ANNEXURE J

DRAFT CIVIL CONSTRUCTION METHODOLOGY

Draft Civil Construction Methodology

Ashley Solar Farm

Document control

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Related documents

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1. Introduction

This document describes the construction methodology of the site activities for the construction of Ashely Solar Farm at Inland Route 72, Ashley, Canterbury, New Zealand to support the requirements for the regional consents.

Intended as a realistic and feasible methodology from which the anticipated effects on the environment of these activities can be identified. It is recognized that once a Physical Works Contract has been awarded and a Contractor (or Contractors) is in place, the methodology will be further refined and developed to ensure compliance to council requirements. It is acknowledged that this must be done within the scope of the conditions which will be in place to manage the environmental effects of the construction activities.

The proposed Ashley solar farm is a 60.7 MWp farm located approximately 35 minutes' drive north of Christchurch. It is primarily surrounded by rural land and wraps around an existing substation.

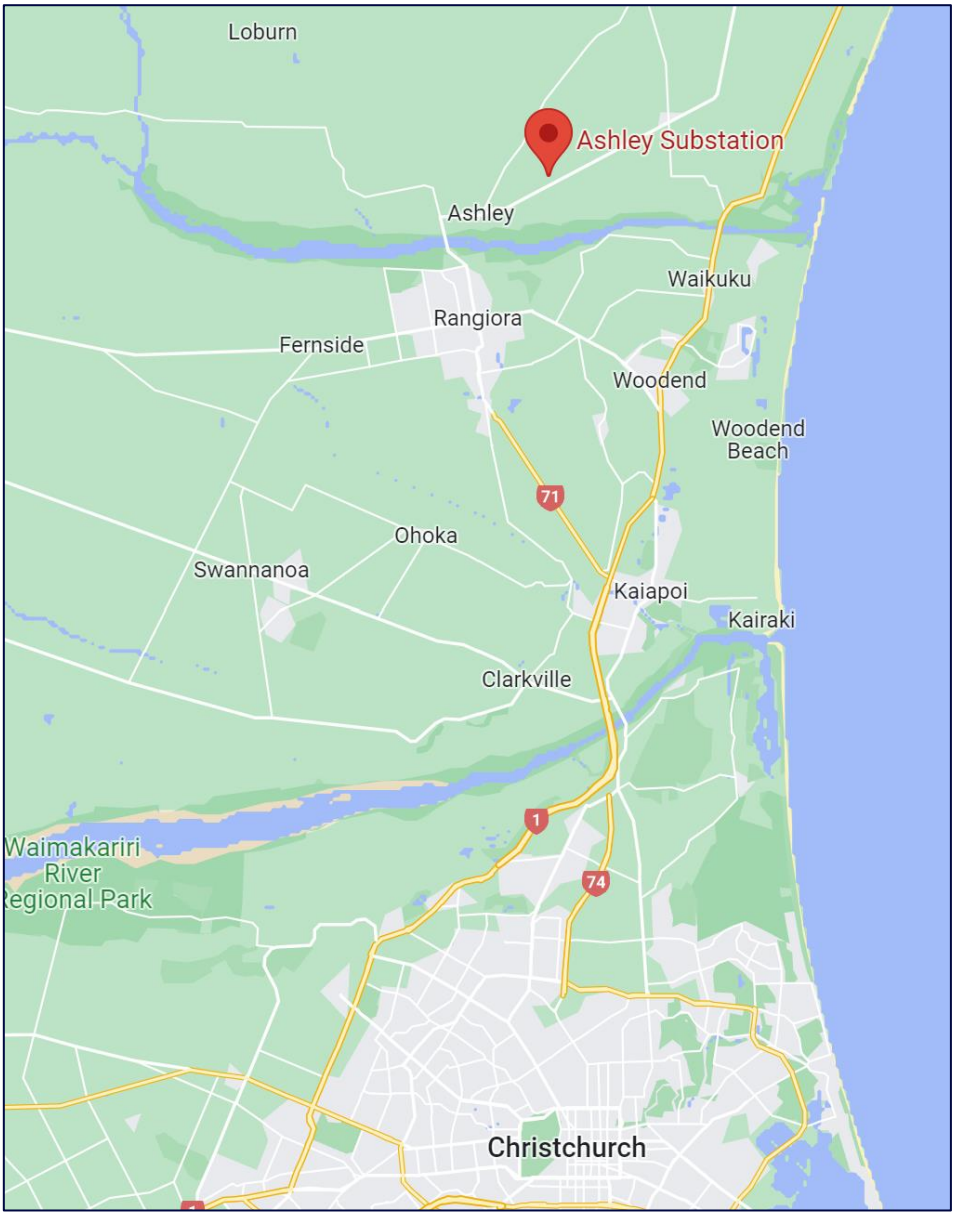

Figure 1: Site Location Map

2. Project Construction Milestones

Construction works are planned to be undertaken in three construction stages with site civil work preparation taking place in the first construction season. Construction stages, 2 and 3, will overlap as preparation works are completed on portions of the site.

2.1 Construction Stage 1 – Dates TBC (3 Months)

Works to be completed during this period include:

- Vegetation Clearance
- PV Array Area Contouring including cut and fill
- Levelling of Laydown Areas
- Improvement of existing tracks and Accessways
- Fencing
- Stormwater Reticulation
- Site village set-up
- Parking Area

2.2 Construction Stage 2 - Dates TBC (6 Months)

Works to complete the Pile Driving and earthworks for different PV areas include:

- Lot 1 to 22 (or more depending on final layout)
- Remedial Piling – Predrilling before piling in case of restrictions underground.

2.3 Construction Stage 3 - Dates TBC (3 Months)

Works to be completed during this period include:

- Cable Trenching for all 13 of the PV area lots including PV Array DC, Auxiliary, Communications, and MV trenches.
- Foundations for the Buildings including septic tank.
- Foundations for Inverters
- Installation of PV mounting structure and PV modules
- Foundations for water tanks
- Foundations of camera poles
- Placement and fixing the inverters to the inverter pads

3. Construction Sequencing

The construction sequencing is indicative of the order in which activities would be performed and is subject to change and the programme adopted by the contractor.

The area of earthwork which can be open at any one time limits the opening of areas for earthwork thus, as earthworks are completed in Lot 1 and stabilised, corresponding areas in Lot 2 are able to be opened. This process continues through to the last section.

Construction works are planned to be undertaken in three construction seasons with some preliminary enabling work taking place in the first construction season.

3.1 Construction Stage 1 – Dates TBC (3 Months)

- Site preparation, including clearing and grubbing of land, conservation of topsoil, grading, levelling, earth moving, soil improvement, and site rehabilitation.
- Removal of stock water troughs and associated pipework.
- PV Array Area contouring by cut and fill.
- General Levelling of Laydown Areas
- Improvement of internal roads/accessways and main entrance to the site
- Installation of security fence and cameras
- Construction of parking Area and unloading area at the access point
- Stormwater reticulation of the site by construction of drains
- Removal/demolishing of existing building at the site main entrance
- Installation of erosion and sediment control devices
- Parking Area levelling

3.2 Construction Stage 2 - Dates TBC (6 Months)

Lot 1 to Lot 22 (or more depending on final layout and earthing plan)

- Pile Driving to be undertaken with 2 x Pile Driving Machines
- Remedial Piling – Predrilling before piling in case of restrictions underground.
- Auxiliary Cable Trenching
- Cutting for DC cable trenches
- Cutting and Filling for MV cable trenches
- Construction of Building Foundation
- Construction of wastewater holding tank
- Construction of Inverter Foundation
- PV Array Mounting Installation
- Placement and fixing the inverters to the inverter pads

3.3 Construction Stage 3 - Dates TBC (3 Months)

Lot 1 to Lot 22

- Backfill of DC cable trench
- PV Module Installation
- Foundation Installations

4. Preliminary and Enabling Works

4.1 Pre- construction meeting

In accordance with normal practice a pre-construction meeting on-site will be held prior to works commencing with the persons undertaking authorized activities in possession of consent conditions.

4.2 Sediment Control

Sediment control devices will be installed for preliminary works.

5. General Operations

5.1 Contractors Site Establishment

Main access to the construction site operations will be gained primarily from Beatties Road. The contractor site establishment, offices, lunchrooms, and storage will be within the site perimeter.

Additional site buildings containing shelters and toilets will be located at several locations within the site boundary.

5.2 Hours of Work

It is proposed that the hours of work for site operations be in daylight from sunrise to sunset within the hours of 7am to 6:30pm Monday to Friday.

5.3 Security

Permanent fencing and security cameras will be installed in the Construction Stage 1 phase of the project.

6. Construction Traffic Volumes

An assessment of the number of heavy vehicles (trucks) using Golden Stairs Road for the full period of construction season has been undertaken.

Stage 1	Dates TBC - 90 days	330 Arrivals & departures Average 3.5 per day
Stage 2	Dates TBC - 180 days	300 Arrivals & departures Average 1.6 per day
Stage 3	Dates TBC - 90 days	120 Arrivals & departures Average 0.6 per day

Note: Trucks are typically only laden for one direction and empty for return.

7. Stormwater and Sediment Control

7.1 Sediment and Erosion Control Strategy

The sediment and erosion control strategy has been developed generally in accordance with Canterbury Regional Council guidelines. (Strategy TBC)

The methodology for erosion and sediment control is described in detail in the report "Ashley Solar Farm - Erosion and Sediment Control Plan". (Document TBC)

The proposed development is intended to be opened in stages with grass and topsoil cover maintained as long as possible. It is intended that the bulk earthworks be completed in a single progressive earthworks' operation.

7.1.1 Methodology

The following broadly describes the proposed earthworks and sediment control methodology for the bulk of the works:

Topsoil stripping: Only where necessary, topsoil shall be stripped from the extent of works in an incremental fashion to form earth bunds on each side. Top soil will be stored and reused on the site as cut an fill material, bedding sand or general topsoil distribution

Clean water diversions: Existing drains formed to manage runoff are intended to be retained if practicable to convey clean water.

Silt Fences (SF): Silt fences will be employed at areas where the stabilised surface has been disturbed and there is no surrounding vegetation to secure runoff.

Decanting earth bunds (DEB.s): Decanting earth bunds (DEB) shall be formed as per the sediment and erosion control plan.

Dirty water cut-off drains: Cut-off or contour drains shall be formed as shown on the sediment control plans to manage/convey runoff within the earthwork's extents.

Cut to Fill: With the above sediment and erosion control measures in place, the cut to fill operation shall be undertaken in an incremental manner.

Sediment Retention Ponds: Existing ponds will be used to help control sediment

Stabilisation: Prior to the removal of any sediment control devices, earthworks within that catchment will have been stabilised.

8. Dust, Noise and Vibration Control

8.1 Dust Control

Detailed information regarding dust control is presented in the Erosion & Sediment Control Plan.

The following general measures will be adopted.

- Roads, access ways, site laydowns and parking areas during construction to be kept well metalled and regularly watered when required during dry periods.
- Significant spills of materials that may cause dust during construction to be cleaned up as soon as practicable.
- Exposed areas of earthworks to be minimised.
- When loading trucks, materials to be dropped from as low height as possible.
- Pre-water areas prior to any cut and fill activity
- Excavated areas and cleared areas to be stabilised immediately or, if not able to, water as necessary
- If control measures fail, suspend work in very dry, windy conditions.
- Stockpiles of materials to be monitored and options to prevent dust considered. E.g., cover, let crust over, dampen if active or vegetate if inactive.
- Minimise drop heights for stockpiles.
- Regulate maximum speed limit onsite.
- Cover loads of fine materials.

8.2 Noise Control

Engine starting and the use of machinery will be restricted to 7:30am to 6pm Monday to Friday and 8:30 to 4:30pm on Saturdays.

The proposed limits on noise generated from construction activity measured at any adjacent residence will not exceed the following limits.

Time period	**Weekdays** (dBA)		**Saturdays** (dBA)		**Sundays and public holidays** (dBA)	
	L_{eq}	L_{max}	L_{eq}	L_{max}	L_{eq}	L_{max}
0630-0730	60	75	45	75	45	75
0730-1800	75	90	75	90	55	85
1800-2000	70	85	45	75	45	75
2000-0630	45	75	45	75	45	75

8.3 Vibration Control

The following mitigation measures are planned in relation to vibration inducing plant being operated in proximity to buildings:

- Residents will be advised prior to construction activities being undertaken in close proximity to their buildings.
- The lightest practicable model of vibration inducing plant shall be used within 30m of dwellings.
- Compaction shall be performed using the lightest practical compaction equipment operating with the highest practicable vibration frequency to achieve specified compaction.
- Excavator operators shall avoid banging buckets on the ground and workers will be advised how to minimise vibration.

The residents' perceived potential concerns of vibration effects should be minimized by prior communication and the restricted hours of work.

9. Earthworks

Prior to establishing erosion and sediment controls, a pre-construction meeting onsite will be held.

Preliminary works that will be in place for earthworks to commence include Site entrances, Silt Fences. Set up temporary controls for minor works - including clean water drains, bunds, silt fences and SSF.

- Install site entrances and undertake 'cut and cover' operation for stabilised access road - controls include clean water drains and culverts.
- Install silt fences when ground is expected to be disturbed by clearing.
- Exposed or open earthworks will be kept below volume **8,000 m²** during the construction phase. The period of (dates TBC) (2 months) will be the time of major earthworks (including grubbing, levelling, and drainage). The stormwater drain will be filled with drainage material in sections around the site consequently with the earthworks keeping the open areas to minimum.

The table below summarizes the type of earthworks to be completed and at what stage.

Earthworks	Timeline	Area	Open Period	Sequence
Fencing	Stage 1 (2 weeks)	2,000m²	1-2 weeks	1
Internal Roads	Stage 1 (2 months)	6000 m²	Permanently	3
Car Parking Levelling	Stage 1 (2 weeks)	300 m²	Permanently	4
Laydown Area Levelling	Stage 1 (1 month)	9500 m²	2-3 days	5
Stormwater Drain	Stage 1 (2 months)	TBC m²	Permanently	6
Site Grubbing Levelling	Stage 2 (3 months)	75,492 m² in total, split 22 Lots	3-4 days per lot	2
Foundations	Stage 3 (4 months)	Building 200 m² Inverters 260 m² Tanks 40 m²	1-2 weeks	7
Cable Trenching	Stage 3 (3 months)	Total Approx. 8,500 m² (including DC and MV trenches) Other Trenches	2-4 weeks	8

The Table below splits the site grubbing and levelling further down into individual Lots. The values presented are indicative and will be finalized as part of the detailed design phase. Should it appear that any of the Lots might exceed the total 8,000m² earthworks allocation, the Lots will be further subdivided into smaller sections.

Lots	Lot Total Area	Lot % Coverage	Earthworks Area [m²]	Facility MW Capacity kW
1	9,970	30%	2,991	1,304
2	23,773	5%	1,189	3,108
3	9,538	30%	2,861	1,247
4	21,553	15%	3,233	2,818
5	29,161	15%	4,374	3,813
6	29,175	22%	6,419	3,814
7	26,795	20%	5,359	3,503
8	10,619	25%	2,655	1,388
9	26,632	15%	3,995	3,482
10	23,792	20%	4,758	3,111
11	13,910	50%	6,955	1,819
12	29,176	10%	2,918	3,815
13	19,888	30%	5,966	2,600
14	18,782	5%	939	2,456
15	17,475	5%	874	2,285
16	16,804	25%	4,201	2,197
17	24,402	15%	3,660	3,190
18	29,181	5%	1,459	3,815
19	29,795	10%	2,980	3,895
20	28,394	20%	5,679	3,712
21	13,396	5%	670	1,751
22	13,590	10%	1,359	1,577
Total	**465,801 m²**		**75,492 m²**	**60,700 kWp**

CONCEPT DESIGN

PV MODULE:	CSI CS7N-685TB-AG
PV MODULE SIZE:	2384 x 1303 x 33 (mm)
No. OF MODULE:	88,624
PV SYSTEM SIZE:	60.7MWp DC / 54.6MVA AC
ARRAY SLOPE:	25°
ORIENTATION:	NORTH
MOUNTING TYPE:	GROUND-MOUNT FIXED-TILT
PITCH / GCR%:	8m / 60%

LEGEND

	SITE BOUNDARY + POST-AND-WIRE FENCE
	LOTS OF BIFACIAL SOLAR MODULES
	2 x 29 TABLES OF BIFACIAL SOLAR MODULES
	PROPOSED GRAVEL ROADS (2.5m WIDTH)
	PROPOSED ACCESS ROADS (6m WIDTH)
	4200kW CENTRAL INVERTER + SERVICE SETBACKS
	LV CABLE TRENCHING
	MV CABLE TRENCHING
	SWITCHING STATION BUILDING (40m²)
	O&M BUILDING (100m²)
	STORAGE BUILDING (100m²)
	SECURITY FENCE
	TRANSMISSION LINES
	WEATHER STATION
	LAYDOWN AREA
	POST-AND-WIRE FENCE AROUND EPHEMERAL STREAMS
	SHELTERBELT

LOT 1 9970.23 m²
LOT 2 23773.62 m²
LOT 3 9538.00 m²
LOT 4 21553.37 m²
LOT 5 29161.84 m²
LOT 6 29175.30 m²
LOT 7 26795.56 m²
LOT 8 10619.44 m²
LOT 9 26632.67 m²
LOT 10 23792.10 m²
LOT 11 13,910.66 m²
LOT 11
LOT 12 29176.99 m²
LOT 13 19888.48 m²
LOT 13
LOT 14 18782.48 m²
LOT 15 17475.23 m²
LOT 16 16804.58 m²
LOT 17 24402.59 m²
LOT 18 29181.09 m²
LOT 19 29,795.53 m²
LOT 19
LOT 20 28,394.36 m²
LOT 20
LOT 21
LOT 21 17,396.48 m²
LOT 22 13,590.59 m²
LOT 22

SITE PARKING
SITE ACCESS

Cut	-0.100	0.100	Fill

From, m	To, m	Color
-∞	-0.300	
-0.300	-0.100	
-0.100	0.100	
0.100	0.300	
0.300	∞	

Rev	Date	Description	Drawn	Designed	Approved
0	21/09/2023	CONCEPT DESIGN	A.P	M.R	G.V

Design	M.Robinson
Drawn	A.Menon
Date	18/09/2023
Checked	G.van der Beek
CAD File	2933 – GA22

DESIGNER: vector powersmart

CLIENT: SOLAR BAY

SOLAR BAY

SOLAR BAY – ASHLEY

INLAND RTE 72, ASHLEY, CANTERBURY
PV PROPOSED LAYOUT
GENERAL ARRANGEMENT (GA)

Scale@A3	Sales Order No.
1:5000	2933

Drawing No. 2933 – GA22

Sheet	Revision
1 of 1	0