley).

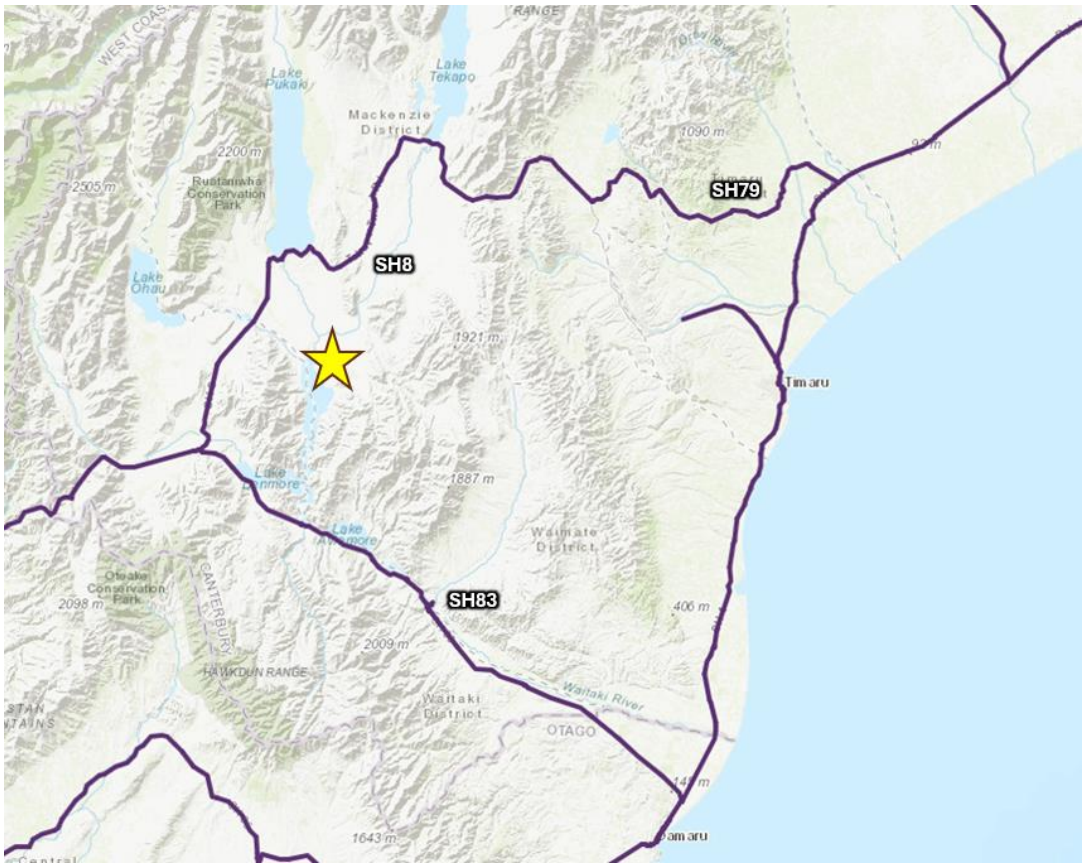

Figure 3-2: State Highway HPMV Routes

In addition, NZTA has a map for 50MAX[1] routes[2] which give freight operators an option to carry increased payloads on parts of the network that are unable to carry HPMVs. Mackenzie District local roads are not included on the map. SH8 between Washdyke and Fairlie is suitable for 50MAX vehicles.

[1] 50MAX vehicle combinations have one more axle than conventional 44-tonne vehicle combinations, meaning the overall truck load is spread further and there is no additional wear on roads per tonne of freight. This means 50MAX gives operators an option to carry increased payloads on parts of the network that, while economically important to New Zealand, carry lower volumes of freight.
[2] https://www.nzta.govt.nz/assets/Commercial-Driving/docs/50Max-maps/50MAX-Canterbury.pdf

4 Existing Road Infrastructure

4.1 SH8 / Haldon Road Intersection

Haldon Road meets SH8 at 'Dog Kennel Corner'. Haldon Road splits and meets SH8 at each end of the curve, as shown below.

Figure 4-1: SH8 Dog Kennel Corner Boundaries

The SH8 curve has an 85km/h advisory speed. Vehicle speeds for design purposes in the order of 100km/h can be expected on such a curve. NZTA requirements for sight distances at intersections to observe potentially conflicting vehicles reference Austroads. That specifies a safe intersection sight distance (SISD) for a 100km/h design speed of approximately 250m, and for the advisory 85km/h speed approximately 200m.

A sightline of approximately 220m is available across the inside of the curve from each leg of the intersection, as shown in the below photographs. This is less than the Austroads requirement for the likely design speed, and satisfactory for the advisory speed.

Stopping sight distance is the minimum distance required for a driver to react and stop if required, for example if a vehicle is stopped in their path. The requirement for a 100km/h design speed is 165m, which is available.

Figure 4-2: Sightline to West from Eastern Haldon Road Leg

Figure 4-3: Sightline to East from Western Haldon Road Leg

The alignments of the two Haldon Road approaches to SH8 mean that drivers must look behind to see vehicles approaching from the curve. Drivers exiting towards the east are required to cross the

westbound traffic stream before entering the eastbound lane, whereas drivers exiting towards the west effectively make a merge movement, with visibility to the right available on the approach to SH8.

The two Haldon Road legs have sealed widths of approximately 5.2m which would not accommodate two-way movement by heavy vehicles within the formed seal width.

4.2 Intersection of Two Haldon Road Legs

The two Haldon Road legs meet at a form of Y-intersection, with the western leg curving around into the main Haldon Road alignment, as shown below. The intersection is uncontrolled.

Figure 4-4: Intersection of Haldon Road Legs

4.3 Haldon Road

Haldon Road is sealed to the Snowy Creek bridge, approximately 16km from SH8. It is unsealed for its remaining length of approximately 23km to Haldon Arm Road.

4.3.1 Sealed Section

The road is generally flat and straight, with good forward visibility along most of the route. A typical view is shown in the following photograph.

Figure 4-5: Typical Sealed Section of Haldon Road

Carriageway widths vary, with much of the sealed section having widths in the 5.8m-6m range which is marginal for two-way heavy vehicle movement passing without using some of the unsealed shoulder, but acceptable for low volume usage where good visibility forward is available. Some localised sections of seal are narrower than this. Generally, the road does not have edge break, with only minor edge break noted in a limited number of locations.

4.3.2 Unsealed Section

The unsealed section of road is also generally flat and straight, with good forward visibility along most of the route. A typical view is shown in the following photograph.

Figure 4-6: Typical Unsealed Section of Haldon Road

The initial gravel road sections (approximately 10km) are generally wide at approximately 6.5m.

Further into the route, the road narrows to generally a 5.5m width. Forward visibility remains generally good and grass shoulders / berms are driveable if required for vehicles to pass.

There are some winding sections where forward visibility is limited. The following areas have been identified, with “chainage” references being the distance in kilometres from SH8:

- A series of curves from approximate chainage 28.400 to 29.100. As shown below there is a permanent ‘Hump’ warning sign in advance of a crest curve with limited visibility within this section of road.

Figure 4-7: Permanent Hump Warning Sign

- A series of curves from approximate chainage 33.500 to 34.400. There is a permanent Road Narrows warning sign in advance of this section of road, as shown below.

Figure 4-8: Approach to Narrower / Winding Section of Haldon Road (Chainage Approx. 33.500)

- A series of curves over the last 1.5km of Haldon Road before the Haldon Arm Road intersection. There is a permanent Reverse Curve warning sign in advance of this section of road, as shown below.

Figure 4-9: Warning Sign for Section of Haldon Road in Advance of Haldon Arm Road

Sections of the road and particularly the unsealed sections were noted to be in poor condition. There are locations with potholes (for example the below near the Hakataramea Pass Road intersection), corrugations and gravel heaped at the edge of the carriageway.

Figure 4-10: Poor Road Condition at Hakataramea Pass Road Intersection

4.3.3 One Lane Bridges / Cattle Stops

There are five one lane bridges on Haldon Road across Bullocky Creek, Red Hut Creek, Mackenzie Stream, Snowy River and Station Creek. Generally, the level of forward visibility at the one lane bridges is good although it varies. The Red Hut Creek bridge, shown below, is located at the top of a crest, limiting forward visibility. The one lane bridges have typical warning and priority signage and markings. The direction of priority (northbound or southbound) varies across the bridges.

Figure 4-11: Red Hut Creek Bridge, Northern Approach

There are three cattle stops on Haldon Road between SH8 and Haldon Arm Road and these also have warning signage.

4.3.4 Intersections

Mackenzie Pass Road and Hakataramea Road meet Haldon Road at basic uncontrolled T-intersections, as shown in the two figures below. Good driver sightlines are available at the intersections.

Figure 4-12: Haldon Road / Mackenzie Pass Road Intersection

Figure 4-13: Haldon Road / Hakataramea Pass Road Intersection

4.4 Haldon Road / Haldon Arm Road Intersection

Haldon Arm Road meets Haldon Road at a form of Y-intersection, where Haldon Arm Road curves into the Haldon Road northern approach, as shown below. Good visibility is available between the three legs of the intersection.

Figure 4-14: Haldon Road / Haldon Arm Road Intersection

4.5 Haldon Arm Road

Haldon Arm Road runs to the west of Haldon Road, providing access to the Haldon Arm camping ground as well as the Site. There is approximately 4.5km between Haldon Road and the Site.

The road generally has a 5.5m wide, unsealed carriageway, as shown in the photograph below. It has a mostly straight and flat alignment. Grass shoulders next to the road are mostly flat and driveable. Sections of the carriageway are in a rough condition with corrugations and there is one cattle stop towards the eastern end of the road.

Figure 4-15: View Along Haldon Arm Road

There is a 45km/h advisory speed curve before the road drops down into the camping ground, where a reduced speed limit of 30km/h is in place.

5 Existing Road Usage

5.1 SH8 Traffic Volumes

NZTA has a traffic count location on SH8 east of Lake Tekapo. An annual average daily traffic volume (AADT) of approximately 2,950 vehicles per day (vpd) was recorded in this location in 2023.

Figure 5-1 shows hourly traffic volumes by direction for a week in March 2024 ('Increasing' is travel towards Lake Tekapo and 'Decreasing' is travel towards Burkes Pass). Typically, two-way traffic volumes peak through the middle of the day at approximately 400 vehicles per hour, with higher traffic volumes recorded on the Sunday.

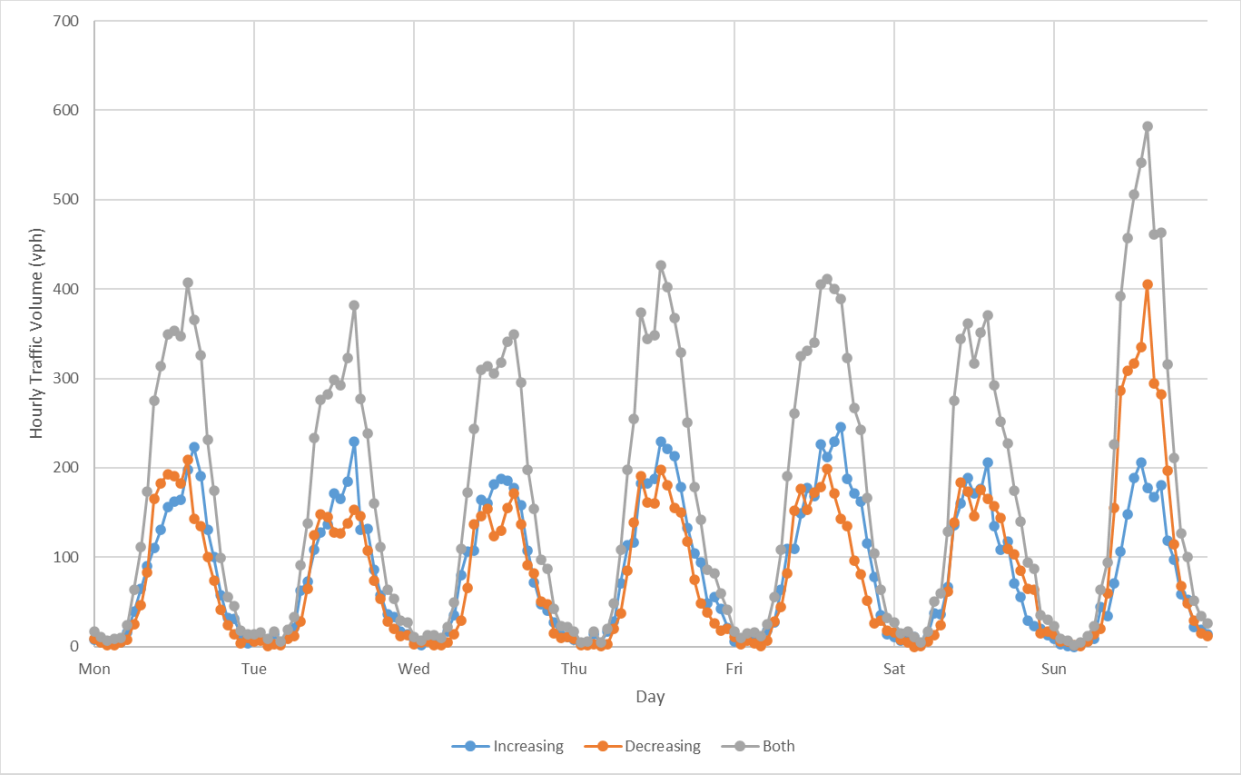

Figure 5-1: Hourly Traffic Volumes on SH8 for March 2024

5.2 Haldon Road Traffic Volumes

Haldon Road typically has low traffic use associated with several large farms. The Mobile Road application reports a Haldon Road 2023 traffic volume estimate of 180 vehicles per day and a 9% heavy proportion.

During the camping season, which in 2024/25 runs from late September until early May, and particularly during the peak summer period, there will be increased traffic volumes generated by the Haldon Arm camping ground.

5.3 Haldon Road Other Activities

It is understood that Haldon Road between SH8 and Mackenzie Pass Road is part of the 'Bullock Wagon Trail', which is a heritage route highlighting historic attractions in the area. This is likely to attract low volumes of tourists to the route, and the 'Keep Left' sign near the start of the Haldon Road route is likely provided for the benefit of foreign drivers.

Dog Kennel Corner has a plaque and information about historical use of the site as a boundary for livestock.

An off-road gravel path has been constructed between Lake Tekapo and Haldon Road next to SH8. Low volumes of touring cyclists could be expected on at least the initial sections of Haldon Road.

There is an orange horse and rider sign in advance of 3249 Haldon Road, suggesting that the road reserve is sometimes used for horse riding.

A search of the Ministry of Education 'School bus route maps' has confirmed that there are no school buses operating on Haldon Road. Similarly, the educationcounts.govt.nz website reports no active school in the vicinity of Haldon Road. A media story from 2021 described Haldon School, based at Haldon Station, as the smallest school in New Zealand. It is understood that at the time the four children attending the school all lived on Haldon Station. However, schools and school bus routes can change over time, and it is possible that children living on Haldon Road could be present at the side of the road at times.

6 Existing Road Safety

The NZTA Crash Analysis System (CAS) has been used to review crash records in the vicinity of the Site. The search area illustrated in Figure 6-1 below, included the SH8 / Haldon Road intersection and the Dog Kennel Corner curve, as well as the full lengths of Haldon Road and Haldon Arm Road. Crashes from the most recent 10-year period of 2014 to 2023 were reviewed.

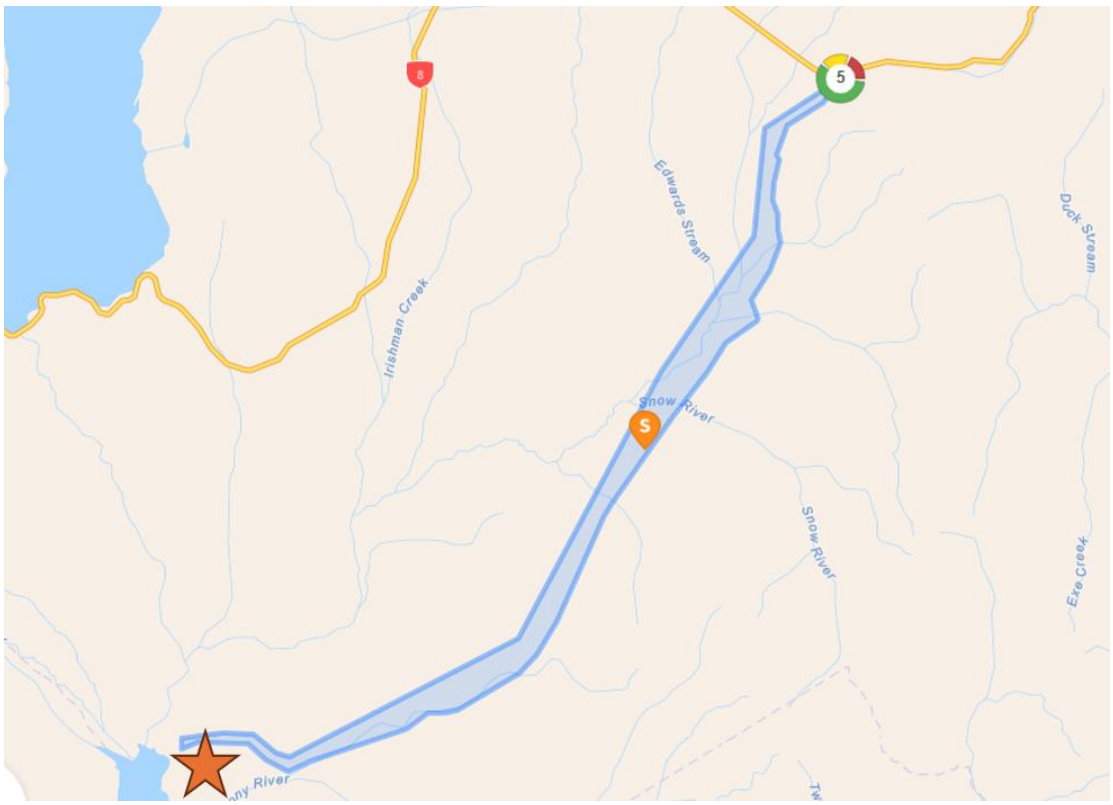

Figure 6-1: Crash Location Map (NZTA CAS)

A total of six crashes were reported within the search area, with five of them being at Dog Kennel Corner and one along Haldon Road.

Figure 6-2 shows the collision diagram for the Dog Kennel Corner crashes. Four of the crashes occurred on SH8 and one non-injury crash occurred at the intersection of the two Haldon Road legs. All five crashes were single-vehicle loss of control crashes. One of the SH8 crashes was a fatal crash, one was a minor-injury crash and the other two were non-injury crashes. Wet or icy conditions, vehicle speed and distraction were factors listed for the crashes. No crashes involving vehicles turning into or out of Haldon Road at SH8 have been reported.

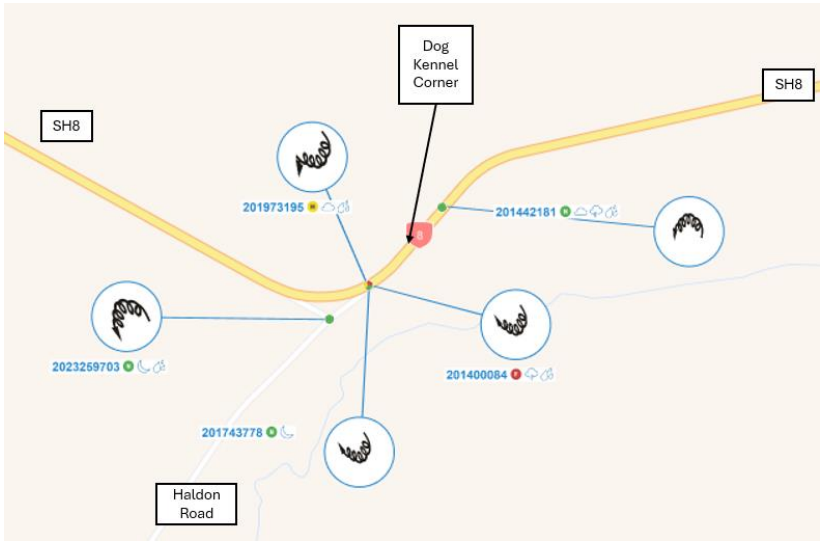

Figure 6-2: Collision Diagram at SH8 and Haldon Road Intersection (NZTA CAS)

The single crash reported along Haldon Road was a serious-injury crash which occurred when a motorcyclist travelling south lost control on the gravel road.

7 Proposed Solar Farm

7.1 Overview

The project involves the construction, operation and maintenance of a photovoltaic solar farm. It will consist of approximately 376,000 solar panels, 42 inverter stations and a National Grid substation set across an approximately 340 ha site.

The solar farm will also include, inverters, transformers and associated switchgear, as well as ancillary buildings, access roads, undergrounding cables, deer fencing, rabbit fencing and other infrastructure. Figure 7-1 shows a schematic of the proposed solar farm layout.

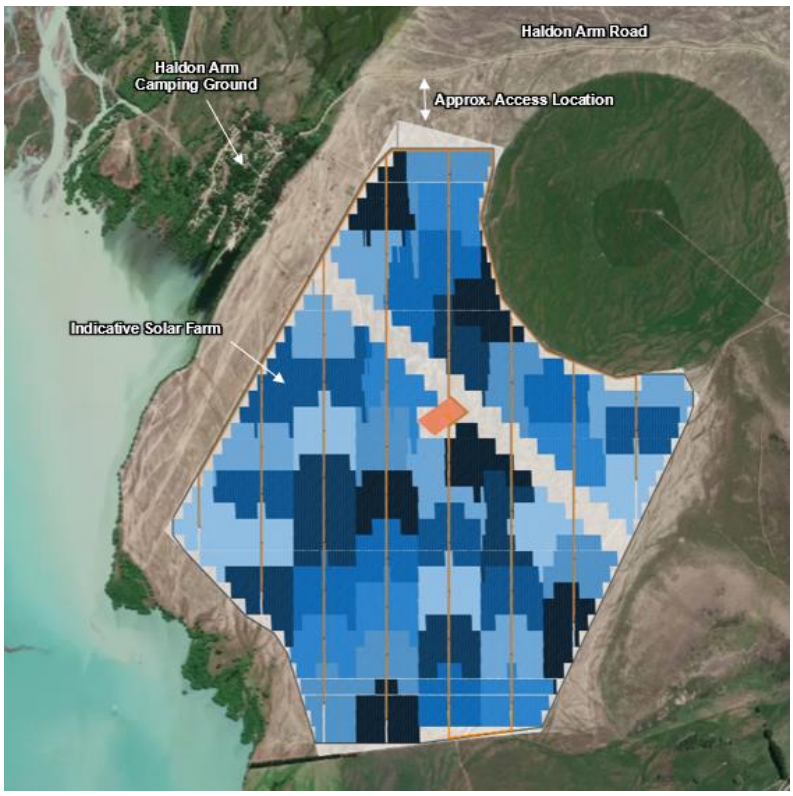

Figure 7-1: General Extent and Layout of the Haldon Solar Project

7.2 Vehicle Access

The Site will be accessed via a single vehicle access point off Haldon Arm Road, located approximately as labelled in Figure 7-1.

The photographs below are from this location, which is approximately 200m east of the 45km/h advisory speed curve. Clear visibility of at least 200m will be available in both directions.

Figure 7-2: Sightline to Left at Haldon Arm Road Access Location

Figure 7-3: Sightline to Right at Haldon Arm Road Access Location

The vehicle access point will be designed at a later stage. However, it will be designed to accommodate truck and trailer left turn entry and right turn exit movements within the formed carriageway.

The access road will be gated for security, with the gate to be set back at least 24m from the edge of the Haldon Arm Road carriageway for queuing space.

7.3 Internal Vehicle Access, Car Parking and Loading

The internal site layout will be designed at a later stage. Vehicle access throughout the solar farm will be provided by way of a combination of formal (all weather standard) and informal access tracks, suitable for the vehicles that will need to use them.

The main access road from Haldon Arm Road into the site will be formed to an all weather standard with a width of at least 4m, with regular widening for passing.

Informal car parking areas, both for during construction and operation, will be provided to meet any and all parking demands. These will be sized to ensure sufficient manoeuvring for parking spaces and to allow for turning around. Similarly, the solar farm and construction works will be planned to allow for convenient heavy vehicle access, manoeuvring and turning as necessary.

8 Traffic Generation

8.1 Operational Traffic Generation

Routine maintenance is expected to involve one or two personnel on the Site full time with corrective maintenance staff called upon as necessary. This will include inspections and any remedial work that may be required. This may include replacing damaged panels if necessary. Site staff will be based in the proposed substation control room.

Cleaning of the single-axis tracking panels will be done by positioning them to face oncoming storm events. Any additional cleaning which is required will be carried out using a tractor equipped with a water tank mounted on the back. Water will be transported to the Site as needed for this purpose.

The solar farm has an asset life of approximately 35 years. Certain equipment, such as the inverters, may need to be replaced within this timeframe. After this time, the facility will either be refurbished or decommissioned.

Based on the above, it is concluded that the solar farm will generate very low traffic volumes once operational, consistent with existing activity levels along Haldon Road and Haldon Arm Road. Accordingly, the remainder of this assessment is focussed on construction traffic generation, effects and management.

8.2 Construction Traffic Generation

Construction traffic will largely comprise of imported material and equipment container deliveries, and personnel travelling to and from the Site. Construction is expected to last for between 14 and 18 months.

8.2.1 Heavy Traffic Generation

The peak in heavy traffic generation is expected to be associated with delivery of imported material for the substation foundation and access roads. An average of approximately 30 deliveries per day

by truck and trailer (30 vehicle movements in and 30 vehicle movements out) are expected over a three-month period early in construction. This represents approximately 70% of imported material delivery. The remaining 30% will be associated with trenching material, which will be delivered over a subsequent period. Assuming this is also delivered over a three-month period, this could involve approximately 10 deliveries per day.

Most solar equipment is transported in standard shipping containers and is relatively lightweight. Predominantly these will be transported by way of truck and trailers. Approximately 10 equipment deliveries per day are expected during a six-month period early in construction.

It is understood that the intention is for much of the substation foundation and access road material to be delivered prior to equipment deliveries starting. However, there could be some short-term overlap. Accordingly, a combined heavy traffic generation of 40 deliveries per day has been assessed. This would represent approximately five heavy vehicle movements in each direction per hour on average, although timing could be more bunched due to the long travel times from source locations.

Outside of imported material and equipment delivery, short peaks in heavy vehicle generation can be expected, for example during construction of the substation. It is considered that 10 heavy vehicle deliveries per day remains appropriate for the purpose of this assessment.

Imported material sources are not known at this stage. Equipment will be delivered from a port, with Lyttelton (Christchurch), Timaru and Port Chalmers (Dunedin) possible options. Flexibility to choose material source locations and a port to suit the construction project are to be retained.

8.2.2 Personnel Traffic Generation

Lodestone expects that there could be approximately 150-200 staff on-site during construction. Most of these would be temporarily staying in the area rather than being locals.

Staff will generally be travelling to the construction site in the morning and leaving in the evening.

Lodestone and their construction contractor will investigate options to provide transport for staff to reduce private vehicle travel, with options being explored currently. Options include providing buses / shuttles from surrounding centres and a barge from the Ohau C power station to the Haldon Arm camping ground (approximately 2.5km distance across the lake).

With means in place to reduce private vehicle travel, it is estimated that there will be less than 100 vehicle movements per day (50 in and 50 out) associated with personnel travel.

9 Construction Traffic Effects Assessment

9.1 SH8 / Haldon Road Intersection- Eastern Leg

9.1.1 Driver Sightline

If imported material and / or equipment delivery is to be to and from SH8 to the east of Dog Kennel Corner, the number of heavy vehicles turning right out of Haldon Road will be higher than usual.

As outlined earlier, the approximately 220m sightline available at the intersection would not meet the Austroads safe intersection sight distance requirement for a 100km/h design speed. However, it exceeds the 165m stopping sight distance for the same design speed. This means drivers can react to a slow moving vehicle pulling out of Haldon Road and come to a complete stop if necessary.

It is considered that 'Trucks Crossing' temporary warning signage should be in place at the intersection during the imported material and equipment delivery periods, as well as any shorter periods of construction when multiple heavy vehicle movements per day are expected. These will increase driver alertness in advance of the intersection and combined with the 220m sightline around the curve, will ensure that trucks can turn out of Haldon Road safely.

A construction traffic management plan (CTMP) is proposed by Lodestone and this will include any temporary traffic management measures to be put in place at Dog Kennel Corner. The CTMP is discussed further in Section 10 of this report.

9.1.2 Driver Observation Angle

As highlighted earlier, drivers approaching SH8 on the eastern Haldon Road leg have a poor observation angle to their left due to the intersection geometry. Truck drivers may have no visibility to their left depending on their vehicle. While no crashes involving vehicles turning out of Haldon Road have been reported in the last 10 years, the increase in use of this intersection by trucks during construction would increase the likelihood of such a crash occurring.

Minor changes to the intersection to provide an improved observation angle for drivers on Haldon Road have been investigated. The below figure indicates the necessary path of a large rigid truck to allow the driver to see traffic approaching from the left at no more than a 20-degree angle behind perpendicular.

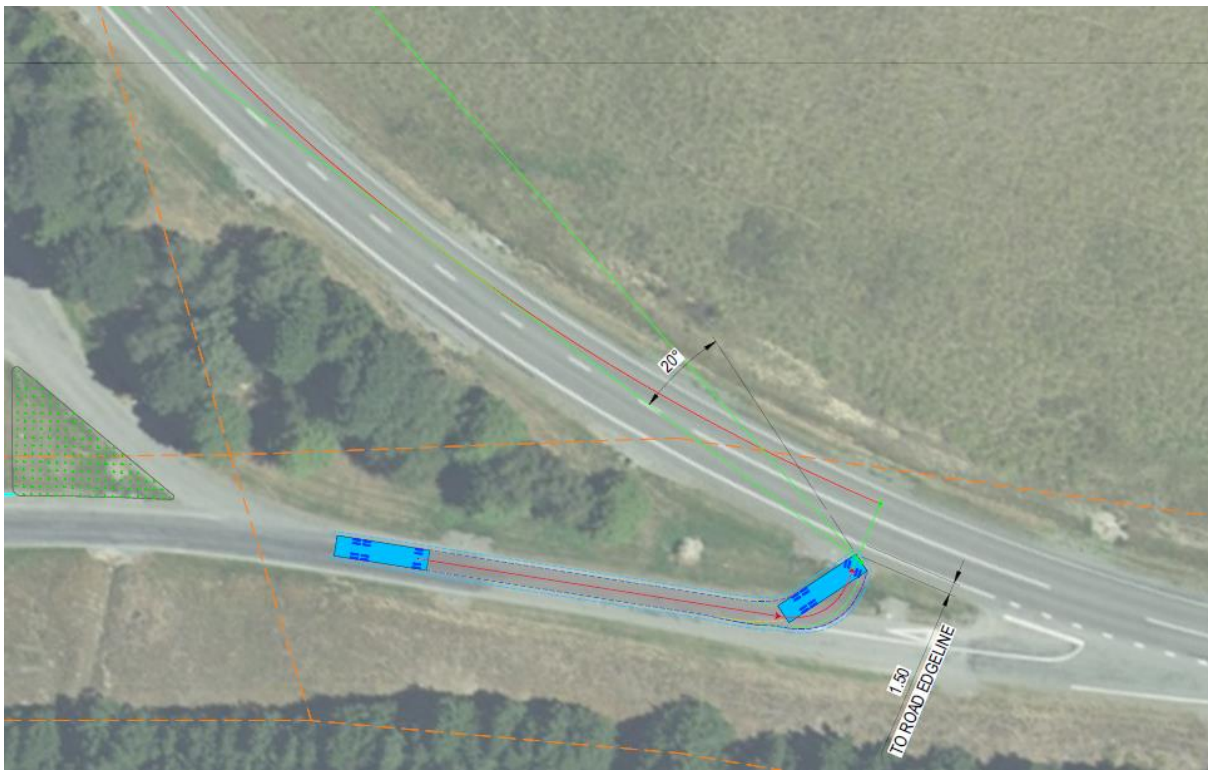

Figure 9-1: Large Rigid Vehicle Path for Improved Observation Angle

Widening to accommodate this path appears feasible in terms of constructability. Ideally the realignment of the approach would not impact the existing delineation signage around the outside of the SH8 curve. It may be necessary for vehicles to meet SH8 east of where the truck above is indicated to avoid the existing signage, and this may require widening on the southern side of Haldon Road, which also appears feasible.

It is recommended that works are carried out to improve the driver observation angle if imported material and / or equipment delivery is to be to and from SH8 to the east of Dog Kennel Corner. The above concept has been discussed with NZTA's safety engineer who agrees with squaring up the approach for driver visibility and that this appears feasible. Details to be worked through would include the Haldon Road approach alignment, line marking on Haldon Road to encourage drivers to approach the intersection to maximise their visibility to the left and any changes to delineation around the curve on SH8 (both line marking and signage).

The CTMP should include provision for a driver and staff induction process where the need for caution at this intersection can be highlighted.

If the approach to SH8 is realigned, there would be more than adequate space for a truck and trailer turning left into Haldon Road to wait clear of the SH8 westbound traffic lane until the exiting vehicle has cleared the intersection (noting the narrow width of the eastern Haldon Road leg as described earlier).

9.2 SH8 / Haldon Road Intersection- Western Leg

The western leg of the intersection is simpler in that drivers exiting only need to give way to traffic approaching from their right. Visibility is available to the right once past the trees at Dog Kennel Corner, and the exit movement is effectively a merge movement given the geometry of the intersection.

If imported material and / or equipment deliveries are via SH8 to the west of Dog Kennel Corner, the number of heavy vehicles turning left out and right in at the western intersection will be increased. Drivers turning left out will face minimal delays given relatively low westbound traffic volumes (up to approximately 250vph). This means if a heavy vehicle arrives on SH8 to turn into Haldon Road while there is a vehicle exiting Haldon Road, there would only be a momentary delay for the driver on SH8 before they can turn (noting the narrow width of the western Haldon Road leg as described earlier). With the low traffic volumes on SH8 and good forward visibility to the intersection for vehicles approaching from the Lake Tekapo direction, it is considered that this would have a negligible effect on the safe operation of SH8.

It is considered that this intersection would also benefit from 'Trucks Crossing' temporary warning signage if it is to be used for imported material and / or equipment deliveries or by multiple trucks per day during other times of construction. This would improve the alertness of drivers in both directions to the possibility of a slow-moving heavy vehicle. As above, temporary traffic management measures at Dog Kennel Corner will be a matter for the CTMP.

9.3 Intersection of Haldon Road Legs

The western Haldon Road leg curves as it approaches the eastern leg. The curved section is not wide enough for two-way vehicle movement and there is a concern that the priority at the intersection is not clear. Vehicles enter Haldon Road from the east at a high speed and if a driver approaching from the west is not aware that they are required to give way, a crash could result. Construction will increase the use of the intersection and therefore the likelihood of a crash, regardless of the direction of travel by trucks.

The extent of minor widening of the intersection necessary to allow for two-way vehicle movement, square up the western approach and formalise priority at the intersection has been investigated. The figure below indicates widening to allow a large heavy vehicle (such as a truck and trailer) to turn left in while a single-unit truck waits to turn right out, and vice versa. This appears to be readily achievable and is recommended along with associated line marking and signage as mitigation for potential construction traffic effects. These actions will also benefit the safety of the intersection longer term. The Mackenzie District Council Manager – Roading has advised in initial consultation that this appears feasible, with no major concerns raised.

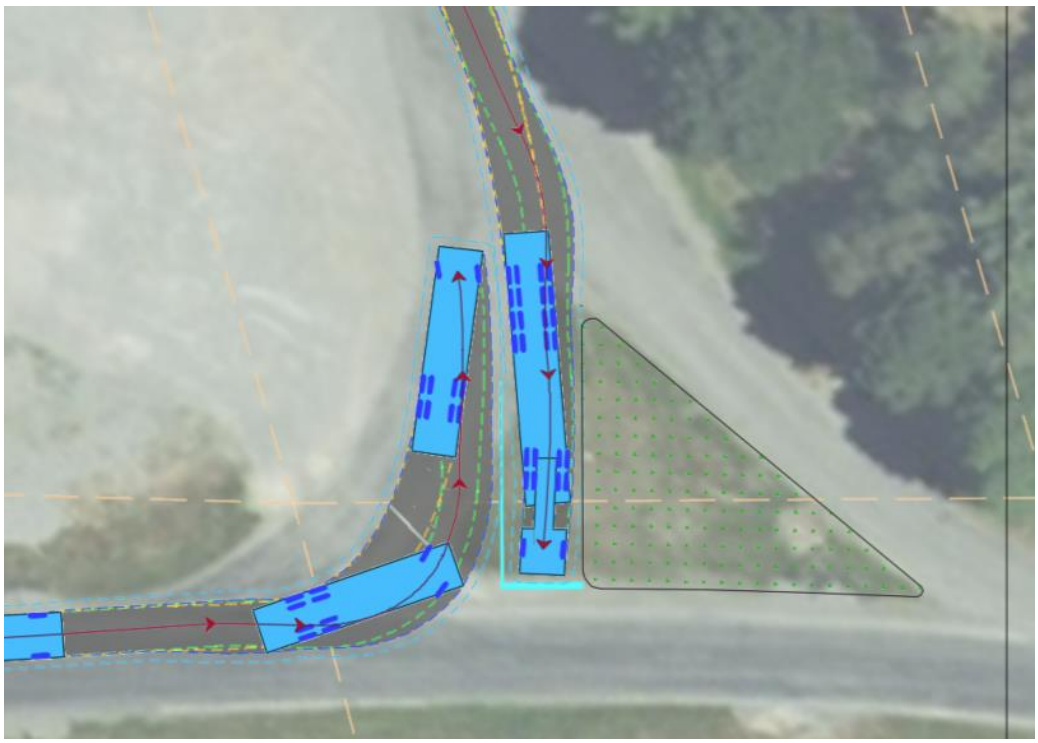

Figure 9-2: Indicative Mitigation Works at Intersection of Haldon Road Legs

9.4 Haldon Road / Haldon Arm Road Route Safety

9.4.1 Carriageway Widths and Forward Visibility

Carriageway widths, both sealed and unsealed, vary along the length of the route. Over much of the route, the carriageway width is suitable for two-way movement by heavy vehicles. However, there are sections where the carriageway width will not be able to accommodate two-way heavy vehicle movement. Generally though, the two roads are straight and flat, and there is good forward visibility for drivers. The road shoulders / verges are typically firm and driveable, and this will allow drivers to manage conflicts with opposing vehicles if required.

Three sections of Haldon Road where forward visibility is limited were highlighted in Section 4.3.2. Drivers travelling at inappropriately high speeds through these sections of road would be a concern as it would increase the risk of a head-on or loss-of-control crash. Crashes are unlikely due to low traffic volumes opposing construction traffic (with light vehicle movements tidal in nature and truck volumes low and spread out) and likely vehicle speeds through these sections of the road. Also, in the unlikely event that a crash did occur, it would likely be at a slow speed, with drivers being able to reduce speed, such that the consequence would be minor. These sections of road have some level of permanent warning signage however it is recommended that these sections of road are reviewed in detail prior to construction and temporary warning signage be provided throughout the construction period. The CTMP should document this review and the outcomes.

Signage in these specific locations could be supplemented by general temporary warning signage in other locations such as the start of Haldon Road near Dog Kennel Corner, where Haldon Road transitions from sealed to unsealed, on Mackenzie Pass Road and Hakataramea Pass Road on

approach to Haldon Road, and at the exit from the camping ground. The CTMP should include provision for consideration of appropriate warning signage along the Haldon Road / Haldon Arm Road route.

The CTMP should also outline driver behaviour expectations, particularly around vehicle speeds along the route and in the above locations, and safe passing, to be outlined during staff and driver induction.

9.4.2 One Lane Bridges

Driver behaviour expectations can also cover the one lane bridges and cattle stops. While there is advanced warning and priority signage, the one lane bridges require varying levels of slowing by drivers due to limited forward visibility. Driver behaviour expectations at one lane bridges would be included in the CTMP, with the expectation that these would be outlined in inductions and on an ongoing basis as required. The structural suitability of one lane bridges will need to be considered as part of any overweight permit for loads such as those associated with substation transformers and inverter units.

9.4.3 Staff Travel

As described earlier, Lodestone and their construction contractor will investigate options to provide transport for staff, to reduce private vehicle usage. While it will be possible for staff to drive their vehicles via the Haldon Road / Haldon Arm Road route safely, reducing private vehicle travel reduces exposure to crashes occurring. Concerns are increased where there are drivers who may not be familiar with driving on such roads. Similarly, there are concerns with travel distances associated with driving to and from the Site, and particularly during icy and / or dark conditions during winter. It is recommended that Lodestone and their construction contractor take measures to reduce staff private vehicle travel to and from the Site. It is recommended that these be documented in the CTMP.

It is considered that a combination of reducing staff private vehicle travel, temporary warning signage and staff induction processes, all to be outlined through a CTMP process, will ensure the ongoing safe operation of Haldon Road and Haldon Arm Road throughout the construction period.

9.5 Haldon Road / Haldon Arm Road Route- Other Road User Safety

9.5.1 Camping Ground Traffic

Traffic volumes will be increased on Haldon Road and Haldon Arm Road during the camping season, which in 2024/25 runs from late September until early May. It is expected that the peak times for the camping ground will be around the Christmas and New Year period.

It is recommended that consideration is given to camping ground traffic and any additional mitigation measures, such as additional warning signage, to ensure the safety of unfamiliar road users during construction. The CTMP should outline any additional mitigation measures to be in place during all or parts of the camping season.

9.5.2 Other Road Users

As highlighted earlier, there could be occasional tourists, children and horse riders present on the side of the road and cyclists on the road. While the use of the route by construction traffic will not impact the safety of these other road users, vehicles, and particularly trucks, travelling at high speed could be intimidating and unpleasant. The CTMP will need to outline driver behaviour expectations when other road users are present. For example, these could include truck drivers slowing to 30km/h when someone is on foot or horseback on the side of the road.

9.5.3 Stock Movements

Stock movements along and across Haldon Road can be expected occasionally. Stock movements will always have priority over construction traffic as would be expected in the rural environment. It is considered that construction traffic should not warrant any changes in how local farmers move stock and their temporary traffic management arrangements.

It will be in the interests of Lodestone and its contractor to inform local farmers of upcoming construction traffic activity as a way of managing construction traffic conflicts with stock movements. It is expected that farmers will be able to move stock outside of staff arrival and departure times and any periods with higher volumes of heavy vehicle movements to minimise interactions with vehicles. The CTMP should include provisions for Lodestone and its contractor to keep local farmers informed of upcoming construction traffic activity.

9.6 Haldon Road / Haldon Arm Road Route- Pavement Maintenance

The increased heavy vehicle usage of the road could have effects on the condition of the carriageway, particularly on seal edges if vehicles are required to drive on the shoulder when passing. Given the length of road, modest heavy vehicle volumes expected and relatively short construction duration, there is considered to be a low likelihood of this occurring. However, a maintenance agreement with Mackenzie District Council is recommended so that damage attributed to construction traffic can be identified and remedied. This would typically include a pre-construction condition survey, ongoing monitoring and a post-construction condition survey. It would also outline when and how remediation work is to be carried out (and funded).

The pre-construction condition survey would highlight any existing road sections in poor condition so that this is not attributed to construction traffic. It is recommended that areas in poor condition (such as the area described in Section 4.3.2) be improved with a suitable running course ahead of construction to support safety of vehicle movements.

9.7 Other Possible Routes

9.7.1 Mcaughtries Road

Mcaughtries Road runs from SH8 near Twizel to the Ohau C power station and camping ground. It has been constructed to a high standard suitable for access to the power station and it will be able to

accommodate staff vehicle movements if Lodestone and their construction contractor run a barge across the lake to the construction Site.

Widespread car parking by staff at / near the Ohau C power station and camping ground could be a concern, particularly at certain times of the year. Even if the barge option is pursued, staff buses / shuttles could run from nearby centres to Ohau C to minimise adverse effects. Staff car parking management measures at Ohau C should be a matter included in the CTMP if a barge is to be utilised.

9.7.2 Iron Bridge Route and Other Private Routes

It is understood that there is an off-road route from SH8 at Lake Pukaki, along the eastern side of the Pukaki River and over the Tekapo River via the 'Iron Bridge', to Haldon Arm camping ground. This is understood to be a 4-wheel drive track through Meridian Energy and Genesis Energy property. It is also understood that the Pukaki River is traversable by 4-wheel drive during much of the year.

These routes may be usable for staff travel to the Site, reducing travel distances and travel on the public road network, which would both be good outcomes. However, it is understood that the use of these routes would be the responsibility of the personnel and not Lodestone on the basis that these are not proposed access routes. The CTMP would need to identify that these routes pass over private property, and that their use would require landowner permission and is not recommended.

10 Construction Traffic Management Plan

The construction of the solar farm will vary the normal operating conditions of the surrounding road network and therefore a Construction Traffic Management Plan (CTMP) is recommended in accordance with the Code of Practice for Temporary Traffic Management (CoPTTM). A number of construction-related matters, including required materials, volumes of materials, origins of materials, construction staging, will be determined following head contractor appointment and subsequent construction planning. As described in the preceding section of this report, the requirement for a CTMP will allow potential adverse effects on the surrounding road network to be appropriately managed in light of that further information around the solar farm construction. The objectives of the CTMP will be to ensure that:

- Construction traffic, particularly heavy traffic, is safely accommodated along all routes to the site;
- Construction traffic can safely turn at intersections without affecting the safety of the intersections;
- Construction traffic can safely turn onto and off the Site at the proposed access location without impacting the safety of the frontage road; and
- Adverse effects on the condition of the public road network as a result of construction traffic are appropriately remedied.

To achieve these objectives it is recommended a CTMP be prepared and certified by Council prior to the commencement of construction. It should specifically include but not be limited to the following:

- Purpose and objectives of the CTMP;
- The process and approach for development of the CTMP;

- Specific details of the construction programme and traffic flows;
- Establishing safe and efficient travel routes, site access points and contractor parking;
- Signage providing guidance to the Site, possibly at the Haldon Road / Haldon Arm Road intersection and at the Site access point;
- Management of road safety including such measures as driver protocols, monitoring and reporting requirements;
- Minimising the effects of construction traffic on local amenity;
- Details of any road safety assessments undertaken;
- Recording and accounting for pavement maintenance;
- Planning for, and details of over-weight / over-dimension transport movements, including any relevant permit provisions;
- Incident reporting mechanisms, recording and reporting methods;
- Provision for emergency services;
- Performance monitoring and response plans in the event of a breach of performance;
- Contingency planning and response provisions;
- Temporary traffic management planning, including at one-lane bridges;
- Consideration for the provision of an 0800 number such that members of the public and road users have a known point of contact for any traffic related issues that may arise during the construction of the solar farm;
- Information availability and reporting; and
- Review and evaluation of the plan's contents.

The following are specific matters highlighted throughout this report to be included:

- Temporary warning signage on SH8 at the Haldon Road intersections;
- Realignment of the Haldon Road eastern approach to SH8 (if this is to be used by imported material and / or equipment deliveries);
- Realignment of the Haldon Road western leg into the Haldon Road eastern leg;
- Review of the three sections of Haldon Road specified in Section 4.3.2 of this report for possible temporary warning signage;
- Other general temporary warning signage along the Haldon Road route;
- Driver behaviour protocols related to vehicle speeds on the Haldon Road / Haldon Arm Road route, passing other traffic, one lane bridges and cattle stops, and courtesy to other road users;
- Measures to reduce private vehicle travel by personnel;
- Additional measures to be in place during the camping season with consideration of camping traffic and peaks in activity;
- Provision to keep local farmers informed of upcoming construction traffic activity;
- Car parking management at Ohau C if personnel parking is to occur there; and
- Information / advice on the use of the Iron Bridge route (or other routes through private property).

The CTMP is to be prepared in consultation with NZTA, and subject to Mackenzie District Council's certification.

With the above measures in place and based on the process necessary in its establishment, it is assessed a comprehensive mechanism will be developed to ensure the potential transport effects associated with the temporary construction traffic movements will be avoided and / or appropriately mitigated to a level where they are sufficiently small not to adversely affect other users of the road network.

11 District Plan Assessment

11.1 Proposed District Plan

Section 15 of the Operative District Plan is being replaced by Plan Change 27 as part of Stage 3 of the Mackenzie District Plan Review. Now that decisions have been made, all provisions in Plan Change 27 have legal effect, and all rules that have not been appealed are now treated as Operative.

An assessment against transport standards that apply in the general rural zone (GRUZ) is contained in Appendix A.

One matter of non-compliance relating to sightlines at the Haldon Arm Road access point has been identified. Both the Plan Change 27 and Operative District Plan provisions require sightlines at accesses based on the posted speed limit, which is 100km/h on Haldon Arm Road. Vehicle speeds along the section of Haldon Road where the access point is proposed will be considerably slower than this, estimated to be approximately 60km/h. The Austroads safe intersection sight distance requirement for a 60km/h design speed is approximately 120m. The available sightlines of approximately 200m length will ensure drivers can turn into and out of the Site safely, and without affecting the safe operation of Haldon Arm Road.

11.2 Operative District Plan

The proposed solar farm has also been assessed against relevant rules from Section 15 Transportation of the Operative Mackenzie District Plan which is being replaced by the Proposed District Plan. Section 15 does not appear to be applicable to utilities, noting that the rules in Section 16 prevail over all other rules in the District Plan where utilities are concerned. Similarly, Section 15 does not appear to address construction traffic independently of the primary land use activity. In lieu of an express provision stating that these rules do not apply, an assessment against these is provided for completeness. The full assessment is contained in Appendix B. Two matters of non-compliance, relating to mobility parking and vehicle crossing length, are assessed below. The third matter of non-compliance identified, relating to access point sightlines, was assessed in the previous section.

11.2.1 Standard 2.d Mobility Parking

The Operative District Plan has a requirement for mobility parking. Car parking is proposed in informal parking areas and no mobility parking is proposed. This arrangement is typical at construction sites and at activities with very low visitor numbers such as a solar farm. Demand for a mobility parking space is considered unlikely given the nature of the activity and it is assessed that there will be negligible adverse effects on the accessibility of the solar farm site arising from the non-provision. It is a matter that Lodestone will need to monitor and provision for if the identified need for a mobility space changes.

The Plan Change 27 provisions do not require mobility parking in the general rural zone (GRUZ).

11.2.2 Standard 2.m Length of Vehicle Crossing

The Operative District Plan specifies a maximum vehicle crossing length of 9m. This is considered to be intended for an urban environment rather than a rural environment. It is proposed to design the vehicle crossing to accommodate left turn entry and right turn exit movements by a truck and trailer within the formed carriageway. It is possible that the vehicle crossing will need to be longer than 9m to accommodate this manoeuvring and this is considered to be a preferable outcome. Haldon Arm Road is a low volume rural road with no pedestrian activity and there will be no adverse effect arising from any non-compliance with this standard.

The vehicle crossing design standards from Plan Change 27 do not apply to vehicle crossings for non-residential activities on local roads.

12 Conclusion

Operation and maintenance of the proposed solar farm will generate low traffic volumes consistent with the existing use of Haldon Road and Haldon Arm Road and accordingly this integrated transport assessment has been focussed on temporary construction traffic effects and mitigation.

A CTMP approach is proposed to ensure the ongoing safety of the local road network and the SH8 intersection during construction. Minor physical works are recommended at the eastern SH8 / Haldon Road intersection if this is to be used for imported material and / or equipment deliveries and at the intersection of the two Haldon Road legs. These are to be supported by management measures including warning signage, driver behaviour protocols and private vehicle travel minimisation. It has been assessed that the proposed CTMP will ensure any temporary construction effects are appropriately mitigated and therefore the proposal will have minimal effect on the safe and efficient operation of the road network.

Appendices

Appendix A Plan Change 27 Transport Rules Compliance Assessment

Requirement	Proposed Provision	Compliance
TRAN-R3 Vehicle Crossing		
TRAN-S9 Vehicle Crossing Design Not applicable for a vehicle crossing on a local road		
TRAN-S10 Siting of Vehicle Crossings A vehicle crossing on a local road with a speed limit >50km/h to be at least 60m from a local road intersection. Sight distance of 282m for a vehicle crossing on a road with a 100km/h posted speed limit in 'all other zones'.	Nearest intersection is Haldon Arm Road / Haldon Road intersection which is over 4km away. Sightlines of approximately 200m will be available in each direction.	No- see assessment re sightlines in Section 11.1 of report.
TRAN-R4 Vehicle Accessway Assessed as not applicable as no legal accessway proposed between Haldon Arm Road and the Site.		
TRAN-R6 Parking, Manoeuvring and Loading Areas Associated with a Non-Residential Activity		
TRAN-S1 Minimum Parking Space Requirements On-site car parking spaces are to be provided with the minimum number of parking spaces as outlined in TRAN-Table 3. No relevant activity type listed in the table.	Informal parking areas will be provided on site to meet demands, both during construction and operation.	Yes- no relevant rate included in table however it is assessed that a compliant number of parking spaces will be available on the Site regardless of activity rate adopted.
TRAN-S2 Size of Parking Spaces N/A in GRUZ		
TRAN-S3 Mobility Parking Requirement N/A in GRUZ		
TRAN-S4 Reverse Manoeuvring All activities shall provide for sufficient on-site manoeuvring to ensure that no reversing is needed to a vehicle accessway that provides for six or more parking spaces.	Space will be available for all reverse manoeuvring and turning to occur on the Site.	Yes
TRAN-S5 Queuing On-site queuing spaces shall be provided for all vehicles entering a parking area or loading area in accordance with TRAN-Table 6. (10.5m for 21-50 parking spaces,	At least 24m queuing space will be ensured at the Haldon Arm Road access point.	Yes

15.5m for 51-100, 20.5m for 101-150 and 25.5m for 151+)		
TRAN-S6 Loading Areas N/A in GRUZ		
TRAN-S7 Surface and Drainage of Parking and Loading Areas For sites with four or more on-site vehicle parking spaces, the surface must be metaled or sealed and drained.	Surface and stormwater design done by others. Not applicable for transport assessment.	N/A.
TRAN-S8 Landscaping For sites containing five or more car parking spaces for non-residential activity a landscaping strip must be provided within or immediately adjacent to the parking area with a minimum width or diameter of 1.5m. The landscaping strip must contain a combination of trees, shrubs and groundcover. Landscaping must be maintained so as to not obscure visibility or impede the movement of vehicles, cycles or pedestrians.	Landscaping will not affect visibility or safety of people accessing the Site. Landscaping design done by others.	Yes, from a transport safety perspective.
TRAN-S14 Cycle Parking N/A in GRUZ		
TRAN-R7 High Traffic Generator An activity that generates up to 200 equivalent car movements per day accessed from a local road is not a 'high traffic generator'	Solar project will generate less than 200ecm/day	Not a high traffic generator

Appendix B Operative Mackenzie District Plan Section 15 Transport Rules Assessment

Requirement	Proposed Provision	Compliance
2.a. Minimum Parking Space Requirements		
Table 1 shows the minimum number of parking spaces to be provided at all times on the same site for any activity in any zone other than the Town Centre Zone in Fairlie. If any activity is not listed in the Table, the activity closest in nature to the new activity should be used.	Informal parking areas will be provided on site to meet demands, both during construction and operation.	Yes- no relevant rate included in Table 1 however it is assessed that a compliant number of parking spaces will be available on the Site regardless of activity rate adopted.
2.c. Size of Parking Spaces		
All required parking spaces other than for residential units, and associated manoeuvre areas are to be designed to accommodate a 90 percentile design motor car.	Informal parking areas will be large enough to accommodate 90 percentile car.	Yes.
2.d. Car Spaces for People with Disabilities		
Car parking areas shall include spaces for people with disabilities provided at the rate of: • 1 for 10-50 spaces • 2 for up to 100 total spaces • Plus 1 more for every additional 50 spaces.	No mobility parking proposed based on current construction workforce expectations.	No, see report Section 11.2.1 for assessment.
2.f. Reverse Manoeuvring		
On-site manoeuvring for a 90 percentile car shall be provided to ensure that no vehicle is required to reverse either onto or off a site where any development is required to provide 10 or more parking spaces.	Space will be available for all reverse manoeuvring to occur on the Site.	Yes.
2.h Queuing		
Queuing space shall be provided for all vehicles entering a parking or loading area where conflict with vehicles already on site is likely to arise. The required queuing space length shall be in accordance with Table 2 (10.5m for 21-50 parking spaces, 15.0m for 51-100, 19.5m for 101-150 and 24.0m for 151+)	At least 24m queuing space will be ensured at the Haldon Arm Road access point.	Yes.
2.i Loading Areas		
This rule outlines requirements for loading space dimensions.	The layout of the Site will be designed to accommodate all loading activities both during construction and operation.	Yes.
2.j Surface and Drainage of Parking and Loading Areas		

The surface of all parking, loading and trade vehicle storage areas shall be formed and paved or otherwise maintained, so as not to create a dust or noise nuisance, nor to deteriorate in adverse weather conditions. The first 5.5m of such areas (as measured from the road boundary) shall be formed and surfaced to ensure that material such as mud, stone chips or gravel is not carried onto any footpath, road or service lane. Stormwater originating from the property shall be disposed of within the property by sump and piped to the street channel or stormwater drain.	Surface and stormwater design done by others. Not applicable for transport assessment.	N/A.
2.k Landscaping		
Landscaping shall not adversely affect the visibility of motorists leaving a site or create an unsafe environment for persons using the car park or the adjacent footpath. All car parking areas containing 5 or more spaces shall have a landscape strip 1.5m deep along the road frontage.	Landscaping will not affect visibility or safety of people accessing the Site. Landscaping design done by others.	Yes, from a transport safety perspective.
2.l Standards of Vehicle Crossing		
Vehicle access to any site shall be by way of a vehicle crossing constructed pursuant to Council standards, from the roadway to the road or service lane boundary of the site and shall be at the owners expense. Vehicle crossings shall be constructed to the following standards: Drive-in accesses and other activities: heavy duty vehicle culverts and crossings shall be constructed and maintained so that they remain in a good state of repair and are fit for their purpose of carrying all types of normal road traffic.	Heavy duty vehicle crossing to be constructed suitable for construction and operational activities.	Yes.
2.m Length of Vehicle Crossings		
The following crossing lengths shall apply for 'other' activities: Minimum 4m, maximum 9m The length of culverts and crossings shall be the actual length of channel covers or the length of the full dropped kerb.	Vehicle crossing design to be confirmed at a later stage.	Potential non-compliance- see Section 11.2.2 of report for assessment.
2.n Minimum Distance of Vehicle Crossings from Intersections		
No part of any vehicle crossing shall be located closer to the intersection of any roads than the distances permitted in Table 4. A vehicle crossing on a local road shall be at least 55m from a rural local road intersection.	Nearest intersection is Haldon Arm Road / Haldon Road intersection which is over 4km away.	Yes.

2.p Visibility from Accesses		
All private accesses shall be located to ensure continuous visibility up to the minimum sight distances in Table 5 is achieved: Speed Limit 100km/h = 250m Sight Distance	Sightlines of approximately 200m will be available in each direction.	No- see assessment in Section 11.1 of report.
2.q Private Vehicle Access		
All private vehicular access to fee simple title allotments, cross leases, unit titles or leased premises shall be in accordance with the standards set out below. For access to 0-6 lots in the rural zone: 4.0m carriageway width, turning area required, passing bay and footpath optional.	Carriageway width of at least 4m will be provided.	Yes.
2.r Standard of Vehicle Access		
Rural and Rural Residential Zones Accessways in the Rural zones shall: -be designed to minimise edge break -be designed to ensure that vehicles using the access do not reduce the safe and efficient functioning of the adjacent road -be formed, sealed and maintained to an all weather standard with the first 5.5m of the access (as measured from the formed road surface) being formed to ensure that material such as mud, stone chips, or gravel is not carried onto the road. For the purpose of this rule 'all weather standard' means sealing of accesses on sealed roads and compacted level metal surfacing on unsealed roads. -be designed to ensure that efficient drainage of surface flows in the road reserve is not impeded. This will be achieved by the provision of culverts where necessary, being adequately sized, of sufficient length to limit blockages, and with properly formed inlets and outlets. For the purpose of this rule safe and efficient functioning of the adjacent road requires that where there is likely to be an average of at least 30 heavy vehicle movements in or out of the access per month over three consecutive months during a 12 month period, the access shall be designed and maintained so that a truck and semi-trailer or such larger vehicle which regularly uses the access, will not leave the formed carriageway or the formed access when entering or leaving the property.	Vehicle crossing to be designed at a later stage. It will be designed to accommodate left turn entry and right turn exit vehicle tracking of a truck and trailer within the formed carriageway. It will be formed to an all weather standard. Drainage design being done by others.	Yes.

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