G O U L B U R N S O L A R F A R M

F U N C T I O N A L S P E C I F I C A T I O N

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PART A – OVERVIEW & SCOPE OF WORKS

1 OVERVIEW

This document contains the technical specifications for the Solar Works of the Facility.

2 DEFINITIONS

AC means alternating current.

AEMO means Australian Energy Market Operator.

BCA means Building Code of Australia published by the Australian Building Codes Board.

BESS means Battery Energy Storage System

CA means Connection Agreement

Construction and Environmental Management Plan (CEMP) means the Construction and Environmental Management Plan prepared by the Contractor and submitted to the Principal detailing all aspects of the Project's management.

Council means Goulburn Mulwaree Council

CER means the Australian Government Clean Energy Regulator

CEC means the Australian Government Clean Energy Council

Connection Agreement means the Grid Connection Agreement for connection and operation services between Essential Energy and the Principal.

DC means direct current.

Design Life means in respect of each component of the Works (Solar), the period of 30 years from the Date of Practical Completion.

HV means High Voltage (above 1000 V AC).

IEC means International Electrotechnical Commission, an international standards organisation.

ISO means International Organization for Standardization, an organisation for engineering standards.

ITPs means inspection and test plans prepared by the Contractor and submitted to the Principal prior to the relevant Works being undertaken.

LGC means Large-scale Generation Certificate.

MW_{AC} means the maximum real power allowed to be generated by the Facility and exported to the grid.

MVA means the aggregate nameplate capacity of the inverters based on an ambient temperature of 25°C.

MWp means the aggregate nameplate capacity of the modules in MWp at Standard Test Conditions.

NATA means National Association of Testing Authorities.

O&M means Operation and Maintenance

PCS means Power Conversion System, that comprises the inverter and MV transformer

PoC means Point of Connection, the point of connection (PoC) is connected to point of common coupling via a short section of Neon 19/3.75 AAAC conductor (approximately 35.5m).

PPC means Power Plant Controller

PV means photovoltaic.

SCADA means Supervisory, Control and Data Acquisition system.

SLD means Single Line Diagram

Site means the land on which the Goulburn Solar Farm is to be installed.

Standard Test Conditions or STC means 1000 W/m2, 1.5 Air Mass, 25°C cell temperature, with a reference solar spectral irradiance as defined in IEC 60904-3.

WHS means workplace health and safety.

ZS means zone substation

3 SCOPE OF WORKS

3.1 SCOPE OVERVIEW

The Works comprise the turnkey design, engineering, procurement, factory inspections and testing, delivery to Site (3 Bridge Street, Goulburn), construction, start-up, testing, energisation and commissioning of all plant and equipment (including spares) for a DC coupled system which shall include at least 1.354 MWp (DC) solar PV farm, a future 1 MW/2.3 MWh Battery Energy Storage System (BESS), the HV infrastructure, including provision of all manuals, reports, system settings, drawings and documentation.

The Solar Works as described in this Specification is part of a larger project as noted above which includes Battery Energy Storage System (BESS) which shall be integrated into the Facility at a later date. This specification is for the Solar Works only and is for works required up to the point of connection with provision made for the BESS Works to be added at a later date.

Subject to the scope exclusions, the Solar Works consists of supplying all labour, expertise, supervision, materials and equipment necessary in the design, supply, installation, and commissioning of a fixed tilt, ground mounted solar PV system designed to maximise solar PV generation within the available land area and site constraints.

The Solar Works shall:

- Have a rated DC capacity of 1.354 MWp, that maximises generation at the PoC;
- Be ground mounted with fixed tilt framing and north facing panel orientation;
- Designed to maximize annual solar PV generation within the constraints, land area and limitations of the Site;
- Meet the Design Life.

In general

- The point of common coupling (PCC) is located approximately 22 m downstream of pole CE115828 on the GOU42 Goulburn No.4 33kV distribution feeder supplied from Goulburn 132/66/33 ZS. The point of connection (PoC) is connected to point of common coupling via a short section of Neon 19/3.75 AAAC conductor (approximately 35.5m).
- Subject to the scope exclusions, the Solar Works are for the delivery of all labour, materials testing and commissioning of the system up to the PoC including the supply, installation and commissioning of the revenue and LGC meters.

This document is part of a set of documentation released for this Project. The Contractor must familiarise itself with the all the other documentation (including those listed in Table 1 below) and ensure compliance with the Development Approval granted, the Grid Connection approval granted, the Project Documents and the Civil Works Design and all other relevant codes and standards applicable to the Project.

Connection Access Standards
CAS - Goulburn SF - R02
Network Studies Approvals
Steady State
Goulburn - Steady State Study - Approval (2022 01 20)
833-003-RPT-001_B_GSF Steady-State Study
833-003-RPT-001_B_GSF Steady-State Study (EE Comments 190122)
Frequency Injection
Goulburn 2022 03 25 - Approval of Frequency Injection Study
833-003-RPT-002_A_GSF Frequency Injection Study
Protection
2022 04 20 Goulburn - Protection Study Approval
833-003-RPT-003_B_GSF Protection Study
833-003-RPT-003_B_GSF Protection Study (EE Comments 200422)
Project Documents
as per Schedule 7
Civil Works Design
as per Schedule 6
Reliance Material

Table 1: List of Documentation

The Contractor shall provide a complete turnkey solution that allows for the safe and efficient operation of the Facility by the Principal from the Date of Practical Completion.

All Solar Works shall be undertaken cognisant of future integration of the Battery Works.

3.2 KEY SYSTEM SPECIFICATIONS

System Specifications	
Solar DC Capacity	1,354 kilowatt (kW) or higher
Solar AC Capacity	1,499.00 kilowatt (kW)
Solar AC Grid Export Limitation	1,410.00 kilowatt (kW)
Installation Method	Ground-mounted w. Fixed Tilt Angle
Array Orientation	True North
AC System Connection Point	Essential Energy 33kV Feeder GOUY42

Table 2 – Key System Specifications

3.3 SCOPE OF WORKS INCLUSIONS

- End-to-end high-quality & yield optimised system design in compliance with all applicable standards, regulations, and technical specifications;
- Design and engineering of the Facility (excluding the Civil Works Design) in accordance with all relevant Australian and International Standards, regulatory codes, NSP requirements and in accordance with specific conditions in the Development Consent;
- Procurement, supply and delivery of all equipment (other than the Principal-procured Components) necessary from reputable suppliers to deliver the Solar Works, this shall include solar PV modules, solar mounting systems, AC and DC switchgear, secondary protection hardware, AC & DC cabling, cabling protection, monitoring and control system(s), and any other equipment required in order to satisfy this specification;
- All project management and suitably qualified personnel required to deliver the project;
- Construction of the Solar Works to the highest standards in accordance with all relevant Australian and International Standards, regulatory codes, NSP requirements and in accordance with specific conditions in the Development Consent;
- Dilapidation study prior to commencement of any site works;
- Provision of independent third-party structural certification and site specific foundation designs for all applicable structures.
- Provision of a safety-in-design workshop with nominated site representatives.
- Testing and commissioning of the Solar Works and sub systems to ensure correct installation and operation;
- Provide all design deliverables, including design drawings, engineering calculations, studies, reports, specifications, certifications, project programs, safety plans and all other relevant documentation for client approval prior to commencement of any site works;
- Management and finalisation of the grid connection process with the NSP from current status to permission for permanent energisation of the Facility.
- Connection of the DC array to the PCS. Connection of the PCS to the NSP network. Management of any modification works of the NSP connection point to facilitate the connection. The Solar Works include the Contestable Works but do not include Non-Contestable Works as identified by the DNSP.
- System energisation, testing & commissioning, including any third-party inspections & tests as required
- Provision of on-site training to Principal or the Principal's nominated Personnel.
- Provision of a comprehensive operations & maintenance manual

This specification and associated information is meant as a guide only and does not limit the works which may be required, it is the Contractor’s responsibility to assess the extent of works required under the existing International and Australian Standards, Codes and Regulations as well as the specific requirements of the DA Consent and Grid Connection Approval.

3.4 SCOPE OF WORKS EXCLUSIONS

The following items are excluded from the contractors Scope of Works

- The procurement and delivery to Site of the PCS unit (inverter & transformer skid) is excluded from the Solar Works.
- Civil Works completed by others will precede the installation of the Solar Farm. The Contractor shall integrate its design work and project delivery with all external constraints provided by the works of third parties on site.
- Site perimeter security fence

3.5 SYSTEM AND PRODUCT WARRANTIES

Item	Period
Installation warranty	5 years from Practical Completion on defects in workmanship (separately documented)
Performance guarantee	5 years from Practical Completion
Design Life	30 years from Practical Completion

Table 3: System Warranties

Item	Period
Solar panels	Minimum 10 years product warranty 30 years performance warranty
Batteries (required for solar farm)	2 years
Framing	10 years
DC Cabling and Isolators	5 years
AC Cabling	10 years
BOS Components	2 years minimum

Table 4: Product Warranties

4 PROJECT MANAGEMENT

4.1 PROJECT TEAM

The Contractor shall nominate a dedicated project team for the management and delivery of the Solar Works. The Contractor shall nominate a Project manager, being the main project representative to facilitate all communication with the Principal and its agents.

The Contractor must also liaise with the other contractors and suppliers engaged by the Principal to deliver the other works packages and the Principal-procured Components and ensure that the final products, design and installation are compatible with the systems being delivered by these contractors and suppliers.

4.2 MEETING ATTENDANCE

The Contractor shall allow for weekly meetings during the planning and design phase of the Facility. Participation of the Contractor's key project representatives in all meetings is mandatory. Additional members of the Contractor's project team shall be available to attend meetings as required or requested by the Principal.

PART B – SYSTEM DESIGN

5 DESIGN LIFE

5.1 DESIGN LIFE SPECIFICATION

The design life of the Facility inclusive of all system components within the scope of the Solar Works shall be 30 years. A shorter design life of specific components shall be subject to prior approval by the Principal.

5.2 COMPONENT SELECTION

Component selection and installation methods associated with all parts of the Solar Works shall consider the design life requirements and shall be adjusted accordingly. The Facility is expected to operate consistently and with minimal downtime or need for ongoing active maintenance and repair work for the entirety of the design life period.

6 DESIGN PARAMETERS

Within the scope of the Solar Works, it is the Contractor's responsibility to ensure the following minimum requirements are met when carrying out the design work:

- The Facility design shall be compliant with all applicable standards, regulations as well as NSP, Council requirements and other Authorities having jurisdiction.
- All components selected for the Facility design shall be high-quality products from reputable brands with local representation in Australia.
- The Contractor shall provide a yield-optimised system design that achieves the maximum possible energy output across the year within the Site and geographical location constraints.
- The Facility layout shall allow for easy and efficient access to all parts of the array with sufficient space to carry out inspection, maintenance, and repair work across the design life of the Facility.
- The design of the Facility shall integrate with the Civil Works Design and modifications to be completed by others, noting that some of the Civil Works will only be finalised once the Solar Works have been started.
- The Facility shall be built to withstand a 1-in-100-year flood event without damage to or failure of any system components, including any temporary or long-term reduction in generation.
- The Facility shall be designed and built to allow future integration of the BESS Works.

7 APPLICABLE STANDARDS

7.1 STANDARDS

The Solar Works shall be delivered end-to-end in full compliance with all applicable standards, regulations, and documents, including, but not limited to:

System Specifications	
AS/NZS 5033	Installation of photovoltaic arrays
AS/NZS 3000	Wiring rules
AS/NZS 3008	Selection of cabling
AS/NZS 1768	Lightning protection
AS/NZS 1170.0	Structural design actions
AS/NZS 1170.2	Structural design actions – wind actions
AS 1170.4	Earthquake actions in Australia
AS/NZS 2053	Conduits and fittings for electrical installation
AS/NZS 3017	Electrical installations – testing guidelines
AS 2067	Substations & high voltage Installations exceeding 1kV A.C.
AS/NZS 60076.1	Power transformers General
AS 1429	Electric cables - polymeric insulated - part 1: for working voltages 1.9/3.3 (3.6) kV up to and including 19/33 (36) kV
AS/NZS 3439.1	Low voltage switchgear and control gear
AS/NZS 61439	Low-voltage switchgear and control gear assemblies
AS 60529	Degrees of protection provided by enclosures (IP code)
AS 1379	Specification & supply of concrete
AS 3600	Concrete structures
AS/NZS 2312	Guide to the protection of structural steel against atmospheric corrosion using protective coatings
AS/NZS 2053	Conduits and fittings for electrical installations – general requirements
AS/NZS 3012	Electrical installations – construction and demolition sites
AS/NZS 4680	Hot dip galvanized (zinc) coatings on fabricated ferrous articles
New South Wales	Service and Installation Rules of New South Wales
Essential Energy	Embedded Generator Connection Agreement
Essential Energy	Goulburn Solar Farm Option to Proceed rev. 3
CEC	Grid Connected Solar Systems Design Guidelines for Accredited Installers
CEC	Grid Connected Solar Systems Install and Supervise Guidelines for Accredited Installers

*The latest mandatory version of each standard applies. Where standards are in a transition period, the latest published version shall be followed. All parts of the listed standards apply.

Table 5 – Applicable Standards and Regulations

8 SYSTEM COMPONENT SELECTION

8.1 SOLAR MODULES

The solar module brand shall be Trina Solar. Alternative tier 1 module brands may be proposed by the Contractor but require the prior written approval of the Principal.

The cell technology shall be monocrystalline with a positive power tolerance (only).

Solar modules shall be bi-facial and have a minimum nameplate power capacity of no less than 500 Watt $_{PEAK}$ (W_P).

The selected solar module shall have structural and performance characteristics suitable for the intended installation location and mounting method.

The selected module shall have a V_{OC} temperature coefficient of less than 0.27%.

The solar module output degradation shall not exceed 1% in the first year of operation with a linear output reduction of no more than 0.5% for each following year. Modules are required to have a retained power output capacity of no less than 80% of their nameplate rating after 30 years of operation.

The selected module type shall have all applicable approvals and certifications and be fit for purpose for the installation within at the Site.

The Contractor shall use a manufacturer-approved module fastening methods for the connection of the modules to the mounting system.

8.2 PCS STATION - INVERTER AND TRANSFORMER

A central inverter and voltage transformer product has been selected for this project. The inverter to be installed at the site will be a Fimer PVS980-CS 2.0MVA.

The Principal will free-issue the inverter and transformer as a skid solution to the Contractor. The Contractor shall be responsible for lifting the inverter & transformer skid into position and installing it on Site.

The Principal has provided the Contractor with a copy of the Fimer Supply Agreement. The Contractor shall gain full knowledge of the product solution as supplied and design the Facility to ensure compliant integration of the transformer & skid solution, specifically without voiding any product warranties.

The Contractor is required to undergo installation and commissioning training provided by the supplier to allow correct installation and commissioning of the transformer & skid solution. It is the Contractor's responsibility to ensure that all relevant Personnel have received the required training.

8.3 MOUNTING SYSTEM

The solar mounting system brand shall be Trina. Alternative tier 1 racking system brands may be proposed by the Contractor but require the prior written approval of the Principal.

The mounting system shall be suitable for the Site location and allow for safe installation on Site in compliance with all structural requirements. Undulating or sloping ground conditions shall be taken into consideration when selecting the mounting system and suitability for the respective Site conditions shall be ensured.

The Contractor shall select a suitable high-quality mounting system product that provides durability and corrosion resistance at the installation location in accordance with the design life requirements of the Facility.

8.4 CONCRETE SLABS & STRUCTURAL SUPPORT SYSTEMS

Any concrete slabs, plinths, bases, footings, and support structures shall be designed and constructed to adequately support any equipment for the duration of the design life of the Facility.

When sizing concrete slabs, the Contractor shall consider ease of access for inspection, maintenance, and repair activities to all mounted equipment.

The Contractor shall familiarise itself with any product-specific concrete foundation requirements stipulated by the equipment suppliers as well as the Principal's civil Contractor, and to provide foundations in accordance with these requirements at all times.

Concrete slabs shall be installed with an additional height of 200 – 300mm above the typical reference level in accordance with civil design.

Any metal structural support systems required for the support of ancillary system components shall be hot-dip galvanised steel, fit for purpose and high-quality products from a reputable manufacturer with local representation and warehouse facilities within Australia.

Pre-approved support system brands are:

- Ezystrut
- Flexistrut
- Unistrut

Other support system brands may be proposed by the Contractor but require the prior written approval of the Principal.

8.5 SWITCHBOARDS & METERING BOARDS & ENCLOSURES

Where applicable, the Contractor shall provide and install a suitably rated NATA approved switchboards and enclosures for use within the Facility.

Any new enclosure shall have an ingress protection of no less than IP56 and be rated for outdoor deployment. The housing material shall be fiberglass, aluminium, or stainless steel.

All certification and test reports in accordance with AS/NZS 61439 shall be provided to the Principal prior to installation of associated equipment at the Site.

8.6 CABLE SELECTION

All cabling installed at the Facility shall be selected in accordance with the applicable standards, specifically AS/NZS 3000, AS/NZS 3008, AS/NZS 5033 and AS 1429.

All cabling shall be high-quality products from a reputable manufacturer with local representation in Australia.

8.7 METEOROLOGICAL STATION

The Contractor shall design, supply and commission one complete meteorological station. The station shall be in accordance with Class A monitoring system as defined in IEC 61724-1, as a minimum, include the following equipment.

- Plane-of-Array and Horizontal Irradiance Pyranometers;
- Ambient Temperature Sensors at the average array height;

- Back of Module Temperature sensors;
- Barometric Pressure sensors;
- Anemometer (height 2m);
- Rain Gauge;
- Datalogger

The meteorological sensors shall be located at a suitable location on the Site in such a way to minimize shading or obstructed wind flow. Pyranometers shall be installed in a manner so that they are not shaded at any time (recognising that the pyranometers may need to be installed away from the remainder of the meteorological sensors). This data shall be used in the calculation of Performance Guarantees. The Meteorological station shall be integrated with the SCADA system and shall have capability to log data for the Design Life.

8.8 OTHER COMPONENTS

Any additional components of the facility such as switchgear and disconnectors, relays & modems, sub-meters, and cable support systems shall be of high quality, suitable for the installation at the site and selected in accordance with the design life requirements of the facility.

9 DESIGN DOCUMENTATION

9.1 CONCEPT DESIGN SUBMISSION

As part of the Contract, the Contractor will have submitted a concept system design document set which shall form the basis of the Contractor project design documentation. As a minimum, the following documents are required:

- Array Layout Drawing – showing the proposed location of the solar modules, the PCS, and other relevant components.
- High-level Single Line Diagrams (SLDs) for AC and DC, showing the key system components, their wiring arrangements, and all major new infrastructure components such as the inverter, MV transformer, protection devices and the system connection point.
- A detailed PV Syst simulation report, including a 3D shading model and realistic loss assumptions. The report shall provide the expected annual output for the first year of operation as well as the expected performance ratio of the system as P50, P90 and P99 values.
- A draft bill of materials showing brand and model of all relevant equipment selected for installation at the facility.

The system information provided in this submission shall be clear and consistent with the final product to be supplied and installed by the Contractor.

9.2 PROJECT DESIGN DOCUMENTATION

9.2.1 General Drawing & Submission Format

The Contractor shall provide a comprehensive design drawing set, reflecting in detail all aspects of the Solar Works. The following conditions and inclusions are mandatory and represent minimum requirements:

- Drawing submissions shall be concise, clear and shall contain a drawing transmittal, listing all individual included drawings and their revision status.
- Correct version control of subsequent drawing revisions shall be maintained at all times. Any changes in subsequent revisions shall be clouded for visibility.
- A progressive system design documentation delivery shall be ensured. Submission packs shall be arranged by discipline (E.g., Architectural Electrical Civil etc.). Submission of individual drawings shall be avoided where possible.
- All system drawings shall be CAD based and provided in .pdf and .dwg format. The associated native file formats (e.g., .xlsx, .docx etc.) shall be provided with each submission.
- All drawings shall indicate the sheet size (preferable A3).
- All drawing content (excluding electrical wiring and tables) shall be depicted to scale with individual scaling references.
- Dimensions shall be provided on the drawings for all relevant aspects of the installation such as exclusion zones, location of solar sub-arrays, access paths etc.
- Depicted wiring shall include individual wire IDs for all DC, AC, earth, and communications cabling. Wire IDs are to be reflected on cable tags during the installation.

9.2.2 Module Layout

The system design shall include a detailed module layout plan, showing all solar modules, their location and arrangement.

A lay-down area for all components delivered to Site shall be included.

Section and elevation views shall be included in separate drawings showing array tables, footing types embedment depths, how modules will be installed to the array tables, array tilt angles and other relevant details.

Any array layout-related requirements stipulated in the site-specific structural certificate shall be reflected with accurate dimensions. Appropriate references to any associated third-party information (such as a structural certificate) shall be provided.

The As-built drawing set shall include a module layout plan showing the location of each module with associated module serial number.

9.2.3 String Layout

The system design shall include a detailed string arrangement plan showing the location and extent of all strings of modules with their ID. Where strings run across 2 array tables, it shall be clearly visualised on this plan.

9.2.4 Array Set-out

The system design shall include a detailed array set-out plan including geo-referenced locations of all array table posts, as well as at least one coordinate for all other major system components. The coordinate system shall be MGA 2020 for all applicable drawings.

Any existing underground services relevant for the installation of the Facility shall be verified and reflected on the drawings. Where the spacing between array table posts is not uniform across the array, dimensions shall be provided to show individual distances. The drawing shall further reference the applicable structural certificate and reflect the key

constraints (e.g.: maximum post spacing / minimum embedment depth etc.) included in the certification.

9.2.5 Trench and Conduit Layout

The system design shall include detailed trenching and conduit plans, showing the correct location and size of all trenches, pits, and conduits.

The drawings shall further include section views of all trench types, visualising the conduit sizes and arrangements within a trench.

Additional Detail / section views are required for all pit types to be installed. Section & Detail views shall be provided as a separate drawing.

9.2.6 Cable Reticulation

A cable reticulation plan shall be included in the design documentation, showing how DC string, array and earth cabling will run from sub-arrays to the inverter connection points. This plan shall include information of the size and type of all cable support infrastructure, such as underground conduit or above ground cable tray.

9.2.7 Earthing

A system earthing plan shall be included in the drawing submission, showing details of the complete earthing system arrangement, from the solar array to the PoC.

Where a new earth grid is installed, the details of this installation shall be shown on the plans, or a separate plan referenced correctly. Earth conductor sizes and bonding methodology shall be shown as detail views and via detailed descriptions.

Where specific earthing requirements are stipulated in a separate lightning risk assessment or other studies, those studies shall be referenced, and key requirements reflected on the plans.

The earthing system must clearly and demonstrably ensure the safety of all personnel and equipment under all normal and abnormal operating conditions and all fault conditions that could be reasonably expected. The earthing system must minimise risk of electric shock to personnel or livestock by ensuring that all calculated transferred potentials, step voltages and touch voltages are within allowable limits set out in applicable standards, including analysis of transferred potential to a location external to the Facility whereby electric shock hazard may be introduced.

9.2.8 Site Information

A site information plan in accordance with AS/NZS 5033:2021 is required, including all mandatory details stipulated in the standard. The Contractor shall select a suitable method of identifying the locations of all DC string disconnection points on this plan.

9.2.9 PCS Layout

A detailed PCS layout plan is required, showing the proposed location of the inverter station as well as top-view, elevation view, side/section views and details of the proposed inverter support infrastructure. Appropriate dimensions shall be applied to all views.

9.2.10 Single Line Diagrams

The Contractor shall provide a detailed DC, LV and MV single line diagrams containing all relevant electrical information of the system. This includes module string arrangements, cable sizes, auxiliary power supplies, connection to the NSP HV electrical infrastructure and all other details to comprehensively depict the proposed electrical system configuration.

9.2.11 Protection Wiring Schematics

Separate schematic plans for DC, LV and MV protection shall be included showing in detail the wiring configurations of all the protection devices to be used at the facility and shall be in accordance with the protection studies to be undertaken for this Project.

9.2.12 Cable Schedule

A cable schedule shall be provided, showing the ID, size, origin, and termination point, run lengths and material details for all DC, AC, earth, and communications cables.

9.2.13 System Calculations

Comprehensive system calculations are required. These shall be provided within the design drawing set and as separate documents as part of the design documentation.

The system calculations shall include as a minimum:

- DC string and array cable voltage drop calculations for all strings
- Cable sizing report including site-specific parameters such as soil resistivity and cable installation method including trench sizes and details
- AC Line losses
- Primary & secondary grid protection parameters and set points in accordance with NSP requirements
- Power Quality Setpoints
- String Voltage and Current calculations, clearly showing how compliance with string sizing requirements has been achieved. This includes reference to the lowest applicable site temperature and resulting maximum array voltage.
- All calculations in accordance with AS/NZS 1768 (where required)
- Any other calculations required to comply with applicable standards and regulations

9.2.14 Drawing Issue

Drawings shall be issued initially as “Detailed Design” for review and Principal comment. Following the safety in design workshop and final review of the system design, the complete drawing set shall be issued as “For Construction”.

Following construction and as precondition to Practical Completion, the Contractor shall issue a complete and accurate “As Built” drawing set, accurately reflecting all installed system details. Where the Contractor suspects interfaces with aspects of the Facility’s design or installation that fall outside of the Solar Works could occur, the Contractor shall promptly notify the Principal and liaise with relevant third parties to ensure seamless integration with the Solar Works.

9.2.15 Component Shop Drawings

Any component assemblies being provided by a third party shall be accompanied with a detailed set of workshop drawings. All third-party drawings shall be referenced as applicable in the Contractor's drawing set.

10 SYSTEM INSPECTION, TESTING & COMMISSIONING PLAN

As part of the design submission, the Contractor shall provide a comprehensive and exhaustive inspection, testing and commissioning plan specific to the project. This plan requires approval by the Principal.

The plan shall capture all aspects of the Solar Works, including (but not limited to):

- Programming of the inverter to the set points as required by the DNSP
- Visual inspection of all parts of the installation work including footings, racking, module installation, cabling & cable terminations, civil works, site layout, component selection and labelling.
- All physical tests of installation components (e.g., array pile pull-out tests).
- All required tests and measurements of all parts of the installation in accordance with the applicable standards (specifically AS/NZS 5033, 3000, 3017 & 2067).
- All tests, measurements and data logs required by the DNSP.
- Factory acceptance test reports for all third-party components.
- All commissioning activities including correct system start-up, operation and shut down, data upload to the online portal, correct configuration of system alarms.
- System installation completion, training, and handover.

A comprehensive list of all equipment required for individual tests and checks shall be included in the plan. Calibration certificates and dates for each test device/equipment shall be included.

The plan shall be completed before commencement of any works on Site. Where parts of the works are no longer accessible at the completion of the installation, the plan shall allow progressive completion of sections as applicable.

All tests shall include a description of how the tests are being conducted, including a list of required personnel and test specific equipment.

For each test, a section with expected values and proposed tolerances shall be included to allow verification of correct system operation.

DC cable tests in accordance with AS/NZS 5033 shall be carried out for each string cable and array cabling separately.

The Principal or its representative may choose to attend some or all inspection, testing and commissioning activities; and the structure of the plan shall allow for this.

The completed test plan shall further include a comprehensive list of photos capturing all aspects of the Solar Works. This includes all parts of the Solar Works that may not be accessible at the completion of the installation.

11 PROTECTION STUDIES AND DESIGN

11.1 LV PROTECTION DESIGN GENERAL

Coordination of protection devices requires consideration of both discrimination and cascading protection. Discrimination between protective devices depends on coordination between the operating characteristics of two or more protective devices such that a downstream device with a time/current curve below that of upstream protective device(s) shall operate for a given fault current while the other protective device(s) shall not operate.

Protection studies and system studies shall cover all equipment and systems including but not limited to modules, combiner boxes, and cabling, all auxiliary systems, DC systems, UPS systems, building services, etc.

11.2 MV PROTECTION DESIGN GENERAL

The Facility shall be provided with a protection system which allows faults to be cleared without damage to equipment or threat of injury and to enable the prompt identification and isolation of faults such that the remaining Facility can be safely restored.

Equipment shall be selected such that it is suitable to withstand the expected fault currents for at least the backup protection clearing time, without resulting in additional permanent damage to the equipment.

The Contractor shall conduct short circuit studies and load flow studies to ensure the correct rating of electrical infrastructure work of the Facility.

The Contractor shall provide protection study(s) outlining the control and protection philosophy and the protection settings required for the Power Plant. This study shall ensure that the protection of the equipment operates reliably and interfaces with the NSP protection equipment, in accordance with the requirements of the NER, the NSP, AS 2067 and AS/NZS 3000. This may include the use of procedures to ensure safe working as required.

Suitable protection discrimination shall be applied such that a fault on one piece of equipment does not result in a loss of connection to another device.

Any protection design and installation work shall be in accordance with the document “833-003-RPT-003_B_GSF Protection Study” and associated correspondence with Essential Energy as made available to the Contractor by the Principal.

11.3 LIGHTNING RISK ASSESSMENT

The Contractor shall carry out a lighting risk assessment via a suitably qualified independent third party in accordance with AS/NZS 1768.

As per section 13.3, the Contractor shall allow for installation of suitably sized DC surge protection devices at the array. Any additional recommendations resulting from the lightning risk assessment shall be implemented by the Contractor.

11.4 EARTHING STUDY

An earthing study shall be conducted in accordance with AS 2067. The required earthing system design shall be determined by using suitable modelling software for the whole of the Project, considering the expected step voltage, touch voltage and transfer voltage. The resulting design shall be reflected on the earthing plan.

11.5 INSULATION COORDINATION STUDY

An insulation co-ordination study shall be performed in accordance with AS 1824 taking into account the proposed configuration of the electrical system and likely transients from lightning and switching. Overvoltage protection (e.g. surge arrestors) shall be installed to mitigate against the risk of damage from overvoltage throughout the entire Facility where required.

11.6 NAMING AND LABELLING

All major components including cables, combiner boxes, inverters, transformers and switchgears shall be duly labelled, and colour coded in accordance with the Naming Convention Report that shall be submitted with the design deliverables. All labels must be clear, easily visible, constructed and affixed to last and remain legible for the Design Life and shall, at least, report the following:

- Name of manufacturer;
- Product name and serial number;
- Key technical parameters;
- Manufacturing date and place; and,
- Protection index (where applicable).

PV array row numbering, major equipment components, PV array sections and all electric cables and circuits within the Facility shall be labelled to identify their location or function, as applicable; this shall include at least the following;

- DC String numbering
- DC combiner box numbering
- DC/AC conversion blocks numbering
- Major components including all inverters, transformers, switchgears
- Array Tables
- All electrical circuits
- All required electrical safety labels and signage in line with legislation and best industry practice to identify live equipment

Labelling and numbering systems must be aligned with the 'as-built' documentation.

12 STRUCTURAL CERTIFICATION

12.1 CERTIFICATION GENERAL

All structural certificates shall be provided by a suitably qualified and licensed independent structural engineer. Structural certification information shall be integrated into the design drawing set as appropriate. As a minimum, the applicable structural certificate ID and revision shall be referenced on relevant drawings. Structural certification shall be submitted to the Principal for review.

12.2 STRUCTURAL SOLAR INSTALLATION CERTIFICATION

The Contractor shall provide a structural certificate confirming the suitability of the proposed solar module mounting solution. The certificate shall assess all applicable metrics such as wind actions and ground movements. The solar array shall be designed to importance level 2 and all applicable parameters adjusted accordingly.

As a minimum the certificate shall specify the post embedment method, embedment depth and pile spacing for all array tables across the solar array. Where concrete footings will be installed, the minimum footing diameter and any additional requirements such as concrete reinforcements shall be reflected on the certificate.

12.3 CUSTOM STRUCTURES AND INVERTER STATION CERTIFICATION

Any structure erected to support parts of the system other than the solar array requires separate structural assessment and certification.

This includes any support or roofing structures installed by the Contractor for protection of the central inverter skid and other ancillary equipment.

13 ARRAY CONFIGURATION

13.1 INTEGRATION WITH SITE CIVIL WORKS

The Contractor shall assume that the Civil Works will be built by others (within customary tolerances) according to the Civil Works Design. It is the Contractor's responsibility to gain a comprehensive understanding of the Civil works and to design the Facility based on the provided Civil Works Design, accounting for all applicable constraints and limitations therein.

13.2 ARRAY TABLE LAYOUT

The layout of the array tables shall be optimised within the available array area. Array tables shall be sized such that a minimum clearance distance of 2 metres any point of the array fence is maintained. Where absolutely necessary, this distance may be reduced to 1 metre. The distance between panel rows, from ground-level panel edge to panel edge, shall be no less than 3m. Any deviations require written approval by the Principal.

The array table layout shall further be designed for highest system efficiency. This includes minimising the number of module strings that run between array tables.

The array table layout shall further align with any constraints arising from the Civil Works Design and the Civil Works.

13.3 DC STRING COMBINATION

The Contractor shall propose as part of its system design submission a suitable method to aggregate the DC power output of the individual strings of modules. By default, combination of strings shall be facilitated by suitably sized DC junction / combiner boxes mounted to, or in close proximity to the array tables. Alternative methods of string combination may be deployed by the Contractor.

The following minimum requirements shall be met:

- The solar array output capacity shall be evenly distributed (to the maximum extent practical) across 6 central inverter DC connection terminals.
- Suitably rated DC surge diverters shall be provided at each point of string combination as a minimum
- Combined strings shall be physically located in close proximity to each other to ensure similar cabling lengths from each string to the combination point.

Where individual DC junction boxes will be installed, the supply of

- Fimer SBxx15 DC or
- Weidmueller or
- IPD

Junction boxes is mandated. Other suitable products from different suppliers may be proposed by the Contractor but require the Principal's prior written approval and shall be selected in accordance with the design life requirements of the Facility.

13.4 SPARE DC CABLING

The Contractor shall provide spare DC cabling as part of the solar array design. As a minimum, no less than 10% spare cabling capacity shall be allowed for between the inverter terminals and the furthest array table. The Contractor shall clearly identify spare cable quantities and locations in their design submission and install in the conduits.

13.5 ARRAY SHADING

Solar modules shall be installed such that they can operate free of shading from adjacent rows of modules or nearby obstructions such as fences, gates, and other equipment.

Unless otherwise approved by the Principal, all modules shall be free of shade between 8 am and 4 pm on 21 December (summer solstice) and between 9am and 3pm on the 21 June (winter solstice). The row spacing and module tilt angle shall be adjusted within the overall space constraints of the Site for the maximum solar energy yield across the year. It is the Contractor's responsibility to assess all existing shading obstructions correctly and to adjust the solar module layout accordingly.

14 INVERTER AND SWITCHBOARD SHADING

Excessive heat gains of the inverter and any other related equipment shall be prevented to avoid production losses and to minimise equipment degradation. The Contractor shall

propose a suitable method to keep heat gains within acceptable levels in accordance with manufacturer's recommendations and warranty requirements. As a minimum and in addition to any manufacturers' requirements, the Contractor shall install a metal roofing structure over the inverter & transformer skid and any switchboards that are installed.

The Contractor shall comply with any specific instructions or requirements stipulated in the manufacturer's product documentation.

15 ARRAY ACCESS

The Contractor shall allow for suitable access provisions in their array layout design. Access requirements shall be determined by the Contractor based on the types of activities expected to be carried out over the design life of the Facility. Such activities may include (but are not limited to) inspection and maintenance, ground maintenance, system repair, module replacement and module cleaning. Access clearances shall allow for the safe execution of all activities without the risk of damage to the Facility or personal injury and shall allow for vehicular access where required.

16 ARRAY FENCE AND GATES

The Site perimeter security fence is outside the scope of the Solar Works.

The Contractor shall determine whether a separate security fence is required around the inverter & transformer skid or any other part of the Facility within the perimeter fence and shall allow for the supply and installation of such fence where required in accordance with applicable standards.

17 PCS STATION – INVERTER AND TRANSFORMER

The Contractor shall install and commission the free issued PCS station in accordance with the manufacturer's recommendations. The PCS station shall be slab-mounted. The slab shall be constructed in accordance with applicable standards, integrate with the Civil Works Design and manufacturer's specifications (refer section 7.2). The PCS station design shall allow for easy access to all parts of the skid that require regular inspection or maintenance.

The Contractor shall lift the free-issued inverter & transformer skid into position and complete all installation and commissioning activities. The Contractor shall ensure all relevant personnel have completed the mandatory training provided by the manufacturer, Fimer prior to conducting any PCS Station installation or commissioning works.

The PCS station design shall further allow for the future integration of the BESS Works. The Contractor shall allow for all applicable provisions in their design. This includes (but is not limited to) installation of additional spare conduits and provision of sufficient spare space for future cabling and cable connection activities.

Commissioning activities of the Contractor shall include the programming and testing of the inverter to the set points as required by the DNSP.

18 SYSTEM PERFORMANCE

18.1 DESIGN EFFICIENCY

The Contractor shall demonstrate to the Principal that the proposed solar system design has been optimised for maximum system energy output across the year. Within the Site

constraints, the design optimisation process shall include (but is not limited to) the following steps:

- Adjustment of the module pitch and row spacing to achieve the maximum net solar exposure of the modules across the year.
- Adjustment of the number of modules within a string to achieve the highest possible power conversion efficiency at the central inverter.
- Strings shall be distributed evenly across all available inverter input terminals.
- Adjustment of the module string layout across the array for shortest cabling distances to minimise losses.
- Adjustment of cable selection to minimise cable losses
- Protection of equipment from direct UV exposure to avoid heat related performance reduction and reduce material degradation.

The Contractor shall arrange strings of modules such that the operational DC voltage remains within the inverter's maximum power point tracker (MPPT) window during the majority of the daylight hours across the year.

18.2 DC VOLTAGE DROP

DC cabling running between sub-arrays and solar inverter shall be optimised for the shortest run lengths. The total maximum power point voltage drop (V_{MPP}) on any string from the last solar module to the inverter connection terminals shall be no more than 2%. A limitation of voltage drop values to below 1% is highly preferable.

The assessment shall be based on the maximum power point current (I_{MPP}). The Contractor shall provide a voltage drop calculation for each string of the array.

18.3 PERFORMANCE PROJECTION REPORT

The Contractor shall generate a detailed system performance model using the PVsyst assessment software. The purpose of the report is to provide the Principal with an accurate projection of the system's energy output in the first year of operation.

The following items are minimum requirements for the assessment model:

- The Contractor shall use the assessment software to assist the system design optimisation process as detailed in clause 17.1. The Contractor shall adjust applicable parameters (e.g., module pitch, row spacing, cable sizes) and generate several reports in an iterative process to demonstrate to the Principal that the optimal system design has been achieved.
- The model shall be accurately referenced to the Site's geographical location and environmental conditions.
- All loss factors used in the model shall be reviewed and adjusted for the location and shall be realistic.
- A 3-dimensional model of the solar array and all applicable shading obstructions such as nearby trees shall be created within PVsyst. All applicable components shall be reflected accurately with their correct size, height and orientation.
- P50, P90 and P99 calculations shall be included in the PVsyst reports.

The final PVsyst report shall be submitted to the Principal together with a summary of the results of all iterative models and their applicable parameters. Iterative reports shall be available on request.

19 MONITORING, METERING AND COMMUNICATION

19.1 COMMUNICATIONS

The Contractor shall provide communication infrastructure suitable to support the control, monitoring and ancillary functions of the Facility for the Design Life. The Contractor shall provide robust, redundant communications links. Communications may be hardwired or wireless, microwave, 4G, etc. at the Contractor's discretion to best suit Site restrictions and in accordance with any NSP requirements (if any).

19.2 SCADA SYSTEM

The Contractor shall design, procure, instal and commission the communications and monitoring system required to facilitate on-Site and remote off-Site operations and maintenance of the Facility, including conducting performance analysis, diagnosis and detecting and supporting warranty claims.

The SCADA system will:

- control and provide communications between the different hardware on-Site;
- enable remote communications to the Site;
- enable communications between the site and the NSP (if required);
- provide data logging of site parameters locally and then to off-Site servers;
- provide a graphical interface of near real time and historical site parameters for authorised SCADA users;
- be able to accept an external file (eg CSV or ZIP) via email with an ON/OFF dispatch signal and control the Facility output accordingly (This functionality is to enable the electricity offtaker to control the plant output to avoid negative electricity market price exposure.)
- Display typical solar farm values such as:
    - Active power
    - Reactive power
    - Voltage
    - Current
    - Daily / monthly /annually aggregated generation values
    - Meteorological data (as per meteorological station)

The SCADA system data shall be on a server which can be accessed remotely by authorised users.

The Contractor shall provide and install a stand-alone wireless modem to allow ongoing upload of system telemetry data to an online monitoring platform.

The Contractor shall arrange a SIM card and its connection on site, in the name of the Principal. The Principal will carry the cost of the data package.

The Contractor shall make all physical data connections and undertake any product registrations as required. The Contractor shall set up all parameters and system information correctly on the portal.

The Contractor shall integrate the meteorological station in the monitoring system and ensure its parameters can be accessed remotely.

An agreed number of user licenses shall be provided to the Principal, and it shall be possible to restrict user-access so as to protect the integrity of the Facility and prevent unwanted, unwarranted and/or unsafe Facility configuration changes.

SCADA and inverter control systems shall be capable of providing all requirements of the NSP and the National Electricity Rules, including as described variously in the Connection Agreements.

The Contractor shall propose and set up a suitable set of system alarms in the portal to notify the Principal of system faults. By default, these shall include:

- Earth Faults
- System Underperformance
- Excessive System Temperatures
- System Outages
- Major System Errors

Additional alarms shall be discussed with the Principal and set up where requested. Alarms shall be limited by relevance – frequent notifications due to temporary faults not affecting the system performance (e.g., temporary loss of communication) shall be avoided.

19.3 REVENUE & LGC METERING

The Contractor is to coordinate the revenue and LGC metering equipment installation as provided by the Principal's nominated metering provider. Enabling equipment for the provision of metering services, such as current voltage transformers, are to be sourced, installed and commissioned by the Contactor.

Where required, the Contractor is responsible to coordinate with the DNSP, the metering coordinator / metering provider selected by the Principal or any other third party for the timely installation of any equipment required to complete the revenue metering installations, including but not limited to current and voltage transformers, the meters themselves and any communication infrastructure.

The current and voltage transformers used must be of the appropriate metering class for revenue and LGC purposes, be compliant with the metering coordinator's / metering provider's and DNSP's requirements and have design life equal to or greater than the Design Life.

The Contractor shall provide detailed wiring diagrams of the metering installation, NATA traceable current and voltage transformer test reports, serial numbers, single line diagrams and all other documentation required for the metering to comply with the National Electricity Rules and any other specific requirements of the DNSP.

19.4 POINT OF CONNECTION POWER QUALITY METERING

The Contractor shall supply and install a suitable power quality meter that as a minimum is able to measure all parameters as listed in the Power Quality Requirements section of the CAS document by Essential Energy, paying particular attention that the communication signal delays are kept to a minimum.

20 LGC CREDITS

The Contractor shall be responsible for the accreditation of the Facility with the Clean Energy Regulator as a power station eligible to create Large-Scale Generation Certificates (LGCs). The accreditation process shall be carried out in a timely manner to ensure LGCs can be generated from the time of system energisation. The Contractor shall demonstrate to the Principal which steps will be taken to ensure this requirement can be fulfilled.

As a minimum, the Contractor shall:

- Supply and install all components required to monitor the energy generation of the Facility to allow generation of LGCs.
- Register the Principal with the Clean Energy Regulator as the owner of the power station
- Accredit the Facility as a power station on behalf of the Principal
- Provide training & handover to enable the Principal to generate LGCs on an ongoing basis.

21 SAFETY IN DESIGN WORKSHOP

The Contractor shall be responsible for conducting a Safety in Design workshop with the Principal prior to proceeding to construction of the Facility.

The workshop shall serve as a risk management process to identify and eliminate (or minimise) the risk to health and safety of installers, owners, neighbours, the general public and site operation personnel throughout the life of the Facility.

22 SPARE PARTS

The Contractor shall allow for the provision and facilitation of provide spare parts on site for the construction phase (for its own use) and operational phase (O&M parts to be handed over to the Principal). A full list of spare parts shall be provided as part of the design documentation.

A full list of available inverter & transformer skid spare parts provided by Fimer is included in the Fimer Supply Agreement and associated documentation.

23 STORAGE SHED

The Contractor shall supply and install a separate storage shed at the Site to house O&M spare parts, the Fimer spare parts and other equipment. The Contractor shall propose a design for a storage shed that is suitable to provide adequate storage conditions for the Facility's main O&M spare parts as well as reasonable space for ground maintenance equipment and other equipment required under the Works Contract.

24 FIREFIGHTING TANK

The Contractor shall source and install at a suitable location on site a 20,000 litre water tank used for firefighting purposes. The tank shall be of high quality, designed to last for the lifetime of the Facility and be equipped with attachment nozzles that are commonly used in New South Wales.

PART C – SYSTEM CONNECTION APPROVAL

25 NSP APPROVAL

The Contractor shall complete the connection and approval process, which includes conduct of all works (including ASP1 works), tests and provision of all documentation required by Essential Energy. This specifically includes any requirements by the NSP as listed in the Option to Proceed, such as easement acquisitions / right of access and the Review of Environmental Factors (REF).

26 OTHER APPROVALS

The Contractor shall obtain all other approvals or certifications required to be permitted to install and operate the Facility. This includes but is not limited to building and construction approvals, Council approvals, environmental approvals and building certificates (including occupancy certificate).

PART D – SYSTEM INSTALLATION

27 OPERATING HOURS

Time of installation activities at the site shall align with the development approval requirements, local regulations and the applicable laws.

High-voltage connection activities shall be coordinated in advance with Essential Energy as a priority. Long lead times for this activity shall be expected. to the Contractor shall organise and coordinate all HV works in a timely manner to avoid delays in the completion and energisation of the Facility.

28 SITE CONDUCT

Professional conduct is expected from all of the Contactor's Personnel at all times. Confronting or offensive behaviour, foul language, swearing and loud music is not acceptable at any time.

Site attendance under the influence of drugs or alcohol is strictly forbidden. Smoking is only permitted in designated locations.

The Contractor's Personnel shall be dressed in appropriate protective and high-visibility clothing, suitable for the activity they are carrying out.

Within the scope as the 'principal Contractor' on site, the Contractor shall be responsible for induction of all personnel and visitors to the Site and enforcement of site rules at all times.

29 DELIVERIES AND ON-SITE STORAGE

The Contractor may assume that the perimeter security fence will be in place prior to the commencement of the Solar Works.

The Contractor shall ensure that all delivered equipment and components are handled and stored appropriately to avoid any damage or degradation.

30 SITE CLEANLINESS AND RUBBISH REMOVAL

The Contractor shall keep the Site clean and tidy throughout the installation process. Rubbish shall be removed daily and may not remain on Site after the Contractor's Personnel leave the Site for the day. This includes all packaging, foils, and cardboard material.

Where packaging of system components remains on Site (e.g. opened pallets of modules, rails & inverters), the Contractor shall ensure that packaging is secured appropriately.

31 AREA OF WORKS

Unless otherwise specified by the Principal, the area of works shall be the Site. The Contractor shall further refer to the Civil Works Design for exact location of all works area boundaries.

32 SYSTEM INSTALLATION & CONNECTION SPECIFICATIONS

32.1 TRENCHING

All cables to be installed in accordance with AS3000 and AS2067 and be marked. All buried cables (including earthing cables and HV cables) will be protected as a category B system from mechanical damage and marked as per AS3000. Cable route markers are to be used to identify the HV cable routes.

All trenches shall be installed in accordance with all details provided in the design drawing set. Locations of any existing underground trenches shall be identified prior to commencement of any works. Where trenches cross existing underground services, non-destructive digging (NDD) equipment shall be used for excavation in these locations.

Excavated spoil may be used to backfill trenches if suitable and where it does not pose any risk to damage conduits or cabling. Suitability shall be confirmed prior to commencement of the installation phase and approved by the Principal. Where the excavated spoil is not suitable for backfill, it shall be removed from Site and disposed of by the Contractor.

The bottom of each trench shall be as smooth as possible and any change in gradient or level shall be made as gradually as possible. Trenches shall be free of stones and other sharp objects and the edges of the trench shall be cleared of any stones, tools or objects which may fall into the trench and damage the cable.

The Contractor shall be responsible for adequate management of all trenching and related activities, including protection of trenches from collapse, cave-in or flooding, Segregation of services as required, backfill and compaction of material and installation of marker tape.

The minimum embedment depths of all new services in accordance with AS3000 shall be complied with at all times. Where this is not possible, compliant mitigation strategies shall be deployed (e.g.: mechanical protection etc.).

Trenching near array tables shall be conducted such that the structural integrity of the array table footings is not compromised.

32.2 PITS

Cable pits shall be installed as a minimum every 100 metres and at every change in direction of the trench. The Contractor shall install all underground cabling appropriately without abrasion and damage to the cabling.

Pits shall be made from concrete. Pits and pit lids shall be rated Class D trafficable. Pits shall not be installed within access paths and shall have self-draining abilities to avoid pooling of water.

32.3 RACKING & SUPPORT SYSTEM INSTALLATION

The mounting system shall be installed in accordance with the approved system design drawings and structural certificate requirements.

The Contractor shall predrill all holes and backfill with stabilised sand, always in accordance with the structural certification and in consideration of the design life of the structure.

By default, the array post installation method shall be pre-drilling of holes, backfill with stabilised sand and profile driving. A suitable design verification test against lateral and vertical movements for at least 2% of all array posts to 150% of the required uplift capacity shall be conducted. Results shall be verified against the requirements of the structural certification and logged on the testing & commissioning report.

Where concrete footings of any type are being installed, conduits running along or in close proximity to array post shall be coordinated appropriately. Where conduits run through a concrete footing, it is the Contractor's responsibility to ensure that the structural rating of the concrete footing is not diminished and that there will be no long-term damage to the conduits.

The array frame shall be assembled in accordance with all manufacturer's specifications. Dissimilar metals shall be separated using suitable and permanent EPDM type rubber pads or equivalent.

Strain on any part of the array frame outside of allowed tolerances (e.g., to accommodate undulating ground conditions etc.) shall be avoided at all times.

The array frame tilt angle shall be consistent across all array tables in accordance with the system design drawings.

Any damage to galvanisation is to be repaired with zinc paint by the Contractor.

32.4 CONDUIT INSTALLATION

All underground conduits shall be rigid HD type.

The size of individual conduits shall be determined based on the number and size of cables running within, in accordance with AS 3000:2018 Appendix C6 specifications. This includes any spare cabling.

All conduits shall be sealed upon completion of the installation work to prevent ingress of pests and vermin.

Any exit points of underground conduit and cabling above ground shall be permanently protected from direct UV radiation.

Bends and turns in conduits shall be minimised and require the installation of sweeping bends to avoid damage to cabling during cable pull activities. All major changes of direction require the installation of cable pits. Maximum cable bending radiuses shall be in accordance with manufacturers' specifications at all times.

The Contractor shall design and install all underground conduits and cabling such that there is no damage to the cabling and cable sheaths.

32.5 MODULE INSTALLATION

All modules shall be installed in accordance with manufacturers' specifications. Clamping zones shall be selected to achieve the highest structural ratings of the modules. The Contractor shall adjust the position of the array table purlins accordingly.

The spacing between 2 adjacent rows of modules on a given array table shall be consistent with the spacing between modules within a row (determined by the width of the mid clamp).

All modules shall be handled with care throughout the installation and commissioning process to avoid any damage to the solar cells. The Contractor shall use a suitable installation method and equipment (e.g., Elevated Work Platforms) to ensure modules are being handled appropriately at all times.

32.6 CABLE INSTALLATION

All above-ground DC & Earth cabling at the array shall run in suitably sized cable tray, metal cable duct or flexible metal conduit. The use of grey PVC conduit is not permitted. Direct UV exposure of cables is to be strictly limited to sections of no more than 20mm in lengths (predominately in locations where cabling passes between adjacent modules).

All cabling running from module junction boxes to adjacent modules or into cable tray or conduit shall be installed neat, tidy, and firmly fixed to the module frame or mounting structure. At no location across the solar array shall cabling be lose or sagging. Strain on cabling or module junction boxes shall be avoided. Cabling shall be fixed using stainless steel cable ties. Cable clips may be used as secondary fasteners in accordance with AS 5033.

Bend radiuses of all cables in accordance with the manufacturers' specifications shall be complied with at all times. Sharp edges of cable tray or conduits shall be smoothed or filed back to avoid damage to cabling.

All cable pull activities shall be conducted in a suitable and careful manner to avoid any damage to cabling. Lubricant shall be used as required and great care shall be taken to avoid any dirt, debris, or abrasive materials to be pull into the conduits together with the cables.

32.7 CABLE TRAY INSTALLATION

All cabling above ground shall run in hot dip galvanised cable tray or duct wherever possible. The use of conduit shall be minimised and is only permitted for short distances. Cable tray or duct shall run behind array tables for the entire lengths of the structure and shall be firmly fixed to the mounting frame in regular intervals. Any metal cut sections susceptible to corrosion shall be treated with a suitable means of corrosion protection such as gal spray or paint. All sharp edges of metal cut sections shall be filed back.

32.8 DC STRING DISCONNECTION POINTS

A string disconnection point shall be provided for each string of modules. String disconnection points shall be clearly labelled and accessible in accordance with AS 5033 requirements. All string disconnection point locations shall be reflected on the PV site information plan.

32.9 DC EARTHING

DC earth cabling shall be installed as required by the earthing and lightning protection studies. Earth cabling shall be bonded to the array tables in suitable locations. Earthing continuity shall be confirmed for each array table. Where required, additional earth leads shall be installed along the array tables to achieve continuity.

Fence posts shall be linked via underground earth cables to the nearest array table post. Earthing continuity along the full perimeter of the fence shall be established and quantity of earthing links selected accordingly.

32.10 PCS STATION INSTALLATION

The Contractor shall install and commission the PCS station and all equipment therein from the point of skid delivery on Site. The Contractor shall prepare all slabs and foundations for the inverter station skid in accordance with the specific manufacturer's specifications and applicable standards. The Contractor shall lift the inverter station skid into position using appropriately rated equipment. Additional fencing or restricted access provisions shall be provided and installed by the Contractor as required by the applicable standards and regulations.

The Contractor shall allow for integration of the BESS Works. The Contractor shall further install a metal canopy roof above the inverter to protect all equipment from direct UV radiation. The roof shall be removable for possible crane access to the PCS at any stage.

32.11 DC CABLE INVERTER CONNECTION

All DC cabling shall be connected to and terminated at the inverter terminals in accordance with the manufacturer's specifications.

32.12 HV CONNECTION WORKS

GCSF have appointed Electrical Design Services (EDS) as the ASP3 for this project. All HV works shall be designed and delivered by the Contractor strictly in accordance with all Essential Energy requirements and the EDS design. The responsibility for management of the ASP3 will be handed over to the Contractor at the time of the works contract execution.

PART E – SYSTEM COMMISSIONING

32.13 SYSTEM COMMISSIONING

The Contractor shall perform all activities associated with the testing & commissioning of the complete Facility. This includes management and coordination of all required third party inspections, tests and other installation related activities in order to gain final connection and energisation approval for the Facility.

The Contractor shall complete the testing & commissioning plan including all applicable system acceptance tests and checks and provide such information to the Principal for review and approval as stipulated in the Contract.

The commissioning of the Facility shall include setup and testing of all applicable system communications (e.g. inverter portal data upload, meter data portal upload etc.).

The Facility will only reach the state of being fully commissioned once all of the following items have been completed:

- The inspection, testing & commissioning plan has been completed.
- All required reports and associated paperwork have been submitted to and approved by the DNSP
- The DNSP has provided their permission to permanently energise the system
- All Defects have been closed out

- All monitoring has been set up and is reporting correctly
- The correct operation of all parts of the system has been verified.
- The accreditation of the Facility as a power station with the CER for generation of LGCs has been approved.
- All metering has been installed and commissioned, enabling the Facility to generate revenue.
- All paperwork related to the installation has been completed and accepted by the Principal or its agents.
- All installation related equipment has been de-commissioned and removed from site
- The Contractor has issued the O&M manual for the installation. The O&M manual has been accepted by the Principal.

PART F – OPERATION & MAINTENANCE MANUAL

33 O&M MANUAL GENERAL

The Contractor shall provide a comprehensive O&M Manual as a precondition to achieving Practical Completion. The manual shall be provided in pdf. and docx. or xlsx. file format. An additional 4 hardcopies of the manual shall be issued to the Principal.

34 O&M MANUAL CONTENT

The O&M Manual shall be specific to the Site and the Facility. Any generic content describing a typical shut-down procedure or maintenance schedules are not acceptable.

The Contractor shall include comprehensive high-resolution picture material of all relevant parts of the installation.

As a minimum, the following items shall be included in the main body of the document:

- A site summary listing all relevant details of the Site and the Facility and the installation including system details, commissioning / energisation date, end dates of warranties, site NMI, special conditions of operation (e.g. dynamic export control) etc.
- A general overview of what has been installed and where main components are located

- A detailed shut down & re-energisation procedure of the complete system. Individual steps shall be accompanied by site specific pictures of applicable components, switches, isolators etc.
- A table showing the projected monthly and annual energy yield for the design life period. As a minimum, a high-level summary shall be provided in the main body of the document and the detailed table moved to the appendix if preferred
- A section detailing how earth fault alarms requirements in accordance with AS/NZS5033 have been complied with for this installation and steps / procedures to be executed in case of an earth fault.
- A table of scheduled maintenance (and ongoing testing) tasks, as well as typical unscheduled maintenance tasks, including instructions.
- Requirements for HV switching procedures.
- Where tasks require special qualifications, this shall be highlighted in the O&M Manual.

As a minimum, the following items shall be included in the appendix of the document:

- A component list showing all main components of the system and associated quantities.
- Serial numbers of all serialised components, including modules, inverter, relays, switchboards and enclosures, meters, modems etc.
- All structural certificates, tests reports, studies
- All testing & commissioning paperwork including certificate of electrical safety and connection approval documentation from the DNSP
- All HV documentation required by Essential Energy
- System performance report in PVsyst and monthly performance projections for the design life period of the system
- As-Built system drawings and associated documentation, calculations etc.
- System Warranty documentation and relevant contact details for all applicable components
- System component data sheets

SCHEDULE 4 SPECIFICATION (BESS)

1. OFFSITE WORKS (BESS)

The Offsite Works (BESS) include the following works:

No.	Item	Detail
1.	Design	All works and services under paragraph 9 (Design Documentation) of the Specification (Solar) applying *mutatis mutandis* to the BESS.
2.	Procurement of battery energy storage system	Trina Elementa-Energy Liquid-cooled Battery Cabinet
3.	Procurement of DC-DC converters	2 x DynaPower DPS 500

2. BESS WORKS

The Battery Energy Storage System (the **"BESS"**) for the Facility encompasses the battery cells, housing, cabling, DC converters, controls and protection.

The BESS shall be selected to meet the following performance requirements and system characteristics:

(a) The BESS shall have a nominal storage capacity of at least 2.2MWh.

(b) The BESS shall be capable of at least 1MW of DC charge and discharge power up to 35ºC ambient temperature.

(c) The battery system will be connected to the DC bus of the inverter, via the provided inverter inputs.

(d) The BESS output to each inverter DC terminal shall be limited if required to prevent fuse damage in normal operation, or fuses shall be upgraded by the contractor to allow for normal operation.

(e) The connection to the inverter DC terminals will use 4 connection slots (2 positive terminals, 2 negative terminals). If Fimer advice permits it, connection points can be increased to improve BESS output, provided PV output is not thereby limited.

(f) The battery system will be provided with DC converters fitted, or retrofitted, such that the battery discharge voltage can be rapidly adjusted to suit the skid DC bus voltage.

(g) The discharge voltage of the DC converter will be set by a controller programmed by the Contractor.

(h) The control program shall be configured such that the DC power converters ramp to supply the power requested by the dispatch commands provided.

(i) The battery system shall be mounted and weather protected in accordance with the manufacturer's recommendations. The mounting and weather protection shall accommodate the design life of the equipment.

(j) The BESS shall be installed under a shelter so as to protect it from direct sun and rain exposure. This shelter must allow for adequate airflow for the BESS to meet manufacturer requirements. The shelter should be designed with the IP rating of the BESS considered.

(k) The foundations installed by the contactor shall meet the manufacturer's installation requirements of the BESS, AS3000 requirements, and be approved by a recognised engineer for their structural suitability.

(l) The BESS should have no temperature derating of output below 50 degrees Celsius ambient temperature.

(m) The provided control system shall be capable of ramping to full capacity charge/discharge according to the Essential Energy Connection Agreement.

(n) The provided BESS shall include a fire suppression system compliant to AS4487 or appropriate equivalent IEC standard.

(o) The BESS should be configured to integrate with Diamond Energy's API, and provide Diamond Energy with status updates to inform dispatch decisions.

(p) The BESS will be capable of the following modes of charging/discharging: charge from solar, discharge battery to grid on command, charge battery from grid on command, discharge battery to supplement solar output up to 1,499kW inverter output to grid.

(q) Maximum auxiliary demand of 65 kW (grid import limited to 50 kW).

(r) Foundations and earthing.

SCHEDULE 5 INDICATIVE BILL OF MATERIALS

Category	Item	Supplier	Model/Type	Quantity
Panels	Panels	Trina	DEG19C.20 545W	2484
Racking	Piles	SMS	Galvanised steel	621
	Rails	SMS	Galvanised steel	311
	Purlins	SMS	Z/C10015AZ	1242
	Bolts	SMS	Grade 4.6	9936
	Concrete	SMS		56m3
Cables	AC		150mm2 Al	
	DC Combined		95mm2 Al	170m
	DC String		6mm2 Cu	9100m
DC Combiners	DC Combiners	Weidmüller	Custom	6
Meter	Meter	Schneider	PM8000	1
Recloser		Noja	33kV 3 phase recloser	1
Poles	Overhead power pole	Koppers	12.5m 6kN timber pole	4
Gas switch	Gas Switch	NGK Stanger	33kV Manual enclosed gas switch	1
Conduit	DC Cable Conduit	Vinidex	150mm heavy duty underground conduit	400m
Skid Shelter	Rain shelter for skid	SEDAC	Custom	1
BESS	BESS	Trina	Elementa 2.3MWh BESS	1
DC Converters	DC converters			
Weather Station	Weather Station	Meteocontrol		1
Dispatch Controller	Dispatch Controller	ComAp	ComAp Dispatch Controller	1

Note – this Indicative Bill of Materials does not include Spare Parts as required by the Specification.

SCHEDULE 6 CIVIL WORKS

The following documents, available to the Contractor on Procore, describe the Civil Works.

Discipline	Drawing No.	Drawing Title	Revision	Drawing Date	Received Date	Set Name
2	SK01	RIPARIAN ZONE LAYOUT PLAN	2	22/11/2023	24/11/2023	PRELIMINARY
Civil	C0001	SHEET & SITE LOCALITY	2	10/02/2023	7/07/2023	FOR INFORMATION
Civil	C0002	GENERAL NOTES AND ABBREVIATIONS	2	10/02/2023	7/07/2023	FOR INFORMATION
Civil	C0010	EXISTING SITE PLAN	2	10/02/2023	7/07/2023	FOR INFORMATION
Civil	C0100	PROPOSED SITE LAYOUT PLAN	2	10/02/2023	7/07/2023	FOR INFORMATION
Civil	C0200	EROSION AND SEDIMENT CONTROL PLAN	2	10/02/2023	7/07/2023	FOR INFORMATION
Civil	C0206	EROSION AND SEDIMENT CONTROL NOTES AND DETAILS	2	10/02/2023	7/07/2023	FOR INFORMATION
Civil	C0300	EARTHWORK GRADING PLAN	2	10/02/2023	7/07/2023	FOR INFORMATION
Civil	C0310	SITE SECTIONS - SHEET 1 OF 3	2	10/02/2023	7/07/2023	FOR INFORMATION
Civil	C0311	SITE SECTIONS - SHEET 2 OF 3	2	10/02/2023	7/07/2023	FOR INFORMATION
Civil	C0312	SITE SECTIONS - SHEET 3 OF 3	2	10/02/2023	7/07/2023	FOR INFORMATION
Civil	C0510	MISCELLANEOUS DETAILS	2	10/02/2023	7/07/2023	FOR INFORMATION
Civil	C0600	ROAD LONGITUDINAL SECTIONS	2	10/02/2023	7/07/2023	FOR INFORMATION
Civil	C0700	ROAD CROSS SECTIONS - SHEET 1 OF 2	2	10/02/2023	7/07/2023	FOR INFORMATION
Civil	C0701	ROAD CROSS SECTIONS - SHEET 2 OF 2	2	10/02/2023	7/07/2023	FOR INFORMATION
Civil	C1100	TURNING PATHS OF 19.0m SEMI TRAILER	2	10/02/2023	7/07/2023	FOR INFORMATION
Civil	C1200	STORMWATER BIO BASIN DETAIL LAYOUT PLAN	2	10/02/2023	7/07/2023	FOR INFORMATION
Civil	SD-R 12	Rural access off a public road	0	1/12/2012		FOR INFORMATION

SCHEDULE 7 PROJECT DOCUMENTS

1. PROJECT AGREEMENTS

1.1 Land Documentation

(a) Lease dated 1 April 2022 between Denrith Pty Ltd and Goulburn Community Solar Pty Ltd.

(b) Head Lease dated 1 April 2022. between AG & JM Divall Pty Limited and MJ Divall Pty Limited, and Denrith Pty Ltd.

(c) Sublease Deed dated 1 April 2022 between AG & JM Divall Pty Limited and MJ Divall Pty Limited, Denrith Pty Ltd and Goulburn Community Solar Pty Ltd.

(d) Memorandum of Sub-Lease Agreement dated 23 July 2021 between the Australian Rail Track Corporation Limited and Denrith Pty Ltd.

(e) Deed of Lease dated 4 June 2004 between the State Rail Authority of New South Wales and the Rail Infrastructure Corporation, and Australian Rail Track Corporation Ltd.

(f) Letter dated 26 May 2021 from Transport for NSW to Community Energy 4 Goulburn that there are no objections from ARTC / TfNSW to the solar farm being constructed over an easement.

(g) Letter dated 31 May 2021 from ARTC to Denrith Pty Ltd and Goulburn Community Solar Pty Ltd that ARTC has no objections to the solar farm being constructed over an easement.

(h) Encroachment Consent dated 27 June 2023 granted by Essential Energy to Goulburn Community Solar Pty Ltd, based on Clearance Report dated 1 September 2022 prepared by Electrical Design Solutions Pty Ltd for Goulburn Community Solar Pty Ltd.

1.2 Connection Documentation

(a) 'Steady State Study':

(i) prepared by QGE Pty Ltd on 14 January 2022 with Reference Number 833-003-RPT-001; and

(ii) approved by Essential Energy by email received from Joe Munro, Major Network Connections Customer Process Lead for Essential Energy on 20 January 2022.

(b) 'Frequency Injection Study':

(i) prepared by QGE Pty Ltd on 7 March 2022 with Reference Number 833-003-RPT-002; and

(ii) approved by Essential Energy by email received from Joe Munro, Major Network Connections Customer Process Lead for Essential Energy on 25 March 2022.

(c) 'Protection Study':

(i) prepared by QGE Pty Ltd on 28 March 2022 with Reference Number 833-003-RPT-003; and

(ii) approved by Essential Energy by email received from Joe Munro, Major Network Connections Customer Process Lead for Essential Energy on 20 April 2022.

Note: The Protection Study is currently under revision by the Principal.

(d) 'Embedded Generator Connection Agreement' dated 19 August 2022 between Essential Energy and Goulburn Community Solar Pty Ltd:

(i) as interpreted by the letter entitled 'Goulburn Solar Farm – 2954892 Embedded Generation Connection Agreement' dated 16 August 2022 issued by Essential Energy to Goulburn Community Solar Pty Ltd

(the **"Connection Agreement"**).

(e) 'Connection Access Standards – Revision 02' dated 8 August 2022 issued by Essential Energy (the **"Connection Access Standards"**).

(f) 'Goulburn Solar Farm Essential Energy Option to Proceed rev. 3' dated 18 August 2022 between Essential Energy and Goulburn Community Solar Pty Ltd (the **"Connection Option to Proceed"**).

(g) ASP1 Design, being the following drawings available on Procore:

Discipline	Drawing No.	Drawing Title	Revision	Drawing Date	Received Date	Set Name
Electrical	ECN050684	SHEET 1 OF 2	B	21/11/2023	5/12/2023	FOR INFORMATION
Electrical	ECN050684-	SHEET 2 OF 2	B	21/11/2023	5/12/2023	FOR INFORMATION

1.3 **Supply Documentation**

(a) Supply Agreement dated 18 August 2022 between Goulburn Community Solar Pty Ltd and Marici Australia Pty Ltd T/A FIMER Australia in relation to the PVS980-CS inverter and transformer skid for the Goulburn Dispatchable Solar Farm.

1.4 **Civil Works Documentation**

Note: Civil Works Documentation to be advised by the Principal.

1.5 **Funding Documentation**

(a) RCEF Funding Agreement dated 17 February 2020 between The Crown in Right of the State of New South Wales, acting through the Department of Planning, Industry and Environment and Community Energy for Goulburn Incorporated.

1.6 **Other Documentation**

Any such other document as may be directed by the Principal from time to time.

2. PROJECT APPROVALS

2.1 **Principal Approvals**

(a) Development Approval dated 14 June 2017 No. DA/0023/1617 by Goulburn Mulwaree Council.

(b) Notice of Determination of the Modification Application dated 21 September 2022 No. MODDA/0137/2122 to DA/0023/1617 by Goulburn Mulwaree Council.

(c) Notice of Determination of a Modification Application dated 13 July 2023 No. MODDA/0083/2223 to MODDA/0137/223 to DA/0023/1617 by Goulburn Mulwaree Council.

2.2 Contractor Approvals

The Contractor Approvals include (except where stipulated as a Principal Approval):

(a) Any approval and subsidiary document required:

(i) by Goulburn Mulwaree Council; or

(ii) specifically set out in the Planning Documentation referenced in paragraph 2.1 ("Principal Approvals"),

including the construction certificate and the occupancy certificate.

(b) Any approval and subsidiary document required:

(i) by Essential Energy; or

(ii) specifically set out in the Connection Documentation referenced in paragraph 1.4 ("Connection Documentation"),

including any documentation required to allow energisation, testing, commissioning and operation of the Facility.

(c) The certificate of compliance for electrical works (CCEW).

SCHEDULE 8 INSURANCES

1. PRINCIPAL INSURANCES

Not used

2. CONTRACTOR INSURANCES

(a) The Contractor must obtain and maintain the following insurances until the date the Certificate of Final Completion is issued:

(i) Contract Works insurance in relation to the Works in an amount not less than the Contract Price, covering:

(A) all permanent and Temporary Works at the Site forming (or to form part of) the Facility;

(B) all equipment and components incorporated or to be incorporated in the permanent Works at the Site forming (or to form part of) the Facility at the Site (including the Principal-procured Components); and

(C) all Components at the Site (but excluding Construction Equipment, temporary buildings, Site huts and offices used for construction purposes, but not intended for incorporation in the permanent work),

and insuring against the risks of physical loss and/or damage from whatever cause (including resultant loss or damage arising from or as a consequence of faulty materials, workmanship or design) and subject to standard exclusions and sub-limits as contained within the policy.

(ii) Public Liability insurance for the amount of AUD 20 million to cover third party liabilities for physical loss or damage to property and personal injury or death to persons (not being a person who is defined as a worker of the applicable insured under any statute relating to worker's compensation) arising from or in connection with the performance of the Works.

(iii) Transit insurance to cover all risks of physical loss or damage to goods or merchandise or cargo of every description and all interests in connection with the Works whilst in transit from manufacturers' premises anywhere in the world up to the Site in an amount not less than the replacement value of the property insured for any one shipment;

(iv) Constructional plant and equipment insurance for full reinstatement value.

(v) Workers' Compensation insurance as required by law.

(vi) Motor vehicle third party property damage liability insurance having a limit of indemnity of not less than AUD 20 million for any one claim and covering all motor vehicles including motor vehicles being used as a tool of trade. If the Principal does not operate any motor vehicles, it must procure that those Subcontractors that operate any motor vehicles hold such insurance.

(vii) Motor vehicle third party bodily injury liability insurance as required by law.

(viii) Professional Indemnity Insurance having a limit of indemnity of not less than AUD 5 million for any one claim and AUD 5 million in the aggregate for all claims in any one 12 month period of insurance.

(ix) Any additional insurance cover required by law.

(b) Each policy of insurance must be taken out with insurers having a financial strength rating of not lower than Standard and Poors 'A-' or equivalent with other recognised rating agencies.

(c) The Contract Works, Transit and Public Liability insurances must name the Principal and any lender as an insured party and must include cross-liability, waiver of subrogation and non-vitiation provisions.

SCHEDULE 9 COMPONENT WARRANTIES

1. CONTRACTOR-PROCURED COMPONENTS

(a) The Component Warranties for the Contractor-procured Components must apply in respect of defects in design, material and workmanship and be for the warranty periods listed in the table below:

Contractor-procured Components	Manufacturer	Warranty (Years)
Panels	Trina	12 years for defects in design, material and workmanship 30 years for power output: -2% first year degradation, -0.45% degradation annually thereafter
Mounting	SMS	10 years for defects in design, material and workmanship of structural elements 5 years for defects in design, material and workmanship in fixing components
Cables	Various	1 year for defects in design, material and workmanship
DC Combiners	Weidmüller	5 years for defects in design, material and workmanship
Meter	Schneider	5 years for defects in design, material and workmanship
Recloser	Noja	1 year for defects in design, material and workmanship
Gas Switch	NGK Stanger	1 year for defects in design, material and workmanship

(b) The Component Warranties for the Contractor-procured Components must be on no less than industry-standard terms.

2. PRINCIPAL-PROCURED COMPONENTS

(a) The Component Warranties for the Principal-procured Components are:

(i) the warranty "PVS980 product series (Equipment)" in the form set out in Schedule 9 ("Form of Component Warranties"); and

(ii) the warranty "PVS980-CS product series (Equipment)".

(b) The Component Warranties for the Principal-procured Components are appended to this Schedule 9 ("Component Warranties").