APPENDIX A

2022AS RFP Technical Specifications and Required Submittals

Appendix A includes certain technical submittals which are required bid submittals and bidder must include in the bid package as separate attachments:

Appendix A	Supply-side Resource Required Submittals	Applicable to:
Appendix A-2	*Interconnection Studies and Agreements (all bids)*	*All bids*
Appendix A-3	*Permit-Matrix (all bids)*	*All bids*
Appendix A-5	*Project One-Line Drawing and Layout (all bids)*	*All bids*
Appendix A-6	*Division of Responsibility (BTA bids only)*	*BTA bids*
Appendix A-8	*Real Estate Specifications (BTA bids only)*	*BTA bids*
Appendix A-9	*Product Data- Equipment Supply Matrix (all bids)*	*All bids*
Appendix A-10	*Plant Performance Guarantee/Warranties for (BTAs bids only)*	*BTA bids*

In addition to the required submittals, Appendix A includes required technical specifications for BTA bids. BTA bidders must comply with the following specifications or provide an exceptions list:

Appendix A	Supply-side Resource – BTA Technical Specifications	Applicable to:
Appendix A-1.2	*Wind Work Specifications*	*Wind bids*
Appendix A-1.3	*Wind Work Specifications – Observation Tower*	*Wind bids*
Appendix A-1.4	*Solar Work Specifications*	*Solar bids*
Appendix A-1.5	*HV Work Specifications*	*All BTA bids*
Appendix A-1.6	*Battery Energy Storage System Technical Specifications*	*BTA bids with Energy Storage*
Appendix A-4.1	*Contract Safety Plan Requirements*	*All BTA bids*
Appendix A-4.2	*Contractor Health Safety and Environmental Requirements*	*All BTA bids*
Appendix A-7	*General Owner Standards and Specifications:*	*All BTA bids*

A full list of Appendix A technical specifications for wind, solar and energy storage resources is included in Appendix A-1.1 - Technical Specifications Matrix. PacifiCorp will provide any additional Technical Specifications for BTA bids for other resource types upon receipt of Appendix B-1 Notice of Intent to Bid.

APPENDIX A-1.1

Technical Specifications Matrix

[INCLUDED AS SEPARATE ATTACHMENTS]

The following specifications are provided as separate attachments. BTA Bidders must comply with these technical specifications or else provide a documented list of exceptions.

A-1.2	Wind Work Specifications
A-1.3	Wind Work Specifications – Observation Tower
A-1.4	Solar Work Specifications
A-1.5	HV Work Specifications
A-1.6	Battery Energy Storage System Technical Specifications

A-4.1	Contract Safety Plan Requirements
A-4.2	Contractor Health Safety and Environmental Requirements

A-7	**General Owner Standards and Specifications:**
A-7.01	Attachment 1A Project Document Formatting and Requirements
A-7.02	Attachment 1B Project Document Deliverables
A-7.03	Computer Aided Design (PacifiCorp Energy) General AutoCAD/Drafting Standards (Specification DCAP876)
A-7.04.1	Substation Equipment—Power Transformer
A-7.04.2	Substation Equipment—Collector Substation Main Power
A-7.04.3	Two-Winding Dist Transformer Specification
A-7.05	Material Specification ZS 061, Electrical Equipment—Insulating Oil.
A-7.06	Material Specification ZS 065, Wind, Ice, and Seismic Withstand
A-7.07	Material Specification ZS 066, Contaminated-Environment Protection
A-7.08	Procedure SP-TRF-INST, Transformer Receiving, Installation and Testing
A-7.09	Danger Sign
A-7.10.1	PacifiCorp Engineering Handbook, Part 6B.5 Fence Application and Construction
A-7.10.2	Chain Link Fencing and Gates
A-7.10.3	Cantilever Side Gate
A-7.11	PacifiCorp Engineering Handbook, Part 6B.6 Substation Grounding
A-7.12	PacifiCorp Protective Relaying Standard, Document Number: GEN-ENG-RELAY-0001

A-7.13	PacifiCorp Protective Relaying Standard, Arc Flash Hazard Standard, Document: GEN-ENG-RELAY-0002
A-7.14	PacifiCorp Protective Relaying Standard, "Relay Current Transformer (CT) and Potential Transformer (PT) Insulation Integrity Test," Document: GEN-ENG-RELAY-003
A-7.15	PacifiCorp Protective Relaying Standard, "Thermal Plant Protective Relay Maintenance and Testing-PRC-005," Document: GEN-ENG-RELAY-1003
A-7.16	PacifiCorp Protective Relaying Standard, "Relay Testing & Commissioning Checklist"
A-7.17	PacifiCorp Protective Relaying Standard, "Relay Installation Procedure," Document: GPCP-EQPMNT-INST
A-7.18	PacifiCorp Protective Relaying Standard, "Current Transformer Installation Procedure (Relay)," Document: GPCP-CT-INST
A-7.19	PacifiCorp Protective Relaying Standard, "Current Transformer Installation Form (Relay)," Document: GPCP-CT-INST
A-7.20	SG001 Substation High Voltage Signs
A-7.21	Specification for Substation Equipment Installation Testing Commissioning
A-7.22.1	SV001 Bird and Animal Protection-General Installation Instructions
A-7.22.2	SV002 Bird and Animal Protection for Miscellaneous Equipment
A-7.22.3	Bird and Animal Protection—General Installation Instructions
A-7.23	Volume 8 Consultant Drafting Procedures and Standards

APPENDIX A-2

Interconnection Studies or Agreement

Bidders shall provide an unredacted version of the interconnection study and interconnection agreement for the proposed resource and label the attachment as Appendix A-2 to their RFP bid response.

APPENDIX A-3

Permitting Matrix

[INCLUDED AS A SEPARATE EXCEL ATTACHMENT]

Bidders shall complete the Permitting Matrix and label it Appendix A-3 in their bid response.

APPENDIX A-4

Contractor Safety Plan and Contractor Health Safety and Environmental Requirements

[INCLUDED AS SEPARATE ATTACHMENTS]

The following Appendices are provided as separate attachments and are requirements for all BTA bids. All bidders, regardless of transaction structure,[1] are encouraged to abide by and have similar safety standards and requirements.

Appendix A-4.1 (BTA)	Contract Safety Plan Requirements	Separate Attachment	Informational	Word
Appendix A-4.2 (BTA)	Contractor Health Safety and Environmental Requirements	Separate Attachment	Informational	Word

[1] PPA and tolling agreement bidders and Demand-side bidders offering Professional Services Agreement contracts

APPENDIX A-5

Project Single-Line Drawing and Layouts

Bidders shall provide a single line drawing and layout shown on a United States Geological Survey (USGS) 7.5-minute series map for the proposed resource and label the attachments as Appendix A-5 to their RFP bid response.

APPENDIX A-6

Division of Responsibility

[INCLUDED AS A SEPARATE ELECTRONIC SPREADSHEET (EXCEL FILE)]

BTA Bidders shall complete the attached spreadsheet and submit as Appendix A-6 to their RFP bid response.

APPENDIX A-7

General Technical Specifications

[INCLUDED AS SEPARATE ATTACHMENTS]

All BTA bidders are required to comply with the following General Technical Specifications

Appendix A-7 (BTA)	General Technical Specifications
Appendix A-7.01 (BTA)	Project Document Formatting and Requirements
Appendix A-7.02 (BTA)	Document Deliverables
Appendix A-7.03 (BTA)	General AutoCAD Drafting Standards (Spec DCAP876)
Appendix A-7.04.1 (BTA)	EBU PX-S01-S01A Substation Equipment—Power Transformer
Appendix A-7.04.2 (BTA)	EBU PX-S02 Substation Equipment—Collector Substation Main Power
Appendix A-7.04.3 (BTA)	ZS-102 Two-Winding Dist Transformer Specification
Appendix A-7.05 (BTA)	EBU SI-S04 Electrical Equipment-Insulating Oil.
Appendix A-7.06 (BTA)	EBU SI-S02 Wind, Ice, and Seismic Withstand
Appendix A-7.07 (BTA)	EBU SI-S03 Contaminated-Environment Protection
Appendix A-7.08 (BTA)	Procedure SP-TRF-INST Transformer Installation
Appendix A-7.09 (BTA)	TD051 Danger Sign
Appendix A-7.10.1 (BTA)	Engineering Handbook Part 6B 5 Fence Application and Construction
Appendix A-7.10.2 (BTA)	Section 02810 Chain Link Fencing and Gates
Appendix A-7.10.3 (BTA)	Section 02815 Cantilever Slide Gate
Appendix A-7.11 (BTA)	Engineering Handbook Park 6B 6 Substation Grounding
Appendix A-7.12 (BTA)	GEN-ENG-RELAY-0001 Protective Relaying Requirements for New Plants
Appendix A-7.13 (BTA)	GEN-ENG-RELAY-0002-Arc Flash Requirements for New Plants
Appendix A-7.14 (BTA)	GEN-ENG-RELAY-0003 CT and PT Integrity Test
Appendix A-7.15 (BTA)	GEN-ENG-RELAY-1003 Protective Relay Maintenance and Testing PRC 005
Appendix A-7.16 (BTA)	Relay Testing and Commissioning Checklist
Appendix A-7.17 (BTA)	Relay Installation Procedure GPCP-EQPMNT-INST
Appendix A-7.18 (BTA)	Current Transformer Installation Procedure GPCP-CT-INST
Appendix A-7.19 (BTA)	Current Transformer Installation Form GPCF-CT-INST
Appendix A-7.20 (BTA)	SG001 Substation High-Voltage Warning Signs
Appendix A-7.21 (BTA)	EXHIBIT Xv4 Substation Equipment Installation
Appendix A-7.22.1 (BTA)	SV 251 Bird and Animal Protection for Miscellaneous Equipment
Appendix A-7.22.2 (BTA)	SV 001 Bird and Animal Protection—General Information
Appendix A-7.22.3 (BTA)	SV 002 Bird and Animal Protection—General Installation Instructions
Appendix A-7.23 (BTA)	Volume 8 Consultant Drafting Procedures and Standards

APPENDIX A-8

Real Estate Specifications

[INCLUDED AS A SEPARATE ATTACHMENT]

BTA Bidders shall complete and submit attachment labeled as Appendix A-8 to their RFP bid response.

APPENDIX A-9

Equipment Supply Matrix

[INCLUDED AS A SEPARATE ELECTRONIC SPREADSHEET (EXCEL FILE)]

All Bidders shall complete and submit Appendix A-9 to their RFP bid response.

APPENDIX A-10

Plant Performance Guarantee / Warranties

[INCLUDED AS A SEPARATE ELECTRONIC SPREADSHEET (EXCEL FILE)]

BTA bidders to provide equipment warranties and performance guarantees for major equipment components (i.e., turbines, panels, etc.) as Appendix A-10 to their RFP bid response. Warranties shall be consistent with the specifications in Appendix A-1.

2022AS RFP

Appendix A-1.2

PACIFICORP

Wind Energy

Technical Specification

October 2021

RFP APPENDIX A.X (WIND)
<u>WORK SPECIFICATIONS (BTA)</u>

TABLE OF CONTENTS

RFP Appendix A

Wind Energy Technical Specification

October 2021

RFP APPENDIX A.X (WIND)
WORK SPECIFICATIONS (BTA)

1.0 EXHIBIT INFORMATION

1.1 Purpose

1.1.1 Without limiting the information summarized herein, the purpose of this document is to summarize the *minimum* performance specifications, quality standards, scope of work and other criteria required for the engineering, procurement, permitting, and construction of the Project.

(1) The engineering, procurement, and construction of the balance-of-plant infrastructure for the Project, including all civil works, structural works, and electrical works;

(2) Permitting of project in compliance with applicable law and RFP Appendix A Permitting Matrix.

(3) The supply and delivery of WTGs to the Project Site;

(4) The offloading and installation of all WTGs for the Project, and all tasks necessary to achieve mechanical completion of the WTGs;

(5) All tasks necessary to achieve commissioning completion of the WTGs; and

(6) The furnishing and installation of the O&M Building and the meteorological towers.

1.2 Project Description

1.2.1 PacifiCorp (Owner) is soliciting proposals from qualified bidders (Sellers) for cost-effective renewable resources that are located in or can be delivered to PacifiCorp's west balancing authority area ("**PACW**"). Any wind energy project to be owned and operated by PacifiCorp shall meet the PacifiCorp requirements set forth herein. The performance requirement is that the Project must be capable of producing safely, reliably and continuously at rated and all ranges of power output and ambient conditions.

1.3 References

1.3.1 Appendix "A-7" contains the following Owner standards that apply to this Technical Specification:

- RFP Appendix A-7.01: Attachment 1A Project Document Formatting and Requirements.
- RFP Appendix A-7.02: Attachment 1B – Project Document Deliverables
- RFP Appendix A-7.03: Computer Aided Design (PacifiCorp Energy) General AutoCAD/Drafting Standards (Specification DCAP876).
- RFP Appendix A-7.04.1: EBU PX-S01/S01A Substation Equipment—Power Transformer, All Ratings and Substation Equipment—Transformer-Specific Requirements
- RFP Appendix A-7.04.2: EBU PX-S02 Substation Equipment—Collector Substation Main Power Transformer

- RFP Appendix A-7.04.3: ZS-102 Two-Winding Distribution Transformer Inverter Step-Up Liquid-Immersed (Pad Mounted, Compartmental Type)
- RFP Appendix A-7.05: EBU SI-S04 Electrical Equipment—Insulating Oil
- RFP Appendix A-7.06: EBU SI-S02 Wind, Ice, and Seismic Withstand
- RFP Appendix A-7.07: EBU SI-S03 Contaminated Environment Protection
- RFP Appendix A-7.08: SP-TRF-INST Transformer, Oil-Filled Reactor and 3phase Regulator Installation Procedure
- RFP Appendix A-7.09: TD 051 Sign, Danger
- RFP Appendix A-7.10.1: 6B.5—Fence Application and Construction
- RFP Appendix A-7.10.2: Section 02810 Chain Link Fencing and Gates
- RFP Appendix A-7.10.3: Section 02815 Cantilever Slide Gate
- RFP Appendix A-7.11: 6B.6—Substation Grounding
- RFP Appendix A-7.12: GEN-ENG-RELAY-0001 Protective Relaying Standard
- RFP Appendix A-7.13: GEN-ENG-RELAY-0002 Arc Flash Hazard Standard
- RFP Appendix A-7.14: GEN-ENG-RELAY-0003 Relay Current Transformer (CT) and Potential Transformer (PT) Insulation Integrity Test
- RFP Appendix A-7.15: GEN-ENG-RELAY-1003 Thermal Plant Protective Relay Maintenance and Testing – PRC-005
- RFP Appendix A-7.16: Relay Testing and Commissioning Checklist
- RFP Appendix A-7.17: GPCP-EQPMNT-INST Generation Protection and Control Equipment Installation Procedure
- RFP Appendix A-7.18: GPCP-CT-INST Current Transformer Installation Procedure
- RFP Appendix A-7.19: PCF-CT-INST Current Transformer Installation Form
- RFP Appendix A-7.20: SG-001 Substation High-Voltage Warning Signs
- RFP Appendix A-7.21: EXHIBIT X Specification for Substation Equipment Installation, Testing and Commissioning
- RFP Appendix A-7.22.1: SV 251 Bird and Animal Protection for Miscellaneous Equipment
- RFP Appendix A-7.22.2: SV 001 Bird and Animal Protection – General Information
- RFP Appendix A-7.22.3: SV 002 Bird and Animal Protection – General Installation Instructions
- RFP Appendix A-7.23: Volume 8 Consultant Drafting Procedures and Standards (For Engineering Drawings)

1.4 Definitions

The following words shall have the respective meanings set forth below when used in this specification:

1.4.1 “**Access Roads**” means all the complete, fully-functional roads to be constructed by Seller under the Agreement.

1.4.2 “**Agreement**” means the written agreement between Owner and Seller covering the furnishing of Work and other services in connection therewith. Other documents and deliverables are attached to the Agreement and made a part thereof as provided therein.

1.4.3 “**Applicable Standards**” has the meaning set forth in this specification.

1.4.4 “**As-Built Drawings**” means a complete set of drawings prepared by Seller or a Subcontractor which accurately and completely represent the Work as constructed and installed.

1.4.5 “**BOP**” means balance-of-plant.

1.4.6 “**Collection System**” means the permanent electrical and communications infrastructure required to transmit energy and performance and operating data between each Wind Turbine and the Project Substation, or to the Turbine SCADA System control panel as appropriate.

1.4.7 “**Communications System**” means the supervisory, control, and data acquisition system for the Project Substation equipment (including all breakers, switches, transformers, relays, and meters) and permanent meteorological towers; all fiber optic cabling and supporting devices within the Collection System Circuits; and the Turbine SCADA System.

1.4.8 “**Seller**” means the person, firm, or corporation with whom Owner has entered into the Agreement.

1.4.9 “**Seller Deliverables**” means all drawings, plans, studies, reports, calculations, specifications, pictures, videos, test results, manuals, completion certificates, completion procedures, checklists, documents, and other similar items necessary for the successful completion of the Work.

1.4.10 “**Equipment**” means all of the parts, components, equipment, materials, apparatus, structures, tools, supplies, consumables, goods, and other items required or appropriate for a complete, fully-functional Project or that otherwise form or are intended to form part of the Work or the Project, including all equipment, materials, apparatus, structures, tools, supplies and other goods provided and used by Seller and the Subcontractors for performance of the Work, but that are not incorporated into the Project, and excluding all Owner-Supplied Equipment.

1.4.11 “**Foundation**” means each Wind Turbine foundation.

1.4.12 “**Job Book**” means a manual to be prepared by Seller and approved by Owner, which will include all Seller engineering, design, purchasing, and other information relating to the Work.

1.4.13 “**Interconnection Line**” means the [TBD]-kV high-voltage transmission line connecting the Project Substation with the Point of Interconnection. “TBD” is a Project-specific voltage to be specified in the Proposal, but generally expected to be 115 kV or greater.

1.4.14 “**O&M Building**” means the operations and maintenance building for the Project.

1.4.15 “**Owner**” means PacifiCorp.

1.4.16 "**Point of Interconnection**" means the point where the Interconnection Line connects to the interconnection facilities constructed and owned by the interconnecting utility to which electrical power produced by the Project will be delivered.

1.4.17 "**Project**" means the generating facility described in the Proposal.

1.4.18 "**Project Schedule**" means the schedule of key dates, milestones, and other activities for timely completion of the Work, reflecting the project execution plan and anticipated sequence of site operations.

1.4.19 "**Project Site**" or "**Site**" means the location, or proposed location, of the Project.

1.4.20 "**Project Substation**" means the 34.5/[TBD]-kV substation to be located at the Project Site, with all necessary equipment to connect the Project to the interconnecting utility's grid. "TBD" is a Project-specific voltage to be specified in the Proposal, but generally expected to be 115 kV or greater.

1.4.21 "**Proposal**" means the formal offer of Seller together with all information submitted that pertains to this RFP.

1.4.22 "**Prudent Wind Industry Practices**" means (a) those practices, methods, equipment, specifications and standards of safety, performance, dependability, efficiency and economy as are acceptable for construction and professional engineering firms performing design, engineering, procurement and construction services in North America on facilities of the type and size similar to the Project, which in the exercise of reasonable judgment and in the light of the facts known at the time the decision was made, are considered good, safe and prudent practice in connection with the design, construction and use of electrical and other equipment, facilities and improvements, with commensurate standards of safety, performance, dependability, efficiency and economy, are in accordance with generally accepted national standards of professional care, skill, diligence and competence applicable to design, engineering, construction and project management practices, and are consistent with Applicable Laws; and (b) those practices, methods, standards and acts that at a particular time in the exercise of reasonable judgment would have been acceptable to those engaged in, or approved by a significant portion of, the wind power industry for similar facilities in similar geographic areas as a reasonable effort to accomplish the desired result in a manner consistent with Applicable Laws, Applicable Standards, safety, environmental protection, economy and expedition.

1.4.23 "**Quality Plan**" means quality assurance and quality control plan to be prepared by Seller in compliance with the requirements in this specification.

1.4.24 "**Requirements**" means the Work Specifications, Prudent Wind Industry Practices, applicable laws, applicable permits, Applicable Standards, the Project Schedule, the Project's interconnection Agreement, the Project design documents, and the other requirements of the Agreement.

1.4.25 "**RFP**" means request for proposals.

1.4.26 "**Safety Plan**" means safety plan to be prepared by Seller in compliance with the requirements in this specification.

1.4.27 "**SCADA**" means supervisory control and data acquisition.

1.4.28 “**Security Plan**” means security plan to be prepared by Seller in compliance with the requirements in this specification.

1.4.29 “**Turbine Supplier**” means a Project-specific Wind Turbine supplier to be specified in the Proposal.

1.4.30 “**Wind Turbine Generator**” means each of the complete, fully-functional wind turbine generators to be part of the Project.

1.4.31 “**Wind Turbine Pad**” means both the crane pads and hardstands, where (i) “**crane pads**” refer to a hardstand area in connection with the erection or service of a Wind Turbine and (ii) “**hardstands**” refer to any area where Wind Turbine components, Wind Turbine equipment, transport equipment, or storage equipment are stored, placed, or parked, and including parking areas, laydown areas, and other such working areas.

1.4.32 “**Work**” means all actions, capital, contracts, labor, equipment, and materials necessary to construct the proposed Project and furnish wind energy and environmental attributes (including operating the Project) to Owner at the specified delivery point.

1.4.33 “**Work Specifications**” means the minimum performance specifications, quality standards, and other criteria required for the performance of the Work by Seller, each as described in more detail in this specification.

1.4.34 References to “**roads**” and “**roadways**” herein shall be understood to consist of all access roads, Wind Turbine Generator string and spur roads, substation roads, transmission line service roads, meteorological tower roads, maintenance building roads, and temporary construction roads to be constructed for the Project.

1.4.35 As used herein, “**raceway**” shall be understood to include conduit (rigid and flexible), underground duct, wireway, cabinets and boxes, and all materials and devices required to install, support, secure, and provide a complete system for support and protection of electrical conductors.

1.5 Interpretation

1.5.1 References herein to requirements to perform and/or provide work, services, equipment, or other similar items shall be understood to be the responsibility of Seller, unless explicitly noted as being a responsibility of Owner.

1.5.2 The headings of sections and subsections herein are for convenience only and shall be ignored in construing this exhibit.

2.0 STANDARDS OF PRACTICE

2.1 General Provisions

2.1.1 Seller shall be responsible for the interpretation of the data provided herein and validation of the proposed design.

2.1.2 Any proposed materials, structures, and/or assemblies shall be maintainable in the simplest and most cost-effective manner possible.

2.1.3 All materials shall be new, unused, of the highest quality, free of defects and irregularities, and consistent for use in wind generation facilities.

2.1.4 Equipment shall be installed, assembled, and tested in strict compliance with the manufacturer's drawings, code markings, and instructions.

2.1.5 The Seller shall ensure the final drawings, models, and associated documents meet the needs of the Project requirements and adhere to all applicable codes and standards. The Seller shall have the overall responsibility for the design and engineering provided by their Engineer of Record (EOR).

2.1.6 Physical and cyber security shall adhere to NERC Critical Infrastructure Protection (CIP) protocol. This compliance shall be demonstrated within the design and using additional reporting and documentation when necessary.

2.2 Supervision and Engineer of Record

2.2.1 All engineering shall be performed under the supervision of and stamped by the engineer(s) of record, who shall be a registered professional engineer with a current license in the Project jurisdiction. Such professional engineer(s) shall be registered in the applicable discipline for the drawings being signed and sealed.

2.2.2 Seller shall provide all engineering, technical expertise, management, and supervision, to design, engineer, specify and complete all aspects of the Project, including but not limited to: land use, access, interconnection, equipment, structures, devices, materials, construction, testing, and commissioning, (unless otherwise noted).

2.2.3 Seller shall be responsible for complying with all technical requirements contained in the Power Purchase Agreement and Generation Interconnection Agreement, including all Utility and ISO requirements.

2.2.4 Seller shall be aware of all local requirements and shall be incorporated into the design and construction of the Project. All Work concerning the geotechnical services shall be supervised and directed by a qualified, competent, practicing geotechnical engineer. A geotechnical engineer or engineering geologist shall observe, log borings, obtain soil samples, and record blow counts of the samples, drill rates, rock quality, depth to ground water, and other pertinent data under the direction of a licensed geotechnical engineer.

2.2.5 All Project submittals shall be subject to review and/or approval by Owner, as applicable, and shall meet the minimum requirements for submittals set forth in Section 3.2 (*Submittal Requirements*) herein.

2.3 Applicable Standards

2.3.1 The Applicable Standards shall include (i) the minimum standards and industry codes and any other criteria required for the performance of the Work by Seller, (ii) each of the standards and industry codes listed below, and (iii) each of the relevant standards and codes issued by the organizations listed below (collectively, the "**Applicable Standards**").

(1) Aluminum Association ("AA")

(2) American Association of State Highway and Transportation Officials ("AASHTO")

(3) American Concrete Institute ("ACI")

(4) American Institute of Steel Construction ("AISC")

(5) Association of Iron and Steel Engineers ("AISE")

(6) American National Standards Institute ("ANSI")

(7) American Society of Civil Engineers ("ASCE")

(8) American Society of Heating, Refrigeration, and Air Conditioning Engineers ("ASHRAE")

(9) American Society of Mechanical Engineers ("ASME")

(10) American Society of Nondestructive Testing ("ASNT")

(11) American Society of Testing and Materials ("ASTM")

(12) American Water Works Association ("AWWA")

(13) American Welding Society ("AWS")

(14) Avian Power Line Interaction Committee ("APLIC")

(15) Code of Federal Regulations ("CFR")

(16) Concrete Reinforcing Steel Institute ("CRSI")

(17) Crane Manufacturer Association of America ("CMAA")

(18) United States Environmental Protection Agency ("EPA")

(19) Federal Aviation Agency, Department of Transportation ("FAA")

(20) Federal Energy Regulatory Commission ("FERC").

(21) Federal Highway Administration ("FHWA")

(22) IAPMO Uniform Plumbing Code

(23) Illuminating Engineering Society (“IES”)

(24) Institute of Electrical and Electronic Engineers (“IEEE”)

(25) Instrumentation Society of America (“ISA”)

(26) Insulated Cable Engineering Association (“ICEA”)

(27) International Building Code (“IBC”)

(28) International Code Council (“ICC”)

(29) International Electrotechnical Commission (“IEC”)

(30) Applicable state requirements, including State Department of Transportation and Environmental Protection

(31) National Electric Code (“NEC”)

(32) National Electrical Contractors Association (“NECA”)

(33) National Electric Safety Code (“NESC”)

(34) National Electrical Manufacturers Association (“NEMA”)

(35) National Electrical Testing Association (“NETA”)

(36) National Fire Protection Association (“NFPA”)

(37) National Safety Council (“NSC”)

(38) North American Electric Reliability Corporation (NERC)

(39) Occupational Safety and Health Administration (“OSHA”)

(40) Post-Tensioning Institute (“PTI”)

(41) Scientific Apparatus Makers Association (“SAMA”)

(42) Sheet Metal and Air Conditioning Contractors National Association (“SMACNA”)

(43) Society for Protective Coatings (“SPC”)

(44) Telecommunications Industry Association/Electronic Industries Association (“TIA/EIA”)

(45) Underwriter’s Laboratories (“UL”)

(46) Uniform Building Code (“UBC”)

(47) DNVGL-ST-C502, Offshore Concrete Structures.

2.3.2 Unless otherwise specified, all engineering, procurement, and construction associated with the Project shall comply with the latest revision of all applicable codes and standards including, but not limited to, those listed herein. Any departure from the referenced codes and standards must be fully explained in writing and submitted for Owner's review and approval prior to implementation.

2.3.3 All specific standards applicable to pieces of equipment, structures, and/or buildings may not be listed herein. Specifications may describe the specific standards that may apply.

2.3.4 Any general standard or organization listed above shall be understood to include all relevant codes, standards, and/or guidelines under that standard or organization. For example, ACI shall include ACI 301, ACI 305, ACI 306, ACI 318, etc.

2.3.5 Unless otherwise specified herein, in the case of conflict between any Applicable Standards, the more stringent requirement shall apply.

2.3.6 It is the Seller's responsibility to be knowledgeable to include designs and practices that incorporate the latest revisions of all applicable codes, standards and regulations.

2.4 Approved Suppliers

2.4.1 This Section 2.4 contains a list of approved materials, equipment suppliers, and subcontractors. If Seller is considering the selection of a material, equipment supplier, or subcontractor that is not listed herein, Seller shall request approval from Owner prior to executing any contract for the procurement of such material or with such equipment supplier or subcontractor. Equipment catalog cut sheets shall be submitted for Owner review and approval prior to procurement.

2.4.2 Collection system:

(1) Approved cable suppliers:

(a) Prysmian/General Cable

(b) Southwire

(c) Okonite

(2) Approved junction box suppliers:

(a) Hubbell (Trinetics)

(b) SolarBos

(3) Approved pad-mount transformer suppliers:

(a) Cooper-Eaton

(b) General Electric

(c) Howard

(d) Virginia Transformer

(4) Approved 34.5-kV disconnect and grounding switch suppliers:

(a) Cleveland / Price

(b) Morpac

(c) Royal

(d) Southern States

(e) USCO

(f) SPS

(5) Approved 34.5-kV circuit breaker suppliers:

(a) ABB (with spring/hydraulic mechanism)

(b) Siemens

(c) EMA

(6) Approved grounding rod suppliers:

(a) Blackburn

(b) Weaver

(7) Approved cable splice suppliers:

(a) 3M

(8) Approved fault indicator suppliers:

(a) Cooper

(b) Power Delivery Products

(c) Schweitzer Engineering Laboratories

(9) Approved shear bolt connection suppliers:

(a) 3M

(b) Burndy

(c) CMC

(d) Polaris Connectors

(e) TE

2.4.3 Meteorological towers:

(1) Approved meteorological tower suppliers:

(a) Nello Corporation

(b) Renewable NRG Systems

(c) SABRE Industries Inc

(d) World Tower Company Inc.

(e) Ariel Erectors

(2) Approved MET Tower installation contractors:

(a) VIKOR

(b) Anetech, LLC

(c) PowerShare Cooperative

(d) Rinehart Tower Service, Inc

(3) Approved anemometer suppliers:

(a) Vaisala

(b) Thies (First Class Advanced)

(c) RISØ / WindSensor (Class 1)

(d) RM Young (vertical anemometers)

(e) NRG

(4) Approved wind direction sensor suppliers:

(a) Vaisala

(b) Thies

(c) NRG

(5) Approved data logger suppliers:

(a) Campbell Scientific

2.4.4 Wind Turbine Generators:

(1) Approved Turbine Suppliers:

(a) General Electric

(b) Siemens Gamesa

(c) Vestas

3.0 GENERAL SPECIFICATIONS

3.1 General Provisions

3.1.1 All Work, including construction, materials storage, grading, landscaping, cut/fill, erosion control, and other similar or related activities, shall not extend beyond the designated disturbance areas. Unnecessary disturbance of the existing Project Site conditions shall be minimized, and under no circumstance may Seller perform any Work or cause any disturbance beyond these corridors without explicit written confirmation from Owner.

3.1.2 Existing access to the Project Site, including along public roads, shall remain open throughout construction.

3.1.3 All existing infrastructure, including communications towers, pipelines, telephone lines, and electrical lines, shall be maintained in their current condition throughout the construction of the Project.

3.1.4 Temporary power and utilities must be included by Seller including easements and access need for construction.

3.1.5 Seller shall maintain an office on or close to the site of the Project. These construction office trailers shall be delivered, set-up, furnished and ready to use including power, phone service, internet service, HVAC systems, sewer and restroom facilities and decking by Seller's mobilization date and shall be demobilized after substantial completion has been achieved.

3.1.6 Seller shall provide sufficient space and electrical service in the office complex area for one office trailer for the turbine supplier. Site grading shall include parking space for turbine supplier's personnel.

3.1.7 Seller shall maintain two-way radio communication till substantial completion. Each crew shall have a radio for communications, at all times, effective communication for compliance with the Seller's emergency action plan.

3.2 Submittal Requirements

3.2.1 This Section 3.2 sets forth the *minimum* requirements for all Seller-provided submittals, including Seller Deliverables.

3.2.2 General requirements:

(1) Seller is required to submit a Master Drawing List showing all drawings and documents estimated to be provided for the project within ten (10) Business Days after Notice to Proceed.

(2) Seller shall name and label all submittals using an Owner-approved naming convention. Such naming convention shall be used consistently for all submittals, and the only filename modification for revised submittals shall be a change in revision number. Unidentifiable submittals will be returned for proper identification.

(3) Submittals shall be accompanied by copies of native, electronic design files (e.g., AutoCAD .dwg file, PLS-CADD .bak file, etc.), including for interim design transmittals (e.g., 30%, 90%, etc. as applicable) and As-Built Drawings.

(4) All design submittals shall be provided in a common and consistent coordinate system. Such coordinate system shall be subject to Owner approval.

(5) All drawings shall be clearly marked with: Revision numbers, dates, clouds around any change and appropriate explanations for the design changes.

(6) Seller shall maintain current set of IFC drawings on-site at all times, updated to the latest revisions.

3.2.3 Quality requirements:

(1) Scanned submittals are not acceptable. All submittal text shall be electronically recognizable and searchable.

(2) Submittals to Owner shall be of suitable quality for legibility and reproduction purposes. Every line, character, and letter shall be clearly legible. Drawings shall be useable for further reproduction to yield legible hard copies.

(3) Documents submitted to Owner that do not conform to specified requirements shall be subject to rejection by Owner, and upon request, Seller shall resubmit conforming documents. If conforming submittals cannot be obtained, such documents shall be retraced, redrawn, or photographically restored as may be necessary to meet such requirements. Seller's (or its subcontractor's) failure to initially satisfy the legibility quality requirements will not relieve Seller (or its subcontractors) from meeting the required schedule for submittals.

3.2.4 Quantity requirements:

(1) Seller shall electronically transmit one (1) copy of all submittals to Owner, including modifications to submittals, except as otherwise specified elsewhere in the Agreement.

(2) Seller shall provide four (4) complete, full-size (size D), color sets *and* four (4) complete, 11-inch by 17-inch, color sets of As-Built Drawings in hard copy format, as well as one (1) complete, full-size (size D) set of As-Built Drawings in electronic format on external hard drive.

3.2.5 Languages and dimensions:

(1) All words shall be in the English language.

(2) All dimensional units shall be in English units. When both metric and English units of measurement are presented, English dimensional units shall prevail.

(3) All drawings and dimensions shall be to scale; not-to-scale ("**NTS**") dimensions will not be permitted on scalable drawings. A scale bar shall be included to permit use following photo-reduction.

3.2.6 Submittal completeness:

(1) Submittals shall be complete with respect to dimensions, design criteria, materials of construction, and other information specified to enable Owner to review the information effectively.

(2) Where standard drawings are furnished which cover a number of variations of the general class of equipment, each drawing shall be annotated to indicate exactly which parts of the drawing apply to the equipment being furnished. Use hatch marks to indicate variations which do not apply to the submittal. The use of "highlighting markers" will not be an acceptable means of annotating submittals. Such annotation shall also include proper identification of the submittal permanently attached to the drawing.

3.2.7 Transmittal of submittals:

(1) Submittals and Project documents shall be transmitted in (i) nonproprietary, native electronic format, incorporating any necessary reference files; and/or (ii) Adobe (*.pdf) files created directly from native electronic format.

(2) All electronic submittals shall be uploaded to Owner's web-based document management site. Selected submittals may also be required to be provided on CD, DVD, or flash drive.

(3) All electronic submittals shall be clearly named and versioned (e.g., revision number, date appended to file name).

(4) Each submittal shall be accompanied by a completed transmittal letter. Submittals that are not accompanied by a completed transmittal letter will not be accepted and will be returned to Seller. All Seller transmittal letters submitted to Owner shall contain the following information, at a minimum:

(a) Transmittal number

(b) Date of transmittal

(c) Seller's name

(d) Project name

(e) Owner's project number

(f) Filename and revision number

(g) Description of the information contained in the specific transmittal

(h) Purpose of transmitting to Owner (i.e., issued for information, issued for review, etc.), including applicable Agreement references

(5) Seller shall check and approve submittals of subcontractors and manufacturers prior to transmitting them to Owner. Seller's submission shall constitute a representation to Owner that Seller approves such submittal(s) and has determined and verified all information contained therein, and Seller assumes full responsibility for doing so; and Seller has coordinated each submittal with requirements of the Work and the Agreement.

(6) Seller shall, at the time of each submission, call to the attention of Owner in the letter of transmittal any and all deviations from the Requirements.

3.2.8 Owner's review:

(1) Owner's review and approval of submittals will not relieve Seller of responsibility for any deviation from the Requirements unless Seller has in writing called Owner's attention to such deviation at the time of submission, and Owner has given written concurrence in and approval of the specific deviation. Approval by Owner shall not relieve Seller from responsibility for errors or omissions in submittals.

(2) Seller shall make all modifications noted or indicated by Owner and return the required number of revised submittals until approved. Direct specific attention in writing, or on revised submittals, to changes other than the modifications called for by Owner on previous submittals. After submittals have been approved, submit copies thereof for final distribution. Previously approved submittals transmitted for final distribution will not be further reviewed and are not to be revised. If errors are discovered during manufacture or fabrication, correct the submittal and resubmit for review.

(3) Seller shall not construct any portion of the Work until issued-for-construction drawings have been approved by Owner. Wind Turbine Generator Foundations shall not be constructed until the Wind Turbine Generator Foundation drawings and calculations have been approved by Owner, including its independent engineer.

(4) Seller shall submit equipment catalog cut sheets for Owner review and approval prior to procurement.

(5) Review of drawings by Owner does not relieve Seller of responsibility for errors, correctness of details or conformance with these specifications.

3.2.9 Design submittals:

(1) The civil works design documents shall include a plan view of all access roads, crane paths, Wind Turbine Generator Pads, Wind Turbine Generator locations, staging / laydown areas, and limits of disturbance; profile views for all vertical curves; Wind Turbine Generator delivery flow plan; grading and drainage plans; erosion control details; fencing and gate details; public road improvement details; compaction details; backfill / fill properties; road materials properties; road cross-sections; drawing index; bill of materials; construction sequencing; and inspection, testing, and quality control requirements, at a minimum.

(2) The Turbine Foundation design documents shall include reinforcing steel details; rebar shop drawings; conduit details; grouting details; civil requirements (e.g., backfill, compaction, drainage, etc.); structural calculations; tensioning sequencing and parameters; drawing index; bill of materials; construction sequencing; and inspection, testing, and quality control requirements, at a minimum.

(3) The Collection System Circuit design documents shall include a plan view of the overall system; one-line electrical diagram; cable installation details, including cable specifications, trench details, splice details, and cable marker details; cable crossing details, including road crossings, utility crossings, pipeline crossings, and directional boring; grounding details, including trench grounds and Wind Turbine Generator grounding; termination details, including junction boxes and Wind Turbine Generator switchgear; junction box details; meteorological tower power details; conduit and cable schedules; the Project Electrical Studies, as defined in this specification; drawing index; bill of materials; construction sequencing; and inspection, testing, and quality control requirements, at a minimum.

(4) The Communications System design documents shall include a plan view of the fiber optic cable layout; fiber optic loop diagram, including communication loop and connection details for all Wind Turbine Generators, permanent meteorological towers, and the O&M Building; communications block diagram, including all Communications System equipment, Owner-Supplied Equipment (including Wind Turbine Generators and the Turbine SCADA System), and utility equipment; logic descriptions; points lists; rack layout diagrams; HMI screen development; fiber termination diagrams; drawing index; bill of materials; construction sequencing; and inspection, testing, and quality control requirements, at a minimum.

(5) The O&M Building design documents shall include electrical works, including grounding and lighting plans, one-line diagrams, electrical load list, power distribution board, backup generator distribution, communications, and construction specifications; civil works, including site plan, subgrade preparation, grading/drainage, paving plan/design, access road plan, and laydown area; structural works, including structural steel drawings, foundation and equipment pads (locations and details), rebar, design calculations, and construction specifications; mechanical works, including equipment arrangements/locations, equipment list, HVAC layout, fire protection and monitoring, piping and plumbing, vendor drawings (as applicable), and construction specifications; architectural works, including building layout/plans/elevations, finishes, schedules for windows and doors, and hardware; drawing index; bill of materials; construction sequencing; and inspection, testing, and quality control requirements, at a minimum.

(6) The meteorological tower design documents shall include road access, foundation plans and details, including all structural calculations, pier details, and footing details; tower details, including boom elevations, boom directions, equipment mounting, guying details, and hardware details; instrument details, wiring schematics; H-frame diagrams; grounding details; power supply details; drawing index; bill of materials; construction sequencing; and inspection, testing, and quality control requirements, at a minimum.

(7) Issued-for-construction drawings shall not be changed or substantially deviated from without Owner approval.

(8) As-Built Drawings: As-Built Drawings shall be issued as the next sequential revision from previous releases. The revision block shall state “As Built”. All clouds, revision diamonds, and other interim control markings shall be removed, and all information listed as “later” or “hold” shall be completed. The As-Built Drawings shall include a final bill of materials. As-Built Drawings shall be created in the latest version of AutoCAD, or in the version of AutoCAD utilized by Owner, as applicable.

(9) All design submittals shall bear the Project name and the status of the submittal (e.g., Preliminary, Issued for Bid, Issued for Construction, As Built).

(10) Each drawing and submittal shall be sequentially numbered with a unique identifier.

(11) All materials shall be fully identified by Seller, and each engineering package shall include a bill of materials, including all equipment and materials to be procured. Every item in the bill of materials shall have a unique identifier (typically numerical). Each bill of materials shall list product name, manufacturer, unique product / part number, and quantity.

3.3 Project Construction Documentation

3.3.1 Seller shall prepare and submit all Seller Deliverables required to be delivered to Owner. All such Seller Deliverables shall be subject to review; shall be coordinated and discussed with all pertinent parties prior to and during the construction phase of the Project; and shall comply with the Technical Specifications.

3.3.2 Seller shall perform the Work in accordance with the safety plan set forth in Exhibit Q-1 ("**Safety Plan**").

3.3.3 Seller shall perform the Work in accordance with the requirements of the Quality Control Manual.

3.3.4 Seller shall provide two (2) complete copies of Job Books in hard copy format and four (4) complete copies of Job Books in electronic format on external hard drive. Job Books shall comply with the requirements as set forth in the Technical Specifications.

3.3.5 Seller shall prepare, implement, and manage a detailed project execution plan that is specific to the Project and Project Site. The project execution plan shall be sufficient in scope and detail to convey the means and methods that will be employed by Seller to perform all aspects of the Work. Key elements of the project execution plan shall include, but not be limited to, project management structure and key personnel; roles and responsibilities; staffing plans; communications protocol; engineering execution plans; and construction management plans, including, but not limited to, cost controls, schedule controls, mobilization, document management, materials management, details for receipt and transport of equipment, construction sequencing, movement of cranes during construction, and other similar items.

3.3.6 Seller shall prepare, implement, and manage a detailed traffic management plan that is specific to the Project and Project Site. The traffic management plan shall clearly identify all haul routes from the nearest highway; proposed traffic flow within the Project Site, including public and non-public roads; plans for managing construction, delivery, public, and other traffic at the Project Site during construction; daily concrete truck delivery flow plans; and mitigation measures to reduce risk and impact to non-construction vehicles due to construction activities.

3.3.7 Seller shall prepare, implement, and manage critical lift plans that are specific to the Project and Project Site. The critical lift plan shall clearly identify precautions for all critical lifts; coordination plans, including pre-lift meetings, with all participating personnel; and sample documentation/checklists for all critical lifts. Prior to performing any critical lift, Seller shall perform a practice lift with a similar crane configuration and load configuration; practice lifts shall always be performed with the same crew and using the same lifting equipment as those used for the critical lift. Any lift exceeding ninety percent (90%) of a crane's load chart is prohibited. For purposes of this exhibit, a "critical lift" shall include any lift that exceeds seventy-five percent (75%) of the rated capacity of the crane, per the respective crane's load chart; any lift that exceeds 50,000 pounds; any lift that requires the use of more than one crane; any lift requiring blind picks; any man-basket lifting operation; any load that is lifted/transported over or near energized electrical equipment, such as power lines, transformers, or switchgear; any lift in a confined space or restricted area (including an operating facility) where the load, or any part of the crane or equipment structure, could come within one (1) meter of any existing structure; or any lift where the equipment is set up near manholes, catch basins, sewers, sinkholes or other known surface or sub-surface interferences.

3.3.8 Seller shall prepare a storm water pollution prevention plan (the "**SWPPP**") for the Project.

3.3.9 Seller shall prepare and submit all required geotechnical documentation and submittals, as more particularly described in Section **Error! Reference source not found.** of this Exhibit A.

3.3.10 Seller shall prepare blasting plans and procedures for all blasting work to be performed at the Project Site. Such plans and procedures shall include, a description of safety buffer zones, parameters for blasting times during the day, and approved certification as required from the authority having jurisdiction.

3.3.11 Seller shall prepare and submit concrete and grout mix designs; concrete and grout placement procedures; and grout specification sheets as Seller Deliverables. Each mix design submitted by Seller shall be accompanied by documentation of achieving Project-specific compressive strength requirements according to ACI procedures.

3.3.12 Seller shall prepare energization plans and procedures for each collection system circuit, the Substation, and the transmission interconnection line. Energization plans shall be submitted to Owner *prior* to use. Energization plans shall include both electrical and communications infrastructure as well as backfeed plans, soaking plans, testing plans, and lock out tag out procedures.

3.3.13 Seller shall provide a foundation inspection report for each Turbine Foundation excavation and every drilled pier constructed (if any) (each, a "**Foundation Inspection Report**"). A Foundation Inspection Report, including all accompanying documentation, shall be provided to Owner as a condition of each Turbine Foundation completion and shall include the minimum information set forth in the Technical Specifications.

3.3.14 Seller shall provide a bolt tensioning plan, including procedures for tightening / re-tightening, with recommendations covering the design life of the Project.

3.3.15 Seller shall prepare the design documents, including civil works, WTG foundations, collection system circuits, communications system, Substation, transmission interconnection line, O&M Building, and meteorological towers. All design documents shall meet the minimum requirements set forth in the Technical Specifications.

3.4 Project Schedule Requirements

3.4.1 This Section 3.4 provides an outline for the *minimum* contents and requirements of the Project Schedule to be prepared by Seller. Seller shall provide Initial Level 3 Schedule, twenty-one (21) days after Notice to Proceed and at a level of engineering deliverable that supports construction detailed activity breakdowns for task duration and estimates of the work to be detailed/performed for the schedule. Final Level 3 Baseline Project Schedule to be provided within 1 week after approval of Initial Level 3 Schedule.

3.4.2 For purposes of only this Section 3.4, the following words shall have the respective meanings set forth below.

(1) "**Activity**" means a discrete part of a contract that can be identified for planning, scheduling, monitoring, and controlling the construction Work. Activities included in a construction schedule consume time and resources but shall not include planned work stoppages. Activities shall not normally reflect the Work of more than one trade.

(2) "**Baseline**" schedule means the initial Project Schedule, as approved by Owner.

(3) "**Critical path**" means the longest sequence of activities in a project plan which must be completed on time for that project to complete by the stated due date.

(4) "**Critical path method**" or "**CPM**" means a method of planning and scheduling a construction contract where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Agreement.

(5) "**Float**" means the measure of leeway in starting and completing an activity. Float time (including total float) is not for the exclusive use or benefit of either Owner or Seller, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Agreement completion date.

(6) "**Predecessor activity**" means an activity that precedes another activity in the network.

(7) "**Resource loading**" means the allocation of manpower, equipment, or material necessary for the completion of an activity as scheduled.

(8) "**Successor activity**" means an activity that follows another activity in the network.

(9) "**Total float**" is the measure of leeway in starting or completing an activity without adversely affecting an intermediate deadline or the planned Agreement completion date.

3.4.3 General requirements:

(1) Seller's accepted Baseline schedule will be set forth in Appendix B (*Critical Path Schedule Requirements*).

(2) Seller shall utilize Primavera Professional Project Management Software from Oracle for preparation of the Project Schedule. At a minimum, this shall be version Primavera P6.7 or newer.

(3) Activities in the Project Schedule shall be defined so that no single construction activity is longer than 20 calendar days and no single other activity is longer than 30 calendar days, respectively, unless specifically allowed by Owner.

(4) Each activity shall be assigned a number. Numbering shall be such that predecessor activity numbers are smaller numerically than successor activity numbers in the Baseline Project Schedule. Seller shall use even-numbered activities for base Agreement Work, and odd-numbered activities for change order work. No activity number shall change after approval of the Baseline Project Schedule.

(5) The Project Schedule shall include a clear and logical work breakdown structure, wherein all items are assigned a sensible activity number based upon the type of work being performed. Such work breakdown structure shall be subject to approval by Owner.

(6) Procurement process activities shall be included for all long-lead and major items (as defined by Owner) as separate activities in the Project Schedule. Procurement cycle activities shall include, but not be limited to, submittals, approvals, purchasing, fabrication, and delivery.

(7) The Project Schedule shall indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

(a) Preparation and processing of submittals

(b) Mobilization and demobilization

(c) Acquisition of key permits

(d) Completion of interconnection studies and interconnection agreement, respectively

(e) Purchase of major equipment

(f) Delivery

(g) Fabrication

(h) Utility interruptions

(i) Installation

(j) Work by Owner that may affect or be affected by Seller's activities

(k) Startup and initial operations

(l) Tests and inspections

(m) Training

(8) The Project Schedule shall include Milestones indicated in the Agreement, including, but not limited to, guaranteed Milestone completion dates and any critical milestones in Appendix M (*Critical Milestones*). All major milestones shall be presented at the top of the Project Schedule.

(9) The Project Schedule shall show the Work in Gantt chart format, on a sheet size of 11-inch by 17-inch, the scale and spacing shall allow room for notation and revisions, and the font shall be sized such that it is easily legible when printed.

(10) Each revised or updated Project Schedule shall show actual progress compared to the originally accepted Baseline schedule and any proposed changes in the schedule of remaining Work.

(11) The Project Schedule shall clearly identify all critical path activities. Scheduled start and completion dates shall be consistent with Agreement milestone dates.

(12) Seller shall not use artificial activity durations, preferential logic, or other devices for sequestering Float. Owner retains the right to reject any schedule submittal in which Seller has sequestered Float. Any activity with lag greater than two (2) days shall be identified in the activity description.

(13) Constraint dates shall be kept to a minimum, and all constraints shall be identified with descriptive text in the activity description.

(14) All activities shall have a predecessor activity and successor activity except for the first and last activities in the Project Schedule.

(15) Each Project Schedule shall meet the minimum requirements for submittals set forth in Section 3.2 (*Submittal Requirements*) herein.

(16) The Project Schedule shall include allowances for delays that may be encountered for reasonably expected weather conditions, non-working holidays, and other similar items.

(17) Recovery Schedule - A detailed breakdown of the detailed schedule may be requested by Owner as a mitigation plan for a Critical Milestone activity that becomes delayed.

3.4.4 Concurrent with each Project Schedule submittal, Seller shall submit the following reports:

(1) General: electronic copies of the complete Project Schedule file in P6 executable (*.xer) format (including the Project-specific *.plf layout filters) and Adobe (*.pdf) format, respectively.

(2) Critical path report: list of all activities on critical path, sorted in ascending order by activity number.

(3) Activity report: list of all activities sorted by activity number and then start date, or actual start date if known. Within each activity, Seller shall indicate estimated completion percentage in no greater than 10 percent (10%) increments.

(4) Logic report: list of preceding and succeeding activities for all activities, sorted in ascending order by activity number.

(5) Total float report: list of all activities sorted in ascending order by activity number and showing total float by activity.

(6) Three-week look ahead: list of all planned Work activities during the current week and the subsequent two-week interval, sorted in ascending order by activity number.

(7) Tabulated reports and/or schedule layouts showing the following:

(a) Identification of activities that have been added, deleted, or changed

(b) Changes in activity durations in workdays

(c) Changes in total float

(d) Detailed schedule layout showing start and finish date variances

(e) Critical path and near critical path (1 to 15 days float) layout with variances

(f) Major milestone report with variances

(g) Activity constraints, including type

(8) Format for each activity in all reports described above shall contain, at a minimum, activity number, activity description, resource loading, original duration, remaining duration, early finish date, late start date, late finish date (or actual start date and/or actual finish date, as applicable), and total float in calendar days.

3.5 Job Book Requirements

3.5.1 This Section 3.5 sets forth an outline for the *minimum* contents of the Job Books to be prepared by Seller.

3.5.2 Job Book outline:

(1) **General:**

(a) Index:

1. Job Book index

2. Project Directory

3. Drawing index, including all categories listed under Section 3.5.2(2)(b) below

(b) Schedule:

1. Final Project Schedule

2. Actual delivery schedule of Owner-Supplied Equipment

(c) Seller plans:

1. Safety Plan

2. Security Plan

3. Environmental Plan

4. Project execution plan

(d) Health and safety statistics:

1. Project construction Work hours and statistical information

2. Incident reports, including accidents, thefts, injuries, and near misses

(e) Changes:

1. Project Change Orders

2. Seller correspondence concerning Change Orders

(f) Permits:

1. Owner permits

2. Seller permits

3. Certification of compliance to permit requirements

(g) Training:

1. Project construction training records

2. Copies of training manuals

(h) Reporting:

1. Plan of the day reports

2. Weekly progress reports and identify critical recovery actions

3. Monthly progress reports with critical recovery actions

(i) Contracting:

1. List of Subcontractors used on the Project

2. Summary of all work performed by Subcontractors

3. Copies of all subcontracts for construction services (non-priced)

4. Copies of purchase orders for major equipment

(2) **Drawings and manuals:**

(a) Design documentation:

1. Project Site plan
2. As-built Wind Turbine Generator coordinates
3. Design basis and Project Site data
4. Engineering calculations and design studies
5. Final geotechnical engineering report

(b) Issued for construction drawings:

1. Civil works
2. Collection System Circuits
3. Turbine Foundations
4. Project Substation (including civil, structural, and electrical)
5. Interconnection Line
6. SCADA System
7. O&M Building
8. Meteorological towers
9. As-Built Drawings, including all items listed under Section 3.5.2(b) above
10. Project bill of materials
11. Correspondence between Owner and Seller, including RFIs

(c) Manufacturer model/serial number with manuals and data sheets for all equipment within or a part of the following:

1. Collection System Circuits
2. Project Substation
3. Interconnection Line
4. SCADA System
5. O&M Building

(d) Other equipment documentation:

1. Instruction manuals where appropriate for building systems

2. Equipment factory acceptance test reports

3. Spare parts list

4. Warranty agreements (including contact information) for all Equipment

(e) Material safety data sheets

(3) **Quality assurance documentation:**

(a) Construction photographs:

1. Photographs of construction activities

2. Photographs of Project Site restoration

(b) Civil / structural works:

1. Road base aggregate proctor testing results

2. Road base density testing results

3. Access Road inspection documentation

4. Drainage structure inspection documentation

5. Soil testing results

6. Compaction testing results road subgrade and aggregate base

7. Moisture and density analysis

8. Drainage works (including culverts) inspection reports

9. Concrete mix design(s) and placement procedures

10. Grout mix design(s) and placement procedures, including specification sheets

11. Concrete and grout testing results / reports

12. Concrete batch tickets

13. Trial Batch Testing Report

14. Site Water Analysis Report

15. Batch Plant Scale Certification

16. Crane Pad compaction test results

17. Non-conformance and corrective action reports

(c) Turbine Foundations:

1. Wind Turbine Generator pad inspection and testing results

2. Turbine Foundation subgrade inspection and testing results

3. Wind Turbine Generator Foundation subgrade improvement inspection (if any)

4. Wind Turbine Generator Foundation coordinate survey and top of concrete level check

5. Foundation Inspection Report

6. Batch Plant Inspection report

7. Reinforcing steel placement inspection

8. Concrete mix design(s) and placement procedures

9. Grout mix design(s) and placement procedures, including specification sheets

10. Electrical conduit and ground grid installation inspection report

11. Concrete and grout testing results (Sampling, Compressive Strength, Temp, Density, Slump, and Air Content)

12. Concrete batch tickets

13. Concrete pour logs

14. Foundation Concrete Compressive Strength Test Documentation

15. Grout placement inspection

16. Foundation Grout Compressive Strength Test Documentation

17. Pre-backfill Turbine Foundation inspection

18. Turbine Foundation backfill testing

19. Reinforcing steel, embedment ring, and anchor bolt mill certificates

20. Anchor Bolt Embedment Plate Placement inspection

21. Anchor Bolt tensioning reports

22. Non-conformance and corrective action reports

(d) Collection System Circuits:

1. Check of delivered cables and other materials

2. Trenching and cable installation inspection

3. Electrical cable and fiber optic cable splice inspections, including coordinates of splice locations

4. Trench backfilling inspection

5. Marker ball placement and inspection, including coordinates of the marker ball locations

6. Termination inspections (ground level, T-body and riser pole terminations)

7. Junction box inspection, including coordinates of cabinet locations

8. Directional boring inspection

9. Tile repair reports

10. Pad-mount / medium-voltage transformer installation inspection

11. Energization and testing procedures

12. Electrical testing and commissioning results, including commissioning checklists (VLF testing, Partial Discharge (PD) testing and Meggar testing)

13. Splice locations with marker balls and GPC coordinates

14. Junction box locations and GPS coordinates

15. Fiber OTDR testing

16. Installation of above ground cable markers inspection

17. Non-conformance and corrective action reports

(e) Project Substation:

1. Construction inspection documentation

2. Control building/switchgear inspection

3. Main Power transformer factory acceptance test

4. Control Building factory acceptance test

5. Main power transformer foundation installation inspection

6. Equipment foundation excavation, reinforcement, concrete placement, earthing installation, foundation backfilling inspection

7. Concrete cable trenches installation inspection

8. Fences and gates installation inspection

9. Substation yard earthing system installation inspection

10. Final grade level and backfilling inspection of substation yard

11. Relay functionality check

12. Energization and testing procedures

13. Electrical testing and commissioning results, including commissioning checklists

14. Communications validation and IT integration

15. Non-conformance and corrective action reports

16. Switching Procedures

(f) Interconnection Line:

1. Check of the delivered material

2. Check of pole coordinates and orientation

3. Pole drilling, reinforcement placement, concrete placement inspection

4. Pole, insulators and conductor's installation inspection

5. Construction inspection documentation

6. Energization and testing procedures

7. Electrical testing and commissioning results, including commissioning checklists

8. Non-conformance and corrective action reports

(g) Agreement certificates (e.g., Certificate of Access Road Completion).

(h) Other certifications:

1. Reinforcing steel mill certificates

2. Flange bolt certifications

3. Tooling calibration records and testing certificates

4. Rigging inspection reports

5. Welding certifications

6. Equipment receipt, inspection, and inventory reports

(4) **Wind Turbine Generator binders (One per Wind Turbine Generator):**

(a) Wind Turbine Generator Equipment receipt and visual inspection forms

(b) Certificate of Wind Turbine Generator Mechanical Completion

(c) Wind Turbine Generator punch lists

(d) Turbine Supplier assembly and erection checklists

(e) Anchor bolt tensioning logs, including 10% inspection

(f) Torque logs, including tower, nacelle, rotor, and rotor blades

(g) Wind Turbine Generator wiring testing results

(h) Wind Turbine Generator grounding testing results

(i) Service lift installation checklist (if applicable)

(j) Mechanical walk down inspections

(k) Wind Turbine Generator functional tests

(l) Wind Turbine Generator SCADA tests on completion

(5) **MET tower:**

(a) Check of the delivered material

(b) Foundation inspection report

(c) Instrumentation installation inspection

(d) Torque and bolt inspection

(e) Electrical connection inspection

(f) Grounding inspection

(g) MET tower commissioning report

(h) MET tower communication check

(6) **O&M Building:**

(a) Check of the delivered material

(b) Foundation excavation inspection including checks for foundation base level

(c) Reinforcement inspection

(d) Conduit and earthing installation inspection

(e) Concrete placement inspection

(f) Steel building installation inspection

(g) Brickwork inspection (if any)

(h) LV installation, including HVAC inspection

(i) Plumbing works inspection

(j) Fire suppression system inspection

(k) Emergency lighting system inspection (if any)

(l) Doors and windows installation inspection

(m) Plastering and painting inspection

(n) Roof works installation inspection

(o) Electrical equipment installation inspection

(p) Security system installation inspection

(q) Sanitary works installation inspection

(r) Outdoor perimeter works inspection

(7) **Handover Documents:**

(a) Roads completion certificates

(b) Wind Turbine Generator Foundation completion certificates

(c) Collection Circuit Completion Certificates

(d) Wind Turbine Generator Mechanical Completion Certificates

(e) Substation Completion Certificate

(f) Transmission Line Completion Certificate

(g) O&M Building Completion Certificate

(h) MET tower Completion Certificate

(i) MET tower Commissioning Certificate

(j) Wind Turbine Generator Commissioning Certificate

(k) Project Substantial Completion Certificate

(l) Project Final Completion Certificate

(m) All the associated punch lists

(n) All certificates of insurance

(o) Any third-party inspection reports

(p) All approved permits and utility permissions

(q) Partial and Final Lien Release Certificates

(r) Set of Project Record drawings

3.6 Quality Plan Requirements

3.6.1 This Section 3.6 sets forth an outline for the *minimum* contents and requirements of the Quality Plan to be prepared by Seller.

3.6.2 Quality Plan outline:

(1) **Overview:**

(a) Purpose and scope of quality assurance program

(b) Description of quality system procedures

(2) **Personnel:**

(a) Roles and responsibilities:

1. Project director(s)

2. Project manager

3. Quality manager

4. Safety manger

5. Environmental manger

6. Construction manager / site manager

7. Project engineer(s)

8. Superintendents and foremen

9. Testers / inspectors (including third parties)

(b) Organization chart (including all personnel listed in Section 3.6.2(2)(a) above)

(c) Reporting responsibilities:

1. Lines of authority

2. Communication procedures

3. Authority to stop work

(3) **Administration:**

(a) Document control:

1. Document control plan / procedure

2. Transmittal process, including naming convention

3. Document revision process / change management

4. Redlines and as-built documents

(b) Routine documentation procedures:

1. Daily, weekly, and monthly reporting

2. Incident reporting

3. Non-conformance reports

4. Technical clarifications / requests for information

5. Notice of design change process

6. Field design change process

7. Request for Information (RFI)

(c) Personnel training:

1. Requirements (competency / certification)

2. Records

(d) Quality meetings

(4) **Inspections, testing, and non-conformance:**

(a) Audits:

1. Schedule of audits

2. Audit personnel

3. Non-conformance reports

(b) Inspections (including frequency, duration, procedures, and documentation for each):

1. Tools and equipment

2. Materials

3. Field work (e.g., civil works, electrical works, structural works)

4. Field tests and laboratory qualifications

5. Checklists and installation procedures

(c) Non-conformance reporting

(d) Issues / conflict resolution process

(5) **Sample forms:**

(a) Non-conformance report

(b) Request for information

(c) Transmittal

(d) Inspections

3.6.3 Other Quality Plan requirements:

(1) The Quality Plan shall be specific to the Project and the Project Site.

(2) The Quality Plan shall be sufficient in scope and detail to convey the means and methods that will be employed by Seller to perform all aspects of the Work.

(3) The Quality Plan shall clearly communicate the anticipated actions of Seller in the event of defects or non-conformance of the Work, including corrective action.

3.7 Safety Plan Requirements

3.7.1 This Section 3.7 sets forth an outline for the *minimum* contents and requirements of the Safety Plan to be prepared by Seller.

3.7.2 Safety Plan outline:

(1) **General:**

- (a) Purpose and scope of safety program
- (b) Project Site description
- (c) Project Site map
- (d) Roles and responsibilities / key personnel / contact information

(2) **Project Site rules:**

- (a) Project Site / employee orientation
- (b) Project Site- and task-specific training
- (c) Stretching program
- (d) Firearms / weapons
- (e) Motor vehicle operation qualifications and requirements
- (f) Heavy equipment operation qualifications and requirements
- (g) Substance abuse program
- (h) Removal of employees
- (i) Subcontractor management
- (j) Badging requirements
- (k) Tours / third-party visits
- (l) Disruption avoidance plan
- (m) Incident notification procedures

(3) **Emergency procedures:**

- (a) Safety stand-down procedures
- (b) Explosion procedures
- (c) Severe weather procedures
- (d) Bomb threat procedures
- (e) Utility emergency procedures

(f) Civil disturbance procedures

(g) Tower rescue procedures

(h) Snake / insect bite and dangerous animals

(i) Spill control and prevention plan

(j) Evacuation procedures

(k) Emergency route map

(l) Emergency contacts and first responder list

(4) **Health and safety programs:**

(a) Job safety and environmental analysis (“**JSEA**”) program / pre-task planning

(b) Toolbox talks

(c) Personal protective equipment (“**PPE**”) requirements

(d) Fire prevention and suppress procedures

(e) Fall protection program

(f) Material Handling and Storage

(g) Welding and Cutting

(h) Walking / working surfaces

(i) Stairways and Ladders

(j) Scaffold standards

(k) Tower climbing program

(l) Crane and erection safety program

(m) Crane walking procedures

(n) Excavation and trenching program

(o) Hazard communication / hazardous materials program

(p) Electrical safety

(q) Lockout / tagout (“**LOTO**”) program

(r) Motor vehicle and traffic safety program

(s) Respiratory protection program

(t) Concrete safety program

(u) Confined space entry program

(v) Inspection / audit program

(w) Incident / injury reporting and investigation program

(x) Hand and power tool safety program

(y) First aid / CPR / medical response program

(z) Bloodborne pathogens

(aa) Permitted work requirements

(bb) Blasting requirements

(cc) Competency requirements

(dd) Hunting safety

(ee) Environmental program

(ff) Working on or near exposed energized parts

(gg) Deenergizing lines and equipment for employee protection

(5) **Required checklists and forms:**

(a) Accident / injury / incident report forms

(b) Site orientation training verification form – employee

(c) Site orientation training verification form – visitor

(d) Stretch and bend sign-in form

(e) Safety audit checklist

(f) Site inspection forms

(g) Critical lift planning forms and checklists

(h) Excavation inspection form

(i) Competency evaluation forms

(j) JSEA form

(k) Toolbox talk form

(l) Rigging inspection forms

(m) Hazardous materials inventory form

(n) Heavy equipment inspection forms (daily, monthly)

(o) Heavy equipment operator certification form

(p) Respirator compliance checklist

(q) Respirator fit test certification form

(r) Form of LOTO permit and extraction form

(s) Form of hot work permit

(t) Form of dig permit

(u) Form of blasting permit

(v) Form of confined space entry permit

3.7.3 Other Safety Plan requirements:

(1) The Safety Plan shall be specific to the Project and the Project Site.

(2) Seller is responsible for creating an energization and de-energization plan for safe operation. The Seller shall coordinate with all applicable parties to coordinate the energization plan. Site safety plans shall detail the process, roles, and responsibilities related to the energization procedure.

(3) Energization and de-energization plans shall be submitted to the Owner for review no less than 30 Business Days before the energization date. The Seller shall hold a meeting with all applicable parties before energization to walk through the energization/de-energization plans.

(4) The Safety Plan shall be sufficient in scope and detail to convey the means and methods that will be employed by Seller to perform all aspects of the Work.

(5) Seller shall be responsible to establish coordination with locally available hospitals and medical facilities to ensure that they will be supporting the project site for nay emergency needs. These details should be part of the site safety plan.

(6) All rigging shall be rated; inspected daily and monthly; and load tested in accordance with the Applicable Standards or other more rigorous requirements set forth in the Safety Plan. The manufacturer-rated capacities shall be legible and permanently affixed. Inspection reports shall be maintained at the Project Site and available for review by Owner. Copies of testing certificates and calibration records for all tooling shall be maintained at the Project Site and available for review by Owner.

(7) Seller shall conduct daily job hazard analysis meetings for each task to be performed in order to identify and mitigate potential hazards prior to beginning Work. Each such meeting shall be specific to the task and shall be conducted at the respective work area. A job hazard analysis form shall be completed daily for each such meeting.

(8) Seller shall conduct site safety orientation (approximately 2-3 hours) for all personnel working on the Project Site, including, but not limited to, Owner, Turbine Supplier, subcontractors, office personnel, and visitors, prior to their being released to work on the Project Site. In addition, there shall be a delivery driver orientation given to all delivery drivers that will visit the site. Personnel who have not attended the site safety orientation and environmental awareness training shall have escorted access around the project site.

(9) Seller shall indicate the minimum ratio of full-time safety representatives to total workers on Site, and provide at least two (2) full-time safety representatives at all times till the final completion of the project. In periods of low activity, these two HSE representatives will be on site on a standby basis. Seller will provide additional safety staff based on the number of employees on site. Seller shall, in all cases where the Seller, or Subcontractor(s) perform any Work during extended or weekend hours, have an HSE representative on-Site till such Work is completed.

(10) HSE representative should have a degree in Health and Safety or equivalent safety experience. Shall be fully dedicated to health and safety with at least half of their time being in the field to ensure adherence with the site safety plan is maintained. Shall have working knowledge of OSHA regulations as well as other applicable agencies related to safe work practices.

(11) Seller shall provide the Owner the weekly hours, number of orientations and incidents for the week on a weekly reporting schedule.

(12) Seller shall conduct daily safety plan of the day meeting at the beginning of each shift including a stretch program, which will occur at the office compound prior to dispatching to site work locations. This meeting can be completed in break-out groups by trade at the respective hob sites. Seller shall conduct a weekly all hands site safety meeting that includes all employees of each Seller for the entire site.

(13) Seller shall document weekly site health and safety inspections with all the corrective actions. Seller shall implement a documented audit program per quarter.

(14) Seller shall establish a Health and Safety Committee consisting of the EPC/BOP Seller and Subcontractor’s employees other than management personnel. The committee shall meet at least once per week and document meeting minutes and actions.

(15) Seller shall establish a weekly Site Safety Managers Meeting with published meeting minutes and actions. This meeting shall include the health and safety representatives from each Seller on site.

(16) Seller shall report incidents to Owner’s Site Safety Representative as soon as practically possible either verbally or electronically. Seller shall perform follow-up written incident investigations that will include recommended corrective actions within forty-eight (48) hours from incident occurrence and submit the investigation report to the Owner. Final reports are due to the Owner no later than ten (10) days after the incident.

(17) Seller shall liaise and coordinate with local emergency services, including coordination with local "life flight" to identify landing sites available for helicopter emergency evacuation of personnel. Seller will develop a written Emergency Management Plan (EMP) which shall include at a minimum injury response, environmental and weather risks. Two safety evacuation drills shall be conducted, one during early works and another prior to the completion of five (5) wind turbines. A report of these drills shall be submitted to Owner which shall include, at a minimum, a timeline of events and any areas that may need improvement.

(18) Seller shall perform all necessary emergency response drills, to be performed at least quarterly, including coordination with local emergency response officials and hospitals and incorporating the dispatch of ambulance and life flight to the Project Site.

(19) Seller shall immediately report all near misses, accidents, thefts, injuries (including first aid), and safety incidents to Owner's site manager and health and safety representative(s). A written incident report shall be submitted to Owner within 48 hours of each incident.

(20) Seller shall provide all necessary safeguards to ensure safety and security of, at a minimum, the Project Site, equipment, and personnel at the Project Site.

(21) Seller shall ensure medical and first aid. Review all Federal and State regulations for first aid kit and AED inspection and/or registrations. All sites shall have AEDs and personnel trained in their operation.

(22) Seller shall provide drug and alcohol testing for all injuries requiring more than first aid; if drug or alcohol use is reasonably suspected; in the event of equipment damage . Drug and alcohol testing shall be performed as soon after the event as reasonably possible.

(23) Training records shall be retained by the Seller for the duration of construction.

(24) Seller shall provide training for the following but not limited to, site evacuation and emergency awareness training, fall prevention awareness training, mobile equipment training, energy isolation training, confined space training, forklift training and reporting requirements.

(25) Seller shall conduct environmental Orientation shall be of an appropriate length (approximately 1 hour). This orientation shall include at the minimum, overview of the environmental regulatory obligations, including relevant site egals, review of the flora, fauna and archaeological restrictions and housekeeping and recycling requirements.

(26) Seller shall meet all safety program requirements of Owner, including Appendix A Contractor Health Safety and Environmental Requirements, and all changes to applicable law and Owner policies.

3.8 Cybersecurity Requirements

3.8.1 General Security Criteria

(1) Please confirm you have and maintain security controls to protect the Company's networks, systems, software, Confidential Information, and Data no less rigorous than those set forth in the latest published version of ISO/IEC 27001 – Information Security Management Systems–Requirements and ISO/IEC 27002 – Code of Practice for International Security Management.

(2) If providing a web portal or web service, please confirm that web services use HTTPS/TLS version 1.2 or later for all content.

(3) Please confirm you encrypt all Company data while at rest as well as when in transit over the network.

(4) Please confirm that all Company-related file transfers are encrypted while at rest as well as when in transit over the network.

(5) For responses above, please confirm all encryption uses NIST-approved algorithms and key lengths.

(6) Please confirm you support federated single-sign-on (SSO) authentication for any Company accounts, whether via web interface or mobile application. You must have the ability to support Azure Active Directory.

(7) If you do not support federated single-sign-on (SSO) authentication, please confirm that Accounts provided by you support multi-factor authentication compliant with NIST SP 800 63-3 Authentication Assurance Level 2. Provide documentation that supports compliance and describe supported authentication mechanisms.

(8) Please confirm, by provision of supporting documentation, that email sent while under the Contract to the Company by you or by any service: Originates from a domain(s) with a published Domain-based Message Authentication, Reporting and Conformance (DMARC) policy of "reject" and with a published Sender Policy Framework (SPF) policy consisting of valid senders and a "fail" directive (-all). If the optional DMARC "pct" directive is used, "pct" must be set to "100";

(9) Please confirm, by provision of supporting documentation, that email sent while under the Contract to the Company by you or by any service passes a Domain-based Message Authentication, Reporting and Conformance (DMARC) authentication check.

(10) Please confirm, by provision of supporting documentation, that email sent while under the Contract to the Company by you or by any service is signed by a DomainKeys Identified Mail (DKIM) 2048 bit key.

(11) Please confirm, by provision of supporting documentation, that email sent while under the Contract to the Company by you or by any service supports Transport Layer Security (TLS).

(12) Please describe your process to disclose known vulnerabilities to the Company related to products or services provided as they pertain to the proposed service.

(13) Please describe methods supplied to the Company to verify software integrity and authenticity for any software or patches provided by you as they pertain to the proposed service.

(14) Please describe your process for security event monitoring and notification/alert/response plans, including response to security incidents affecting the Company.

(15) Please confirm you will notify the Company of a security incident as soon as practicable, but no later than 48 hours after discovery.

(16) Please confirm you will coordinate responses to security incidents with the Company that pose a security risk to the Company.

(17) Please confirm that all rights to any data provided by the Company shall remain exclusive property of the Company.

(18) Please confirm you will not share data with third parties for unrelated commercial purposes, such as advertising or advertising-related purposes.

(19) If remote access of any type will be required as part of the service, please fully describe your requirements for remote access.

(20) If remote access of any type will be required as part of the service, confirm your ability to conform to Company requirements for intermediate host methods for remote access, such as Citrix or Virtual Desktop,

(21) If remote access of any type will be required as part of the service, and if a virtual private network is required, please confirm your ability to terminate in a demilitarized zone network (DMZ). Note that direct virtual private network connectivity to Company corporate networks is always prohibited.

(22) If remote access of any type will be required as part of the service, confirm that you will notify the Company when remote or on-site access is no longer needed by your representatives, where applicable.

(23) Please list facilities proposed in bid located outside the continental United States.

(24) Please list any support staff used during the term of this contract located outside the continental United States.

(25) Please confirm you will disclose third parties upon which you depend to deliver the Company offering (such as third-party software, implementation, hosting, for example).

(26) Please describe your methods to securely ship and deliver products to the Company as they pertain to the proposed service.

3.8.2 For Hosted or Cloud Services:

(1) If your service is comprised in whole or in part of a cloud-based or hosted services solution, please confirm you currently undergo, or are willing to undergo, annual Statement on Standards for Attestation Engagements (SSAE) Service Organization Control (SOC) 2 Type 2 audits ("Audit") for your enterprise or covering the scope of services for the term of the contract with the Company, as appropriate. Note that a datacenter audit alone will not be sufficient. You may include an audit for datacenter/colocation provider for informational purposes.

(2) If your service is comprised in whole or in part of a cloud-based or hosted services solution, please confirm that your administrative access complies with NIST SP 800 63-3 Digital Identity at Authentication Assurance Level 2 or higher, where compromise of one factor does not contribute to compromise of the other factor. Provide compliance documentation and describe supported authentication mechanisms.

3.9 Security Plan Requirements

3.9.1 This Section 3.9 sets forth an outline for the *minimum* contents and requirements of the Security Plan to be prepared by Seller.

3.9.2 Security Plan outline:

(1) General:

(a) Purpose and scope of security program

(b) Project Site description

(c) Project Site map

(d) Roles and responsibilities / key personnel / contact information

(2) Project Site security procedures:

(a) Controlled entry procedures

(b) Badging requirements

(c) Site / employee orientation

(d) Suspicious activity and unauthorized visitor procedures

(e) Security threats / emergency procedures

(f) Firearms / weapons

(g) Site security procedures

(h) Equipment security procedures

(i) Security guards and patrols

(j) Incident notification procedures

3.9.3 Other Security Plan requirements:

(1) The Security Plan shall be specific to the Project and the Project Site.

(2) The Security Plan shall be sufficient in scope and detail to convey the means and methods that will be employed by Seller to perform all aspects of the Work.

(3) Seller shall provide site passports to all project personnel for identification and daily site population tracking purposes. Site personnel shall keep their passports on their person at all times while onsite.

(4) All visitors shall check in with and receive a visitor pass from Security prior to entering the compound area. All visitor passes shall be returned to Security at the end of each day.

(5) A security office shall be located at the compound entrance and supplied with electricity and appropriate toilet facilities as required. The location of the security office shall allow for the security officer to view all persons entering and exiting vehicles without impeding traffic flow. Seller shall ensure that the Security Officer shall be provided a radio, cell phone and a vehicle.

(6) Seller, and Subcontractors shall ensure that their vehicles except for rentals on site temporarily, have placards or company insignias.

3.10 Foundation Inspection Reports

3.10.1 A Foundation Inspection Report shall be provided for each Turbine Foundation excavation and every drilled pier constructed (if any). Each report shall include the following minimum information:

(1) Information on the foundation excavation, including, but not limited to, date, ambient air temperature, line name, structure number, location, structure type, foundation type, size and condition (e.g., dry excavation, casing, slurry) of excavation, soil conditions, depth to rock, depth to water, and method of disposal of excavated/displaced material.

(2) Concrete and concrete placement information, including, but not limited to, concrete supplier, concrete mix number, batch tickets (including batch time), number of cubic meters placed (including time of placement for each truck), concrete temperature, results of concrete testing, name of person performing concrete testing, number of test cylinders cast, placement and compaction method (e.g., free fall, tremie, slurry displacement, pumped), curing measures, and protection against freezing or heat.

(3) A delivery ticket shall be prepared for each load of concrete delivered, including, but not limited to, the number of cubic meters delivered, the quantities of each material in the batch, the ambient temperature at the time of delivery, the time at which the cement was added, the amount of water able to be added at the pour site, and the numerical sequence of the delivery. The delivery ticket shall be handed to the authorized representative of Seller by the truck operator at the time of delivery, and a copy of each delivery ticket shall be included in the Foundation Inspection Report.

3.11 Rigging and Tooling

3.11.1 All rigging shall be rated; inspected daily and monthly; and load tested in accordance with the Applicable Standards or other more rigorous requirements set forth in the HSSE Plan (as defined in this specification). The manufacturer-rated capacities shall be legible and permanently affixed. Inspection reports shall be maintained at the Project Site and available for review by Owner.

3.11.2 Copies of testing certificates and calibration records for all tooling shall be maintained at the Project Site and available for review by Owner.

3.12 Fencing, Walls, and Gates

3.12.1 All permanent fencing and gate materials, including for the Project Substation, O&M Building, and meteorological towers, shall be galvanized in accordance with ASTM A392.

3.12.2 Unless stated otherwise, fencing shall be 8-foot-high (7-foot fence plus 1-foot barbed wire), anti-climb, chain link, grounded, perimeter fencing. Fencing fabric shall be woven into a 2-inch galvanized diamond mesh.

3.12.3 Barbed wire shall be a minimum of 2-strand, #12-1/2 steel wire gauge with 4 half-round barbs of #14 steel wire gauge at 5-inch spacing. After weaving, the wire shall be galvanized per ASTM A121. Barbed wire fencing posts shall be galvanized, standard-weight steel pipe. At least three (3) lines of barbed wire shall be provided when used.

3.12.4 Unless stated otherwise, or as necessary to complete the Work, gate widths shall be consistent with road widths, wherein all gate posts shall be set outside of the road width area.

3.12.5 Sufficient space and graded area shall be provided near each gate to allow truck turning.

3.12.6 All corner posts and gate posts shall be set (embedded) in concrete.

3.12.7 All gates shall be designed to adequately contain livestock without being pushed open, bending, or otherwise failing. Further, all gates shall be designed to adequately prevent opening due to wind conditions expected at the Project Site.

3.12.8 A gate shall be installed at every location where a roadway penetrates an existing fence line at the Project Site. Each such gate shall be a double-hung, prefabricated, finished metal gate. Each such gate shall be a minimum 40-feet-wide manual swing gate during construction and downsized to 20-feet-wide swing gate for operations with a pipe frame and manufacturer's standard coating finish; complete with hinges and latching hardware; complete with a metal hinge post and removable center post; lockable; and each gate post shall be a heavy metal square or round set in concrete.

3.12.9 Cattle guards shall cover the full road width and be installed level and provided with a stable base capable of sustaining heavy loads without shifting or settling.

3.13 Signage

3.13.1 The Seller shall erect directional and access signage on each access road intersection in accordance with the Seller's traffic management plan

3.13.2 Temporary signage shall be legible and of sufficient durability to last the duration of construction activities.

3.13.3 Temporary signage shall be approved by Owner prior to installation.

3.13.4 All signage and equipment marking (including numbering and labeling) are subject to approval by Owner.

3.14 Dust Control

3.14.1 Water used for dust control shall be treated to ensure no negative impacts to human health and ecology, including downstream environments.

3.15 Temporary Facilities

3.15.1 Seller shall furnish and install one (1) 24-foot by 60-foot double-wide office trailer for Owner's exclusive use. Each trailer shall be located at the laydown yard and shall be installed and ready-to-use no later than the Seller mobilization date.

(1) Each trailer shall include at least four (4) offices, and Seller shall furnish each such office in Owner's trailers with two (2) desks, two (2) two-drawer file cabinets, two (2) rolling arm chairs, two (2) visitor chairs, and one (1) 2-foot by 3-foot white board.

(2) Each trailer shall include at least one (1) conference area, and Seller shall furnish each such conference area in Owner's trailers with six (6) 8-foot-long tables, 16 chairs, and one (1) 4-foot by 6-foot white board.

(3) Each trailer shall include at least one (1) unisex restroom, each complete with running water, one (1) flushable toilet, and one (1) flushable urinal.

(4) Each trailer shall include at least one (1) full-size drawing table, one (1) full-size drawing rack, and two (2) 4-foot by 6-foot bookshelves, respectively.

(5) Each trailer shall include one (1) full-size refrigerator with freezer and one (1) full-size microwave. All appliances shall be new and unused.

(6) Each trailer shall be furnished with central HVAC.

(7) Each trailer shall be furnished with at least one (1) first aid kit and one (1) fully-charged fire extinguisher, respectively. Seller shall maintain and recharge such fire extinguishers throughout the duration of the construction activities, as required.

(8) Seller shall provide and install phone service, broadband internet service, electric service, and running water for each Owner trailer, including connection of all communications (phone and internet) to the jobsite. Phone service shall include at least one (1) four-line phone system up to the wall jacks in each trailer. Internet service shall include high-speed internet infrastructure wiring up to the wall jacks in each trailer and high-speed wireless internet service (wifi) throughout the trailer compound, respectively. All utility services shall include use and service charges to Seller's account, including for Owner's trailers.

(9) Seller shall furnish bottled water and ice in each Owner trailer and for Owner's exclusive use throughout the duration of the construction activities.

(10) Seller shall provide daily cleaning services within each Owner trailer throughout the duration of the Work. This shall include cleaning restrooms and trash collection, pickup, and removal, respectively.

3.15.2 Reserved.

3.15.3 Seller shall provide separate office trailers for his own use (including for Turbine Vendor). Seller shall be solely responsible for furnishing his trailer(s), including any utility services.

3.15.4 Seller shall furnish, install, and maintain portable chemical toilets for use by site construction personnel, including Owner, Turbine Vendor, and subcontractors. This shall include cleaning (at least weekly), emptying, and disposal of such toilets through substantial completion of the Project or Seller demobilization, whichever occurs last. Following such date, Seller shall remove all such toilets from the Project Site.

3.15.5 Seller shall design, permit, furnish, construct, and maintain, as required, any temporary fuel containment facilities required to support ongoing construction activities. This shall include removal of all such facilities following substantial completion of the Project or Seller demobilization, whichever occurs last.

3.15.6 Seller shall design, permit, furnish, construct, and maintain (including disposal), as required, any hazardous materials/waste facilities required to support ongoing construction activities. This shall include removal of all such facilities following substantial completion of the Project or Seller demobilization, whichever occurs last. Seller shall provide Owner with a copy of all hazardous material manifests.

3.15.7 As required to perform the Work, Seller shall procure, permit, install, construct, and maintain batch plant(s) at the Project Site, including all necessary labor and materials related to the operation of the batch plant, and removal of the batch plant at the conclusion of the Work. The batch plant shall be removed from the Project Site by Seller within 30 days of the Project Substantial Completion date. Power to operate the batch plant shall be the sole responsibility of Seller.

3.15.8 As required to perform the Work, Seller shall procure, permit, install, construct, and maintain fixed and/or mobile rock crusher(s) at the Project Site, including all necessary labor and materials related to the operation of the rock crusher(s), and removal of the rock crusher(s) at the conclusion of the Work. The location of any fixed rock crusher(s) shall be at the temporary facility areas, and the location of any mobile rock crusher(s) shall remain within the designated disturbance areas. Power to operate the rock crusher(s) shall be the sole responsibility of Seller.

3.15.9 Seller shall design, furnish, construct, install, and maintain one (1) temporary laydown yard.

(1) Seller shall incorporate into the design and construction of the laydown yard any space required by Turbine Vendor for storage or other purposes.

(2) Seller shall furnish and maintain a system of temporary lighting for use in the Project laydown yard and other construction areas where required. All temporary lighting shall be removed at the completion of construction.

(3) Fencing and gates are not required for the laydown yard, however Seller is responsible for all security.

3.16 Debris

Seller's obligations under this Section 3.16 of this Exhibit is subject to Section 2.15 of the Agreement.

3.16.1 Seller shall assume ownership of all construction-related debris and unsuitable materials, and each shall be removed from the Project Site and be properly disposed of by Seller.

3.16.2 Seller shall maintain a continuous and regular clean-up program to avoid accumulation of debris, waste, wreckage, and/or rubbish within the Project Site resulting from the Work and shall maintain the Project Site in a neat and orderly condition throughout the performance of the Work.

3.16.3 Seller shall provide all trash collection, pickup, and removal related to the Work, including within Owner's office trailers and other temporary facilities, and including disposal of cable reels. Dumpsters and trash receptacles shall be provided in sufficient quantities and with sufficient volume to support timely trash removal from the Project Site and preclude windblown trash generated during construction activities. Dumpsters and trash receptacles shall have lids and be emptied at a reasonable frequency to prevent overflowing or accumulation of trash around the dumpster or receptacle.

3.16.4 Seller shall cause its subcontractors, employees, and other representatives to refrain from littering at or within the Project Site, or within other areas (including along public roadways) used in conjunction with the Work.

3.16.5 Seller shall use lined washout pits, washout dumpsters, or other suitable means to contain the excess concrete and runoff from the cleaning of concrete trucks. All washout waste shall be properly disposed of off-Project Site by Seller in accordance with the Technical Specifications.

3.17 Project Site Closeout and Restitution

3.17.1 Seller shall remove all tools, equipment, surplus materials (including unused or useless materials), waste materials, temporary work (including temporary erosion control features), temporary buildings, temporary facilities (including batch plants, rock crushers, and office trailers), and rubbish from the Project Site prior to final completion, and shall cause any facilities used by Seller during the performance of the Work to be restored to the same or better condition that such facilities and the Project Site were in on the date the Seller commenced work at the Project Site, ordinary wear and tear excepted.

3.17.2 Seller shall perform restitution, restoration, and/or reclamation of Work areas to include, but not limited to, the following. Notwithstanding anything that follows, all Work areas at the Project Site shall be restored in accordance with the requirements set forth in the Applicable Permits, the SWPPP, and the other Technical Specifications, as appropriate.

(1) Clean all drains and ditches at completion of the construction Work and leave the Project Site in a neat and presentable condition wherever construction operations have disturbed the conditions existing at the time of starting the Work.

(2) Preserve and/or restore to their pre-construction condition all land and water resources adjacent to construction areas.

(3) Notwithstanding the following paragraph (a), WTG Pads, laydown areas, roadway shoulders, and roadway turning radii shall be de-compacted and reclaimed, including proper grading, aggregate touchup, and seeding with an approved mixture.

(a) Crane pads shall be preserved in a suitable manner to support the use of cranes in ongoing WTG maintenance activities following construction (e.g., cranes required for gearbox removal and / or installation).

(4) Re-dress all road surfaces within the Project Site.

(5) Seed all cut / fill slopes utilizing an approved seed mixture.

(6) Fill all depressions and water pockets caused by construction operations and remove all obstructions within waterways.

(7) Spread surplus fill on-Project Site.

(8) Spread recovered aggregate from laydown yard within approved disturbance limits.

(9) Collect large rocks or boulders unearthed during excavation as part of the Work but not utilized in the construction of the Project and store at the Project Site.

4.0 LOGISTICS SERVICES

4.1 Transportation and Delivery

4.1.1 Seller shall furnish and deliver all Equipment to the Project Site.

4.1.2 Seller shall perform all Job Site clearing necessary for the transportation of Equipment to the Project Site, including, but not limited to, tree trimming / removal and clearing of overhead obstructions.

4.1.3 Seller shall, as required by Applicable Permits, upgrade and maintain public roads, bridges, and culverts as required for the transportation of Equipment to the Project Site and including obtaining any necessary permits.

4.1.4 Seller shall furnish and operate assist vehicles (i.e., prime movers) as necessary for delivery and movement of Equipment at and within the Project Site and as needed to traverse steep grades.

4.1.5 Seller shall inspect all delivery trucks upon arrival to the Project Site to ensure they are free of debris, mud, and vegetation, and to ensure they are in good mechanical condition. Seller shall also regularly inspect trucks and other equipment for oil leaks. Any vehicles that fail to pass this inspection shall be turned away.

4.1.6 Seller shall complete a haul route review for WTG deliveries at the Project Site to demonstrate that road dimensions will be appropriate for successfully delivering components from the Project Site entrance to the WTG Pads in the most critical points in terms of access. The review shall be completed prior to commencing deliveries of WTG equipment to the Project Site, and shall be coordinated between the Turbine Vendor, Owner, and Other Owner Sellers.

4.2 Offloading

4.2.1 Seller shall receive, visually inspect, and inventory all equipment and material deliveries to the Project Site. Seller shall submit reports to Owner within 24 hours of delivery for all Major Equipment or Service regarding receipt, inspection, and inventorying of all such deliveries, including any damage identified.

4.2.2 Seller shall furnish all rigging, tooling, hoisting equipment, lifting devices, and other similar items necessary to offload the equipment.

4.2.3 Seller shall offload all equipment at the Project Site. Seller shall offload and stage all WTG deliveries at the WTG Pad location nearest each WTG.

4.2.4 Seller shall furnish and maintain protective tarps to eliminate unwanted materials from entering WTG equipment after removal of shrink wrapping.

4.2.5 Seller shall furnish and install adequate measures to prevent WTG equipment from being blown over or otherwise damaged while stored at the Project Site. This shall include tie down of blades and other similar measures.

4.3 Coordination

4.3.1 Seller shall actively coordinate the sequence of Work with Owner and Other Owner Sellers to support the Project Schedule.

4.3.2 Seller shall coordinate with all transportation Sellers to mitigate congestion within the Project Site. Seller shall provide directions to the Project laydown yard to all heavy load transportation vehicles upon arrival to the Project Site and, if required by the transportation plan, Seller shall provide an on-Project Site vehicle escort for all such deliveries to the respective delivery location(s).

4.3.3 Seller shall coordinate with local utilities, railroad, and pipeline companies to facilitate crossings and interconnections necessary to perform the Work.

5.0 GEOTECHNICAL WORK SPECIFICATIONS

5.1 General Provisions

5.1.1 All geotechnical, geophysical, and other similar subsurface investigations and testing described herein shall be completed before commencing the applicable Work.

5.1.2 The geotechnical engineering report shall be utilized for the design and construction of all Project structures, including Turbine Foundations. All foundations shall be designed with consultation of a licensed geotechnical engineer.

5.1.3 The maximum loads (including load factors) applied to the foundations and used for design shall be determined from the structure design of the supported structure considering load cases and Applicable Standards associated with the structure type.

5.1.4 Foundation designs shall neglect or degrade soil strength properties at the top of the foundation as a result of frost or disturbance during drilling per recommendations of the geotechnical engineer.

5.1.5 The Project Site premises shall at all times remain free from accumulations of waste materials or rubbish resulting from the subsurface investigations.

5.1.6 All field investigations and all laboratory testing shall comply with the Applicable Standards, including the most current, applicable ASTM standards.

5.2 Field Investigations

5.2.1 Geotechnical borings and material sampling shall be provided at the following minimum frequencies:

(1) Wind Turbine Generators: each Wind Turbine Generator location.

(2) Project Substation: minimum of five (5) locations at the Project Substation.

(3) Interconnection Line: each angled and dead-end structure, respectively, as well as any additional borings and samplings necessary to ensure that adjacent borings are no more than one (1) mile apart.

(4) O&M Building: minimum of one (1) location at the O&M Building.

(5) Meteorological towers: each free-standing meteorological tower location.

5.2.2 Geotechnical borings and material sampling shall be provided at the following minimum depths:

(1) All borings: minimum depth of 35 feet below base of foundation, or greater if specified below.

(2) Wind Turbine Generators: minimum depth of at least one (1) foundation diameter for spread footer foundations, or minimum depth of at least 10 feet beyond the anticipated depth of the foundation at such location (including anchors, if applicable) for rock anchor foundations.

(3) Project Substation: to a minimum depth necessary to provide sufficient information for the data and recommendations required in the geotechnical engineering report.

(4) Interconnection Line: to a minimum depth necessary to provide sufficient information for the data and recommendations required in the geotechnical engineering report.

(5) O&M Building: to a minimum depth necessary to provide sufficient information for the data and recommendations required in the geotechnical engineering report.

(6) Meteorological towers: to a minimum depth necessary to provide sufficient information for the data and recommendations required in the geotechnical engineering report.

5.2.3 Sufficient rock core samples shall be obtained from each boring to adequately characterize and test the material, including coring from the point at which competent rock is encountered and until the appropriate boring depth is achieved (at a minimum). All core samples shall be delineated and digitally photographed in color. Unaltered rock core samples shall be placed in a core box and taken to a laboratory for analysis.

5.2.4 Additional geotechnical and geophysical investigations shall be performed as necessary to adequately describe and characterize the Project Site materials and provide the data and recommendations required in the geotechnical engineering report. These shall include, but not be limited to, standard penetration tests, and Shelby tube samples, additional borings, test pits, seismic refractions, cone penetrometer soundings, *in situ* testing, and other similar or related methods.

5.2.5 If using rock anchor foundations, a rock analysis shall be performed to identify the presence of fissures, rock joints, or other discontinuities that will control the overall strength of the rock mass, including, but not limited to, rock mass rating, rock classifications, depth of overburden, rock quality designation, joint spacing and orientation, stratifications, rock material strength, and water pressure in joints.

5.2.6 Soil resistivity testing shall be completed using the Wenner Four-Electrode method.

5.2.7 Existing utilities in the vicinity of borings or other subsurface test locations shall be identified and protected.

5.2.8 Borings shall be backfilled with cement-bentonite grout and in a manner and with materials required under the applicable laws of the location of the Project Site. Excess cuttings shall be disposed of by Seller in accordance with the applicable Requirements and subject to Owner approval.

5.2.9 Borings shall be drilled using methods that minimize the potential for disturbance, sloughing or mixing of materials within samples. When water is encountered in a hole in cohesionless materials, rotary wash drilling methods with bentonite or polymer slurry shall be used, maintaining a positive head in the borehole at all times.

5.2.10 Unless explicitly stated otherwise, all rock core sampling shall be complete, full-boring-length samples. Such coring shall span from the point at which competent rock is encountered and until the appropriate boring depth is achieved (at a minimum).

5.2.11 All core samples shall be delineated and digitally photographed in color. Unaltered rock core samples shall be placed in a core box and taken to a laboratory for analysis.

5.2.12 Seller shall obtain 24-hour water level readings in boreholes or install piezometers for long-term water level readings as required to determine prevailing groundwater levels.

5.2.13 A geologic review should consist of a review of the geologic data along the Project alignment. This review should identify and document areas of landslides, potential landslides, potential geologic hazards, past (historical) earth movements, and transitions between geologic units. Special consideration should be given to identify active and potential landslide zones.

5.3 Lab Testing

5.3.1 All testing described herein shall be performed by an independent, experienced third party.

5.3.2 Laboratory testing shall be sufficient to provide the data and recommendations required in the geotechnical engineering report, at a minimum. Laboratory testing shall include chemical testing to evaluate corrosion potential and to determine the required cement type for concrete.

5.3.3 At a minimum, laboratory testing shall include the following:

(1) Moisture content (ASTM D2216).

(2) Grain size analysis (per ASTM D422).

(3) Atterberg limits (per ASTM D4318).

(4) Maximum soil density (per ASTM D4253).

(5) Specific gravity (per ASTM D854).

(6) Compaction characteristics of the soil (per ASTM D698 or ASTM D1557 A).

(7) Unit weight determination (per ASTM D653).

(8) Core recovery percentage and rock quality designation when rock is encountered.

(9) Perform multi-channel analysis of surface wave tests.

(10) Soil resistivity testing (per ASTM-G57-95a). Results to be submitted in **Ω**-cm.

(11) Direct shear angle.

(12) Cohesion constant.

(13) Unconfined compressive strength (per ASTM D2166).

(14) Unconsolidated undrained (UU) triaxial compression (per ASTM D2850).

(15) Consolidation test parameters (per ASTM D2435).

(16) Soil corrosiveness (chloride, sulfate, and pH).

(17) California bearing ratio.

(18) Dry and wet densities.

5.4 Submittals

5.4.1 The geotechnical engineering report shall contain the following, at a minimum:

(1) Boring location drawings and coordinates.

(2) Field photographs.

(3) Description of the drilling and sampling program.

(4) Final boring logs.

(5) Description of the geology.

(6) Subsurface and groundwater conditions encountered.

(7) Summary of results of field and laboratory tests performed.

(8) Foundation recommendations (as further described in Section 5.4.2 below).

(9) Specific design criteria for the Project (as further described in Section 5.4.2 below).

5.4.2 Seller's design criteria shall address the following items, as a minimum:

(1) Impacts of new construction on existing facilities.

(2) Factors of safety used in determining allowable foundation loads.

(3) Recommended foundation types for all structures.

(4) Discussion of the dynamic soil properties at the Project Site, including dynamic shear modulus, Poisson's ratio, Young’s Modulus, and shear wave velocity.

(5) Recommendations for designing for seismic issues, including liquefaction potential. Identify the building code site coefficient/site classification for seismic design.

(6) Recommendations for site dewatering and construction practices, including design water level.

(7) For shallow foundations:

(a) Allowable soil bearing values and minimum bearing depths

(b) Anticipated total and differential settlements

(c) Uplift resistance

(d) Lateral resistance

(e) Subgrade modulus

(f) Dynamic spring constants for foundations supporting vibrating machines, if applicable

(8) For deep foundations:

(a) Type of deep foundation (e.g., drilled shaft, rock anchor)

(b) Diameter (or dimensions) and depth of foundation members

(c) Minimum spacing and group reduction factors

(d) Allowable compressive, uplift, and lateral capacities, including allowable skin friction and end bearing capacities

(e) Anticipated settlements and lateral deflections

(f) Static and dynamic spring constants

(9) For retaining structures:

(a) Active, passive and at-rest earth pressures for both drained and undrained conditions and requirements for type of backfill

(b) Required rotation or translation to mobilize active and passive pressures

(c) Recommendations of methods to insure drained conditions

(10) Recommendations for slopes:

(a) Temporary excavation slopes and OSHA soil types

(b) Permanent slopes

(11) Temporary and permanent excavation support requirements

(12) Corrosion potential and chemical attack to construction materials

(13) Recommended cement type in concrete and corrosion protection for buried steel, based on chemical test results. Recommended cement type shall be based on soluble sulfate content in the soil and ACI recommendations.

(14) An evaluation of the expansive, dispersive, and collapsing nature of the on-Site soil materials and discussion of design features to resist these tendencies.

(15) Recommendations for earthwork requirements including acceptable fill materials, moisture contents, compactive effort, lift thickness, proofrolling, equipment, and compaction testing.

(16) Recommended aggregate gradations for general fill, load bearing fill, granular road base, and granular surfacing.

6.0 CIVIL WORKS SPECIFICATIONS

6.1 General Provisions

6.1.1 All civil works design shall conform to Turbine Supplier's requirements for roads, crane pads, and hardstands (the "**Turbine Supplier Project Site Requirements**").

6.1.2 Seller is responsible for all surveying, layout and control work, including establishing and maintaining survey control points for the duration of the Work and conforming to Owner provided ALTA survey.

6.1.3 Seller shall be using the excavated topsoil and excavated material for final dressing of the site. Any additional topsoil, vegetation, organic material, rock, earth, sand and debris shall be removed and disposed by the Seller as per approved procedures and permit requirements. Soils shall not be relocated throughout the project site, unless approved by Owner.

6.1.4 Seller is responsible for restoring all temporarily disturbed areas prior to the completion of the Work. This shall include all crane paths, crane pads, lay down areas, storage areas, road shoulders, collection system trenches, temporary access roads, etc. which should be fully remediated including decompaction as necessary.

6.1.5 Seller is responsible for ensuring, in agricultural areas (wheat, hay, and other actively farmed fields), that all backfill areas impacted by the Work are free of rock to a minimum depth per landowner and environmental agreements.

6.2 Design Working Life

6.2.1 The design working life of the civil works shall be a minimum of 30 years.

6.2.2 The design of the civil works shall be consistent with the following storm events:

(1) Roadways (including all drainage facilities, such as swales and culverts) shall be designed for a 25-year, 24 hours storm event, while being able to safely convey a 100-year, 24 hours storm event.

(2) Wind Turbine Generator Pads shall be designed to withstand a 100-year, 24-hour storm event.

6.3 Project Site Preparation

6.3.1 Project design shall consider existing Project Site conditions with respect to, at a minimum, soil characteristics, permit conditions, site clearing, grading, and drainage including existing floodplains and floodways.

6.3.2 Clearing and grubbing requirements:

(1) Clearing, grubbing, removing and disposing of all vegetation and debris shall be understood to include felling and disposal of trees, brush, and other vegetation within the project limits as shown on the design drawings or as designated by the Owner

(2) Verify limits of clearing and features designated to remain, are clearly labeled and tagged prior to start of work; resolve any areas of confusion prior to start of work.

(3) Stripping shall be understood to consist of excavation and removal of all topsoil and organic matter.

(4) Topsoil shall be stockpiled for later use during landscape reclamation activities. Topsoil shall be stockpiled only in areas designated where it will not interfere with construction operations or existing facilities. Stockpiled topsoil shall be reasonably free of subsoil, stumps, roots, debris, and stones larger than two (2) inches in diameter. Topsoil shall not be used as structural fill. Appropriate erosion control measures shall be utilized on stockpiled topsoil. If the topsoil strata are such that there are more than 2 distinct layers impacted, then each layer shall be stockpiled separately and returned in reverse order, unless agreed upon in writing with Owner.

(5) Debris, rubbish, shrubs, organic matter, and vegetation from developed areas shall be grubbed and removed from the Project Site in accordance with applicable permit instructions and other pertinent Requirements. Burning or burying of materials on site shall not be permitted unless otherwise specified. No fill shall be placed in wetlands, environmentally or culturally sensitive areas unless a permit/approval has been received to do so.

(6) Root mats and stumps shall be completely removed from the Project Site construction areas, holes refilled with select material and compacted adequately for the ultimate expected loading for the material used and graded to drain. Any pockets of organic laden soils, and/or deleterious materials should be excavated to competent soils before proof rolling and placing structural fill.

(7) Except in areas to be excavated, backfill stump holes and other holes from which obstructions are removed, with suitable materials, and compact in accordance with contract documents.

6.3.3 Removal of or damage to trees without written approval of Owner is prohibited outside the designated disturbance areas. Trees shall be adequately protected, including protecting tops, trunks, and roots of existing trees at the Project Site which are to remain, as follows:

(1) Box, fence around, or otherwise protect trees before any construction Work is started.

(2) Do not permit heavy equipment or stockpiles within branch spread (dripline) of trees.

(3) Trim or prune to obtain working space in lieu of complete removal when possible. Conduct operation as follows:

(a) With experienced personnel

(b) Conform to good horticultural practice

(c) Preserve natural shape and character

(d) Protect cuts with Owner-approved tree paint

(4) Grade around trees as follows:

(a) Trenching: where trenching is required around trees which are to remain, avoid cutting the tree roots by careful hand tunneling under or around the roots. Avoid injury to or prolonged exposure of roots.

(b) Raising grades: where existing grade at a tree is below the new finished grade and fill not exceeding 15 inches is required, place 1 to 2 inches of clean, washed gravel directly around the tree trunk. Extend gravel out from trunk on all sides at least 20 inches and finish 2 inches above finished grade at tree. Install gravel before earth fill is placed. Do not leave new earth fill in contact with any tree trunks.

(c) Lowering grades: re-grade by hand to elevation required around existing trees in areas where new finished grade is to be lower. As required, cut the roots cleanly 3 inches below finished grade, and cover scars with tree paint.

(5) Remove when damage occurs and survival is doubtful, following approval by Owner.

(6) Replace with similar item when damaged through carelessness and so requested by Owner.

6.3.4 All underground utilities, pipelines, and other buried facilities shall be located and marked before construction activities, and such items shall be appropriately considered in the Project design.

6.4 Blasting

6.4.1 Blasted material shall be crushed and screened for use as fill on access roads and in other areas of the Project Site assuming the aggregate meets the appropriate geotechnical specifications for this application. Seller shall be responsible for verifying that the quantity and quality of such rock is suitable for use as aggregate at the Project Site.

6.4.2 Controlled blasting will be used to create a precise rock profile without significant final surface irregularities.

6.4.3 Owner shall be notified prior to the use of explosives at the Project Site, and such blasting shall be completed, at a minimum, in accordance with the applicable permits and Seller-furnished blasting plan.

6.4.4 Seller shall prepare blasting plans and procedures for all blasting work to be performed at the Project Site, as required. Such plans and procedures shall include, at a minimum, a description of safety buffer zones, parameters for blasting times during the day and approved certification as required from the authority having jurisdiction, technical report to define detailed parameters, define blast hole alignment, locations, diameters, quantity required, drilling slope and depth, type of explosive, quantity of explosive, blasting sequence, features of fuses, detonators, delayers, triggers and any other special devices.

6.4.5 When the use of explosives is necessary for the Work, Seller shall use the utmost care not to endanger life or property and shall comply with all applicable laws and other Requirements and conduct the necessary advance notifications.

6.4.6 Under no circumstance shall caps or other exploders or fuses be stored, transported, or kept together with powder.

6.4.7 All explosives shall be handled in a secure manner, and all such storage places (if permitted) shall be marked clearly “DANGER - EXPLOSIVES” or as otherwise required by law.

6.4.8 All permits and licenses required for blasting shall be obtained, paid for, and maintained by Seller.

6.4.9 Blasting shall be performed only by persons who are qualified, competent, and thoroughly experienced in the use of explosives for rock excavation.

6.4.10 Charge holes shall be located properly and drilled to correct depths for charges used.

6.4.11 Charges shall be limited in size to the minimum required for reasonable removal of material by excavating equipment.

6.4.12 Excessive overbreak or damage to adjacent structures, exposed cut slopes, equipment, utilities, or buried pipeline and conduit shall be avoided as follows:

(1) With properly designed pattern

(2) By use of Owner-approved explosion mats

6.4.13 Blasting near utilities, pipelines, or facilities (buried or above-ground) shall be subject to approval of owning agency and Owner.

6.4.14 Before delivery of any explosives to the Project Site, Seller shall have obtained a blasting endorsement on their public liability and property damage insurance policy.

6.4.15 Seller shall control debris resulting from blasting, including minimizing, to the extent practicable, the size of said debris. Seller shall use the utmost care not to endanger life or property, and to comply with all applicable laws and conduct the necessary advanced notifications.

6.4.16 Blast mats shall be utilized as required in sensitive areas, including, but not limited to, archeologically sensitive areas, environmentally sensitive areas, existing Project Site facilities, and other Project infrastructure.

6.5 Excavation, Filling, and Backfilling

6.5.1 Different types of excavations based on the type and consistency of soil and rock are provided by the design and/or as requested by Owner. The Seller shall provide his own excavation plan for any excavation activity and shall submit it to Owner for approval before commencing any work. The excavation plan shall contain all the relevant information detailing the means, procedures and scheduling to implement the excavation activities, any environmental conditions and geotechnical characteristics. The Seller shall update the excavation plan as the work progresses.

6.5.2 The excavation plan for all working locations shall include the excavation procedure, type and transport of all the earthmoving equipment, any type of shoring or reinforcement that may be needed for supporting the excavation walls, drainage measures and procedures, blasting procedures, stockpiling and storage procedures for reusable excavated material, detailed work schedule.

6.5.3 Stability of excavation sides shall comply with local codes, ordinances and requirements of agencies having jurisdiction. Shore and bracing are permitted in case of space restrictions or depending on stability of the excavated material. Remove shoring carefully to prevent caving or collapse of excavation. The sides and slopes of the excavation shall be maintained in safe condition until backfilling is complete.

6.5.4 Materials suitable for use as fill at the Project Site shall include only materials that are free of debris, roots, organic matter, frozen matter, coal, ashes or cinders, and as recommended by the geotechnical engineering report.

6.5.5 All excavations shall be maintained in a safe, clean, and sound condition up to the time of concrete placement. The stability of all excavations shall be maintained by providing adequate sheeting, shoring, and bracing to support any lateral earth pressure. Stability considerations shall include the surrounding land surfaces that may impact the Project or nearby improvements. Sheeting, shoring, and bracing shall be removed as backfilling proceeds.

6.5.6 Permanent slope and rock stability measures shall be part of the Project design and shall incorporate the recommendations and requirements set forth in the geotechnical engineering report. Safe stabilization for all slopes, regardless of the type of rock or soil conditions, shall be guaranteed including protection of all personnel and structures against any damage from cave-ins, heaving, or other earth movements.

6.5.7 All structure foundations shall be surveyed and staked prior to excavation. The methods of staking and final alignment of the concrete caisson, anchor bolts, reinforcing steel, stub angles, and embedment sections shall be designed such that the finished condition of the Work meets the requirements for alignment, position, elevation, and rotation.

6.5.8 Seller shall be responsible for locating buried utilities and other underground obstructions prior to any excavation. For underground gas and oil pipelines, it may be required, that the pipeline owner be on site always while the work is occurring within the pipeline easement. Seller shall coordinate such activities with pipeline owners prior to starting work so that the project schedule is not impacted. Excavation by hand tools without any mechanical means shall occur when it is not possible to proceed with earthmoving machines, or a special precision and/or care is needed to avoid any damage to existent underground cables, pipes, sewers, equipment's, objects and manufactured items in general, or other special situations. The Seller shall bear the full cost associated with repairing any damage done to underground utility lines caused by work performed by the Seller. Should uncharted, or incorrectly charted, utilities be encountered during excavation, stop work and contact the Owner immediately.

6.5.9 When excavation reaches the required subgrade elevations, notify the Owner and geotechnical engineer and they will make the inspection of conditions. If the project geotechnical engineer determines that the bearing materials at required subgrade elevations are unsuitable, continue excavation until suitable bearing materials are reached. This shall be after approval from the Owner and geotechnical engineer is received.

6.5.10 Correct unauthorized excavation, including areas over excavated by error, at Sellers' expense.

6.5.11 Stockpile of excavated materials shall be protected from erosion. Do not permit topsoil to be mixed with subsoil. As a guideline, topsoil (from topsoil excavation) shall be deposited, loosely, in heaps with a maximum height of 15 feet and excavated soil (excluding the topsoil from excavation) shall be deposited in subsequent layers, with a slope angle equal to the natural friction angle of the soil. If stockpiles left undisturbed for more than 30 days, then they need to be stabilized. Direct surface water away from the stockpile to prevent erosion, runoff and deterioration of materials.

6.5.12 Prevent surface water and groundwater from flowing into excavations and accumulate. Remove water to prevent softening of foundation bottoms, undercutting foundations which may cause the soil changes that that can impact the structural stability of the foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines and other dewatering systems necessary to convey the water away from excavations. Establish temporary drainage ditches or other diversions outside the excavation limits to convey rainwater or water removed from excavations. Do not use any trenches or other excavations for permanent structures as temporary drainage ditches.

6.5.13 Dispose water from the work in a suitable manner that causes no damage to adjacent property and does not interfere with the traffic flow or other construction activities. Water shall be disposed of in such a manner as not to be a menace to public health and in accordance with Environmental Protection Agency, Corps of Engineers, state water quality control division standards and permits and project storm water pollution prevention plan or environmental plan.

6.5.14 Seller shall be responsible for maintaining a temporary, highly visible fencing around excavations that exceed 4 feet in depth. Such temporary fencing will be used for protecting against fall hazards for site personnel, other people on site, ranch livestock etc. Setback for any temporary fencing shall be a minimum of 6 feet from the edge of the excavation. Carry out daily checks on the conditions and completeness of temporary fencing and carry out repairs if necessary.

6.5.15 All excavations shall have at least two (2) means of ingress and egress.

6.5.16 All foundations shall bear on undisturbed soils or structural fill. Conform to all design elevations and dimensions within acceptable tolerances for placing and removing of concrete formwork, conducting inspections and other construction activities.

6.5.17 Protect excavation bottoms against freezing when atmospheric temperature is less than 35°F or as per design requirements.

6.5.18 The main access to all Wind Turbine Generator excavations shall have safe and functional access and walking surface.

6.5.19 Proof roll subgrade with loaded rubber-tired equipment for a total equipment weight greater than 25 tons to determine soft areas or as per design requirements. After passing proof roll test, road base material, foundation mud mat will be placed on the subgrade. Additional tests for subgrade compaction shall be completed as per design requirements, which may include but not limited to checking the moisture content, in-situ density and degree of compaction. The Seller may be asked by the Owner to implement remedial measures and repeat these tests if the compaction requirements are not met.

6.5.20 Structural fill lifts shall not exceed a thickness of 8 inches. Other fill lifts shall not exceed a thickness of 12 inches.

6.5.21 Embankments (fill and cut) shall have a slope of 3H:1V or flatter. All embankment fill material shall comply with the design requirements. The material shall be uniformly spread in layers and the required degree of compaction should be achieved. The compaction is 95% of standard proctor density or as per the design documents. The embankment construction shall be done with minimal slope to avoid rainwater stagnation and soil softening and to prevent soil washout.

6.5.22 Earthwork activities shall be sub-divided in smaller sections/areas to reduce the time lapse between completion of the layers and placement of new layers above. The Seller shall follow the design guidelines for new embankment constructed on an existing embankment. Embankments to support roads and service yards shall have slopes as per the design/project documents. Areas no longer being actively grades shall be temporarily or permanently stabilized per permit conditions.

6.5.23 The excavated materials may require crushing and screening prior to backfilling of foundations if they do not meet the design specifications of backfill material. The tests that need to be performed as per a minimum shall be particle size distribution, Atterberg limits and abrasion resistance. This is applicable to the material available for backfilling after blasting activities. The Seller shall provide crushing and screening plant in compliance with applicable standards/codes and shall obtain the required approvals from the local authorities. Seller shall submit the crushing and screening plant report to the Owner for review and approval prior to commencing work. The report shall include, but not limited to size of the plant, location of the plant, schedule of crushing activities, permits, compliance with emission standards including pollution, dust and noise.

6.5.24 The material produced from crushing and screening shall be tested as per the frequency mentioned in the design documents. The crushing and screening plant shall be capable of supplying high quality materials in the quantity required. The crushed material should be capable of being handled by earthmoving machines.

6.5.25 The backfill material shall meet the design requirements as this will be spreading the structural loads to the subgrade. To check the material properties, the Seller shall perform tests as per the frequency mentioned in the design documents. For special situations, as per the Owner's request or as per the design, the Seller may be asked to perform these tests with greater frequency under additional compensation or to perform additional test.

6.5.26 Fill activity includes filling soils with compaction into road excavations, trenches, general grading applications and backfilling for foundation excavations. The material for backfilling can be the same as the material excavated if it meets the design requirements as per the design/project documentation.

6.5.27 Soil proposed for fill and backfill shall be approved by geotechnical engineer prior to use. The backfill or fill layers shall be tested during placement and compaction operations. The number of tests shall be made in a quantity to ensure that uniform compaction for each lift is suitably achieved.

6.5.28 Ensure areas to be backfilled are free of debris, snow, ice and water and that ground surface es are not in frozen conditions. Do not use muddy or frozen fill materials. Moisture condition of the fill material shall be as required to achieve design compaction. Compact backfill material in layers not exceeding a thickness of 8".

6.5.29 Use hand tampers or vibrating compactors at foundations or similar locations inaccessible to large equipment and rollers. Rolling equipment shall not be used immediately to the foundations.

6.6 Laydown Yard

6.6.1 The laydown yard shall be sufficient in size to allow for simultaneous (i) storage of equipment, including any Owner-Supplied Equipment, that will not be stored at the Wind Turbine Generator Pads; (ii) storage of office trailers and other temporary facilities; (iii) parking for approximately 20 Owner vehicles; and (iv) regular construction traffic.

6.6.2 The laydown yard shall be covered throughout with crushed rock surfacing. All crushed rock surfacing at the laydown yard shall conform, at a minimum, to the specifications prescribed in Section 6.10 (*Crushed Rock Surfacing*) herein.

6.6.3 The laydown area shall remain suitable for use in all weather conditions.

6.6.4 The laydown yard shall have a two percent (2%) grade, or less if required, for the safe storage of equipment, or to meet manufacturer's requirements for storage of equipment. The surface of the yard shall be free from potholes and ruts and shall allow for free drainage of surface water.

6.6.5 The laydown yard shall comply with the Turbine Supplier Project Site Requirements.

6.6.6 Fencing shall be installed around the perimeter of the laydown yard, and vehicle gates shall be installed at all entrances to the laydown yard. All fencing and gates shall comply with the minimum specifications in Section 3.11 (*Fencing, Walls, and Gates*) herein.

6.6.7 The laydown yard shall have at a minimum two points of ingress/egress which shall always be accessible.

6.7 Roads

6.7.1 Seller is responsible for Construction of the project access roads in accordance with the IFC drawings and specifications, including the ability to withstand both the individual and sustained loading requirements of construction traffic associated with the foundation material deliveries, component deliveries, and erection crane travel.

6.7.2 Seller is responsible for conducting a survey to document the existing conditions of the roads to be utilized, prior to the start of and after the completion of the construction activities. This survey shall include video of the roads and Seller will be submitted to the Owner.

6.7.3 All roads shall be constructed within the permitted corridors. This will include wind turbine generator access roads, string roads, crane pads, public road improvements, MET tower access roads, delivery road improvements, substation access roads including accommodations for MPT delivery, O&M building access road, access roads to the laydown yard and parking lot, turbine staging areas access roads.

6.7.4 Roads shall be designed, constructed, and maintained adequately to support all anticipated construction loads, equipment delivery (including Owner-Supplied Equipment), crane crawling, construction traffic usage, and weather conditions to be expected.

6.7.5 Roads shall be designed and constructed on the predominant upwind side of the wind turbine generators, substation and other types of obstacles such as mounds or hills.

6.7.6 Roads shall comply with the Turbine Supplier Project Site Requirements.

6.7.7 Road entries, intersections, and turns that will be used by heavy equipment shall be designed to accommodate the longest vehicle anticipated to utilize the road so that it will be able to maneuver through the entire Project Site without leaving the graveled road area. Consideration of cantilevered loads (e.g., Wind Turbine Generator blade ends) shall be considered to ensure obstructions adjacent to the roadway are cleared and will not endanger the equipment delivery.

6.7.8 Roads shall be designed with turnarounds to assist in truck and trailer flow throughout the Project Site. Backup motions for tractor trailers shall be kept to a minimum and are subject to Owner approval.

6.7.9 Dead-end roads shall be designed with adequate turnaround space for a tractor/trailer to turn around without leaving the graveled road area. If backup motions for tractor trailers are necessary, the backup path shall be as straight and short as possible. All turnarounds shall be constructed using the same gravel design as the roads.

6.7.10 Roads shall be designed to have a graveled roadway surface with sub-grade cleared and compacted to at least ninety-five percent (95%) of the maximum density within the moisture content of two percent (2%) below optimum to two percent (2%) above optimum, as determined by ASTM Standard D698, unless a higher level of compaction is required by the geotechnical engineering report.

6.7.11 Roads shall be rocked with crushed rock material over a stabilized subgrade. All such crushed rock surfacing shall conform, at a minimum, to the specifications prescribed in Section 6.10 (*Crushed Rock Surfacing*) herein.

6.7.12 Roads shall be constructed within permitted boundaries and shall be subject to grading permit review and approval, if required, from the agency(ies) having jurisdiction.

6.7.13 Roads shall be cleared of overhead obstructions (e.g., power lines). Mark all overhead obstructions with signs and goal posts.

6.7.14 Roads shall be able to accommodate two-way traffic during normal conditions but may be converted to one-way traffic when wide vehicles are entering the Project Site and delivering equipment and/or materials.

6.7.15 Seller is responsible for ongoing regular maintenance of all project and public roads as needed throughout the Work, to include grading, dust control, and snow removal as needed.

6.7.16 Seller is responsible for all surveying and staking out needed to construct the roads in accordance with design plans. The levels and control points and final grade of the roads shall follow the design drawings.

6.7.17 Seller shall be responsible for locating buried utilities and other underground obstructions prior to any excavation. For underground gas and oil pipelines, it may be required, that the pipeline owner be on site always while the work is occurring within the pipeline easement. Seller shall coordinate such activities with pipeline owners prior to starting work so that the project schedule is not impacted. Excavation by hand tools without any mechanical means shall occur when it is not possible to proceed with earthmoving machines, or a special precision and/or care is needed to avoid any damage to existent underground cables, pipes, sewers, equipment's, objects and manufactured items in general, or other special situations. The Seller shall bear the full cost associated with repairing any damage done to underground utility lines caused by work performed by the Seller. Should uncharted, or incorrectly charted, utilities are encountered during excavation, stop work and contact the Owner immediately.

6.7.18 Roads shall be a *minimum* of 20 feet wide. Where crane walks are to be utilized, roads shall have a minimum 10-foot temporary compacted earthen shoulder on each side.

6.7.19 Roads shall have a minimum turning radius on curves of no less than is required for Wind Turbine Generator and other equipment deliveries. Roads shall be widened through turns and curves, as necessary. Seller shall provide documentation for required widenings to demonstrate the ability for required vehicles to accommodate turns safely.

6.7.20 Roads shall be designed and constructed with a maximum grade of ten percent (10%) grade, or less if required by the Turbine Supplier Project Site Requirements. Approaches to Wind Turbine Generator Pads from access roads shall be designed and constructed sufficiently level to allow transport vehicles, including Wind Turbine Generator transport vehicles, to park on a flat surface during offloading.

6.7.21 Roads shall have no more than two percent (2%) crown, unless such roads will be utilized as crane paths, in which case the maximum crown shall be one percent (1%). All roadways, including shoulders, shall be graded to self-drain, and must not allow water to puddle.

6.7.22 Maximum allowable rutting is two (2) inches.

6.7.23 Roads shall meet all required design elements at substantial completion.

6.7.24 Maximum vertical crest and dip on roads is six (6) inches vertical to 50 feet horizontal, or less if required by the Turbine Supplier Project Site Requirements.

6.7.25 The longitudinal radii (convex or concave) of roads shall not be less than 750 feet.

6.7.26 The surface of the road shall be free from potholes and ruts and shall allow for free drainage of surface water.

6.7.27 All non-Wind Turbine Generator roadways shall be able to accommodate light traffic consisting of general-purpose pickup trucks, SUVs, and bucket trucks, or as required during construction to perform the Work. During construction, equipment delivery trucks shall also be able to safely travel these roadways.

6.7.28 All site entrances/exits shall have a system in place to prevent tracking of mud and other debris onto the public way.

6.7.29 Seller shall procure and install cattle guards, when required. Cattle guards shall be installed level and provided with a stable base capable of sustaining heavy loads without shifting or settling.

6.7.30 Seller shall inventory, analyze and verify all existing bridges and culvert crossings on the Project Site are sufficient for the intended Project use. If any improvements are needed to existing culverts and bridges, Seller shall make these improvements as per planned schedule to not delay any major component deliveries or construction traffic.

6.7.31 The Seller shall modify existing public roads, as required, at the access road intersections and other locations as needed to allow the delivery of the turbine components to the respective foundation locations. Modifications to the existing public road should meet all applicable State DOT and local jurisdictional requirements and follow any road use agreements.

6.7.32 Construction and maintenance of project site roads shall follow all storm water pollution prevention and spill prevention plans.

6.7.33 During winter conditions, carry out snow plowing to provide vehicle access to all turbine locations throughout the construction life of the project. This shall be completed by the Seller as soon as safely practical after a storm event. Seller is responsible for applying sand/salt mixture or all sand mixture in the event of icy conditions on access roads and construction areas.

6.7.34 Seller shall prepare, implement, and manage a detailed traffic management plan that is specific to the Project. The traffic management plan shall clearly identify all haul routes from the nearest highway; proposed traffic flow within the Project Site, including public roads; plans for managing construction, delivery, public, and other traffic at the Project Site during construction; daily concrete truck delivery flow plans; and mitigation measures to reduce risk and impact to non-construction vehicles due to construction activities. The Seller is responsible for all signage, spotters or other requirements to meet state traffic requirements. The Seller is responsible for any agency approval needed prior to any road work.

6.7.35 Seller shall provide temporary signs at public and site access road intersections to provide direction to turbine locations; and at the appropriate locations on public roads to indicate that no wind project traffic is allowed along these roads. These signs shall remain in place throughout the construction period.

6.7.36 Lime treatment of road subgrade to modify the physical and mechanical properties of the soil through chemical reactions is acceptable for road subgrade improvement. Seller shall be responsible for submitting to the Owner the procedure for lime stabilization for review and approval before lime application. The lime treatment procedure shall include but not limited to the following: suitable climatic condition for lime treatment, suitable subgrade soil conditions, measures to mitigate frost conditions and dewatering methods, types of lime, storage and delivery of lime material, material dosage requirements, lime application methods and testing methods. The procedure shall follow the latest editions of all applicable standards. Lime stabilization is preferred for cohesive soils.

6.7.37 For granular soils, cement stabilization methods can be used for road subgrade improvement. It is important to remember that in situations where there is time constraint due to fast pace of construction activity, cement stabilization can be considered as an alternative as the cement treated soils can gain strength much quickly compared to lime treated soils. Seller shall be responsible for submitting to the Owner the procedure for lime stabilization for review and approval before cement application. The cement stabilization procedure shall include but not limited to the following: suitable climatic condition for lime treatment, suitable subgrade soil conditions, measures to mitigate frost conditions and dewatering methods, types of lime, storage and delivery of material, optimum dosage of cement, cement application methods and testing methods, placement and compaction methods. The procedure shall follow the latest editions of all applicable standards. For cement stabilization, Type I Portland Cement conforming to ASTM C150 shall be used. Other equivalent products shall be submitted for review and approval.

6.7.38 Geosynthetics may be required as per design requirements to filter, drain, separate, protect and reinforce the ground during and after construction. Materials must be delivered to the construction site in their original packaging with labels along with the manufacturer's technical sheets indicating the main specifications and instructions for proper installation. The Owner may request certificates issued by authorized testing laboratories to confirm the physical, mechanical, hydraulic and durability properties stated in the technical sheets. Materials must be stored on the construction site in their original packaging and be protected from weather and exposure to direct sunlight must be avoided.

6.7.39 Joint types between geotextile sheets can be overlapping, sewn or, with adhesive strips, staples, adhesives (gluing) or hot melt and tying. Geotextiles for filtering can be installed outdoors or underground on horizontal, sloped and vertical surfaces. They can be used around perforated pipes or in trenches. Geotextiles must be installed in a stable position during construction of drains and during burial. If installed in drainage trenches to be filled by gravel, geotextile tarps must be positioned and adhered to the trench bottom and to the walls to avoid tension stress when the drain is filled. The Seller shall ensure that the geotextile material shall not be in contact with rock or any sharp objects.

6.7.40 Geogrid is a geosynthetic formed by a network of integrally connected elements to allow interlocking with surrounding soil, rock, earth and other surrounding materials to function primarily as reinforcement. Geogrids shall not decompose and must be non-toxic, rodent and micro-organism proof, chemically inert and ultraviolet (UV) ray stable. Geogrids must be installed as per the design requirements and manufacture's specifications. Construction site equipment (such as excavators and cranes) should not be allowed to travel directly on geogrids.

6.8 Turbine Foundations

6.8.1 Turbine Foundations shall be constructed at each Wind Turbine Generator location.

6.8.2 Turbine Foundations shall be conventional spread footing / gravity-type foundations. No alternate Turbine Foundation type, including P&H or rock anchor, shall be utilized without Owner approval.

6.8.3 Turbine Foundations shall be reinforced concrete designed in accordance with Turbine Supplier Project Site Requirements; ASCE/AWEA RP2011 "*Recommended Practice for Compliance of Large Land-based Wind Turbine Support Structures*"; ACI 318; and other relevant Applicable Standards and Requirements.

6.8.4 Turbine Foundations shall, at a minimum, be designed using the final geotechnical engineering report, including allowable soil bearing pressure values determined by geotechnical investigation from soil borings at each specific Wind Turbine Generator site and equipment loads provided by the Turbine Supplier. No portion of Turbine Foundations shall be constructed on fill material or within ten (10) feet of a fill slope without Owner approval.

6.8.5 Turbine Foundations shall include a grounding grid. The design and construction of the grounding system in such foundations shall meet or include the following requirements, at a minimum:

(1) Turbine Supplier Project Site Requirements

(2) Incorporate the recommendations and minimum requirements set forth in the geotechnical engineering report

(3) Proper grounding of equipment and structures

(4) Installation of adequate ground for personnel safety, including touch and step potentials (to be demonstrated by Seller via calculations in the grounding study)

(5) Proper grounding for lightning and surge protection

(6) Incorporate local resistivity measurements

(7) A ground resistance <= 2 Ω

6.8.6 All local requirements and the NESC shall be adhered to in the grounding design and construction.

6.8.7 Turbine Foundations shall be designed to have adequate stiffness to maximize the system natural frequency within practical limits.

6.8.8 Turbine Foundation anchor bolts shall have a minimum projection of two (2) anchor bolt diameters beyond the tightened anchor nuts. Anchor bolts not meeting this requirement may be rejected by Owner.

6.8.9 Turbine Foundation materials, including rebar, anchor bolts, forms, concrete, and grout, shall comply with the applicable structural requirements in Section 7.0 (*Structural Works Specifications*) herein.

6.9 Wind Turbine Generator Pads

6.9.1 A Wind Turbine Generator Pad shall be constructed at every Turbine Foundation location.

6.9.2 Wind Turbine Generator Pads shall be sufficient in size to allow for simultaneous offloading, storage, and assembly of all Wind Turbine Generator components, including, but not limited to, rotor, nacelle, and tower sections.

6.9.3 Wind Turbine Generator Pads shall comply with the Turbine Supplier Project Site Requirements and provide minimum bearing capacity requirements for turbine supplier transportation requirements and requirements for the erection crane to install the heaviest turbine component.

6.9.4 Wind Turbine Generator Pads shall be cleared of brush, boulders, and other debris around each Turbine Foundation, up to the pad limits, and shall be continually maintained to ensure a safe working environment.

6.9.5 Wind Turbine Generator Pads shall not exceed two percent (2%) grade, or less if required for the safe execution of Work, including Wind Turbine Generator assembly, storage, or erection.

6.9.6 Wind Turbine Generator Pads shall have a graveled surface with sub-grade cleared and compacted to at least ninety-five percent (95%) of the maximum density within the moisture content of two percent (2%) below optimum to two percent (2%) above optimum, as determined by ASTM Standard D698, unless a higher level of compaction is required by the geotechnical engineering report.

6.9.7 Following Wind Turbine Generator installation, a washed clean gravel ring (i.e., "beauty ring") shall be installed around the perimeter of each Wind Turbine Generator location, at a minimum of 6 inches thick and a distance of twenty (20) feet beyond the Wind Turbine Generator tower wall in all directions. All beauty ring gravel be washed and the maximum aggregate shall not exceed 1½ inches, have 95-100 percent by weight passing a -inch sieve, and 0-10 percent by weight passing a No.4 sieve. Unless explicitly stated otherwise, the beauty ring gravel aggregate shall conform to local department of transportation requirements.

6.9.8 Crane pads shall be designed and constructed to allow for use of cranes in ongoing Wind Turbine Generator maintenance activities following construction (e.g., cranes required for gearbox removal and / or installation).

6.10 Crushed Rock Surfacing

6.10.1 Verify gradients and elevation of the subgrade are correct as per design drawings. Proof roll road subgrade using loaded rubber-tired equipment weighing more than 25 tons to detect soft areas prior to any aggregate placement. If unsuitable/soft subgrade is encountered, Seller shall undercut unstable material and stabilize subgrade using structural fill prior to aggregate placement.

6.10.2 The maximum aggregate size for surface fill (i.e., crushed rock surfacing) shall not exceed three (3) inches, have a no more than 50 percent by weight passing a ¾-inch sieve, and no more than 2 percent by weight passing a No.10 sieve. The material is to be used for roadways, Project Substation, and laydown yard.

6.10.3 Spread and compact aggregate base material in lifts of thickness no greater than 6 inches.

6.10.4 Unless explicitly stated otherwise, all crushed rock surfacing shall be of thickness required by Project Site loading requirements, including those set forth in (i) the Turbine Supplier Project Site Requirements and (ii) the geotechnical engineering report.

6.10.5 Unless explicitly stated otherwise, all aggregate shall conform to local department of transportation requirements.

6.10.6 An aggregate job mix formula shall be established prior to the start of fill operation based on recommendations from the final geotechnical engineering report. This mix shall not be changed without prior approval of Owner. Testing data, including sieve analysis, shall be submitted for all aggregate sources.

6.10.7 Road aggregate characteristics shall be tested as per frequency of testing mentioned in the design requirements. For construction of crane pads/roads, the material must be placed in lifts not exceeding 6 inches or as per the design and should be properly compacted while providing adequate drainage of runoff water away from the pavement surface. The characteristics of the material shall be tested for of grain size analysis, compaction, Atterberg limits, soundness of aggregate, LA abrasion and CBR tests.

6.10.8 Restore all the permanent access roads to meet the road surfacing design conditions at the end of the project.

6.10.9 Finish surfaces by rolling with smooth steel wheel roller. Repair soft and yielding areas that develop in the final rolling.

6.11 Drainage and Erosion Control

6.11.1 The working areas of the Project Site shall be well drained during and after construction, respectively. All drainage shall be away from buildings and foundations.

6.11.2 Seller shall be responsible for submitting Stormwater Pollution Prevention Plan to Pacific Corp for review and approval prior to any site disturbance. Implementing and maintaining a comprehensive storm water pollution prevention plan (SWPPP) during construction. This shall include all required permit submittals. The SWPPP shall be a live document, subject to review and adaptation throughout construction – a final SWPPP will be provided as part of the turnover documentation robustly capturing any residual maintenance requirements.

6.11.3 Roadway cross sections shall be shaped to move water away from the road, such as crowning or cross-slopes, and roads shall be designed and constructed to prevent water ponding. Storm water shall not channel flow across constructed roads.

6.11.4 Controls shall be provided to protect the water quality and shall be in accordance with all Requirements, including applicable laws, applicable permits, and the Seller-provided SWPPP.

6.11.5 Seller shall provide all excavation, embankment preparation, drainage contours and culverts necessary to prevent excessive erosion and degradation of site due to water runoff.

6.11.6 Culvert pipe ends, swales, and ditches shall be designed to control concentrated flow velocities and minimize erosion and siltation. Corrugated metal pipes are most widely used for drainage applications including storm sewers, culverts, and storm water detention and infiltration systems in the wind projects. These pipes can be made of steel or aluminum. Corrugated coupling bands, galvanized steel or aluminum to match pipe, minimum 10-inches (250-mm) wide; connected with two neoprene O-ring gaskets per and two galvanized steel bolts.

6.11.7 Verify is trench cut to the dimensions, and elevations are as indicated on the Construction Drawings. Remove large stones which could damage piping or impede backfilling or compaction. Dewater excavations to maintain dry conditions and preserve final grades at bottom of excavation. Place bedding material at trench bottom, level continuous layer not exceeding 8-inch compacted depth; compact to 95 percent of the modified proctor maximum dry density. Install pipe as per manufacturer's instructions. Seal joints watertight. Keep pipe and fittings clean until work is completed. Lay pipe to alignment and slope gradient noted on the design. Protect pipe and bedding from damage or displacement until backfill operation is in progress.

6.11.8 Riprap shall be placed primarily for culvert outlet protection and embankment slope protection. Riprap shall be tested as per frequency of testing mentioned in design documents. LA abrasion test and soundness test shall be completed for testing the riprap. Riprap shall be irregular shaped rock; 2-inch minimum size, 12-inch maximum size; solid and non-friable. Do not place riprap over frozen subgrade surfaces. Installation thickness of riprap shall be of minimum 6 inches.

6.11.9 Wetlands impacts shall be avoided to the maximum extent practicable and are subject to regulatory approval or other applicable Requirements.

6.11.10 All storm water flows shall be returned to their original drainage patterns and the Project shall not increase flow rates from their historic levels.

6.11.11 Sheet flows shall be collected in roadside drainage swales and conveyed to culverts or channels to safely pass storm water flows.

6.11.12 Culverts or low-water crossings shall be placed under roads where required to pass existing storm water concentrated flows.

6.11.13 Erosion and sediment control, both during and after construction, shall be provided as required by the Requirements to retain sediment onsite and to control the erosion of embankments, temporary and final exposed slopes, and temporary stockpile(s).

6.11.14 All practicable erosion control devices shall be installed and maintained in good working order throughout construction to prevent the unauthorized discharge of material into a wetland or tributary. These controls shall be maintained until permanent erosion controls are in place.

6.11.15 Silt fences, check dams, drainage ditches or swales, straw mulch, and pre-manufactured geotextiles, geotubes, geogrids, cellular geoweb, and other similar items (collectively, the "**Best Management Practices**") shall be utilized as appropriate. Use impervious materials to cover stockpiles when unattended or during rain event. Erosion control measures shall be inspected and maintained daily to ensure their continued effectiveness. No heavy machinery in a wetland or other waterway. Seller shall prepare maps showing location and type of BMPs installed and used for Project Site.

6.11.16 Synthetic, toxic, or otherwise harmful erosion-control materials shall be made inaccessible to livestock on or adjacent to the Project Site during the construction period.

6.11.17 Construction operations shall be continuously monitored by Seller to avoid creating conditions that could lead to excessive erosion of soil with surface runoff from Work areas. Site drainage shall be provided to ensure that water does not "pond" on or near the project facilities constructed by the Seller. Special attention shall be paid to wind turbine foundation areas, substation areas, O&M facilities, and access roads.

6.11.18 Run off from all site roads, parking areas and any areas liable to be contaminated by oil shall be managed in accordance with the Spill Prevention Control and Countermeasure Plan or Storm Water Pollution Prevention Plan.

6.11.19 Seller shall provide construction dust control at the project throughout the duration of the Work, including furnishing of all labor, equipment, and materials, including water and/or equivalent duct control products, necessary for dust control and as necessary to reduce the risk of dust becoming a nuisance. Dust control methods to be reviewed by the Owner prior to implementation.

6.11.20 Local agencies may enforce requirements that limit certain construction activities during a portion of the year (e.g., due to storm events). These requirements shall be incorporated into the proposed SWPPP, erosion control plan, and Project Schedule.

6.11.21 Seller is responsible for maintaining a log of all storm events, the impacts and corrections as required under the SWPPP.

6.11.22 Seller shall document, record and maintain all documentation relating to SWPPP. The SWPPP package shall be submitted to the Owner upon final completion of the project.

6.11.23 Seller shall be responsible for repairing drainage tile systems damaged during the installation of the foundations, collection system, crane walks, or any other activity with the potential to damage drain tiles. Seller shall recognize locations of drain tile by GPS and flagging/staking. All repair made to drain tiles shall fully comply with local Codes and standards and Landowner requirements. Seller shall include the GPS coordinates, photo documentation and field report and submit to the Owner as per the quality job book.

6.12 Site Restoration

6.12.1 Seeding shall occur during a time / season when the probability of successful seed germination is maximized. Hydro-seeding is acceptable for slopes. Material used in the seeding process will be weed free certified in accordance with project permits and local jurisdictional requirements.

6.12.2 Prior to re-seeding, Seller to obtain approval from Owner and landowners on reseeding and the desired seed mix. Active agricultural fields should not be reseeded.

6.12.3 Seller shall restore the erection areas to pre-construction conditions at the completion of the project.

6.12.4 All temporary structures, buildings, temporary concrete footings and slabs, and scaffolding furnished by the Seller during the construction shall be removed, and the involved areas shall be left in their intended or original condition.

6.13 Testing and Quality Control

6.13.1 All testing described herein shall be performed by an independent, experienced third party. Seller shall notify Owner of all testing schedules at least 30 days in advance of testing activities.

6.13.2 All roadways, compacted areas, Wind Turbine Generator Pads, and Turbine Foundations shall be tested to demonstrate they meet stated design criteria and are fit for purpose.

6.13.3 Roadway testing shall include the following, at a minimum:

(1) Maximum dry density and optimum moisture content: per ASTM D698 or ASTM D1557

(2) In-place density by nuclear methods (shallow): per ASTM D2922

(3) Aggregate sampling: per ASTM D75

(4) Sieve analysis of fine and coarse aggregates: per ASTM C136

(5) California Bearing Ratio of laboratory-compacted soils: per ASTM D1883

(6) Sand equivalent value: per ASTM D2419

(7) Liquid limit, plastic limit, and plasticity index: per ASTM D4318

(8) Roadway subgrade and surfacing compaction shall be verified at a minimum of every 1,000 feet. Roadway subgrades shall be proof-rolled over the entire length.

(9) Aggregate base shall be analyzed with a sieve at a minimum of every 2,500 cubic yards.

6.13.4 Turbine Foundation testing shall include the following, at a minimum:

(1) Third-party certification of integrity of Turbine Foundation sub-base.

(2) Concrete and grout strength.

(3) Compaction of backfill around Wind Turbine Generators / Turbine Foundations.

(4) Compaction of Wind Turbine Generator Pads.

(5) Turbine Foundations and Wind Turbine Generator Pads shall be tested in accordance with the recommendations set forth in the geotechnical engineering report. Such areas shall be fully proof-rolled.

6.13.5 Copies of testing reports shall be submitted to Owner within 10 days of completing such test. Testing reports shall include a summary of testing procedures and acceptance criteria. Notwithstanding the preceding requirements, a copy of test results for each Turbine Foundation shall be provided to Owner *prior* to erection of the applicable Wind Turbine Generator.

7.0 STRUCTURAL WORKS SPECIFICATIONS

7.1 General Provisions

7.1.1 All buildings, support structures, foundations (including Turbine Foundations), and equipment pads shall be constructed on competent material. All loose materials shall be removed from excavation bottoms. Unsatisfactory foundation subgrade material shall be removed and replaced with compacted structural fill material or with suitable concrete.

7.1.2 All buildings, foundations, meteorological towers, equipment supports, and other structures shall be designed in accordance with the latest edition of the Applicable Standards.

7.1.3 As further described in Section 3.0 (*Geotechnical Specifications*), the geotechnical engineering report shall be utilized for the design and construction of all Project structures, including Turbine Foundations. All foundations shall be designed with consultation of a licensed geotechnical engineer.

7.1.4 The foundation designer shall perform and detail all appropriate design verifications in a calculation report. The following information shall be included at a minimum:

a. List of all design standards utilized with revisions/edition.

a. List of design load cases based on wind turbine loading information

b. List of all safety factors, load factors, materials factors, etc. and correlation to the design standard they are taken from.

c. Justification for foundation type and shape based on the Geotechnical Assessment and site conditions.

d. Coordination with Civil Engineer to ensure alignment of final proposed grades with civil site plans.

e. Intended soil improvement justification, improvement type, and locations, as needed.

f. Concrete Exposure Class.

g. Environmental Analysis (seismic)

h. Stability Checks:

    i. Differential Settlement

    ii. Foundation Stiffness

    iii. Soil Bearing Capacity

    iv. Gapping Requirements

    v. Overturning & Sliding

i. Structural Analysis Checks:

i. Concrete Design (Raft, Pedestal, etc.)

ii. Anchorage Design (Bolt length, embedment plates, etc.)

iii. Tower Connection Design (grout/concrete crushing at flange)

iv. Fatigue Assessment.

7.1.5 The wind turbine manufacturer shall be responsible for providing all the necessary information for foundation design, such as the following:

a. Load Combinations

i. Ultimate Limit State, ULS (normal and abnormal cases)

ii. Serviceability Limit State, SLS (operational cases)

iii. Fatigue Limit State, FLS

iv. Seismic Load Combinations

b. Interface Geometry & Properties

c. Anchor Bolt Post Tensioning Forces

d. Wind Turbine Requirements for Serviceability (consideration of differential settlement)

e. Allowable Foundation Gap Between Grade (extreme and operational load cases)

f. Location, Geometry, Size of Inserts (conduit)

7.1.6 Wind turbine foundation designer shall be responsible for performing the following geotechnical checks:

a. Differential Settlement

i. Short term & long-term consolidation shall be accurately investigated and reported. With cohesive soils, long term consolidation analyses must be checked for the design life of the wind turbine using the design loads.

b. Rotational and Translational Stiffness

i. The foundation designer shall ensure that the rotational and translational stiffness of the foundation satisfies the requirements as outlined by the wind turbine manufacturer. Foundation designer shall account for translational, rocking, and torsional stiffness of the foundation with respect to dynamic behavior.

c. Sliding

i. Foundation sliding with respect to the horizontal actions transmitted from the wind turbine shall be considered for both undrained and drain conditions of nearby soils.

d. Overturning

   i. Foundation overturning with respect to the horizontal actions transmitted from the wind turbine shall be considered utilizing the factored stabilizing moment due to self-weights, concrete, and backfilling deadloads. Favorable effects of backfill shall be limited to a profile based on the original topography. Passive earth pressures shall not be used in calculating the stabilizing moment.

e. Soil Bearing Capacity Check

   i. Soil pressure below foundation shall be evaluated for short term and long-term loading considering external actions and taking into consideration the water table. Foundation designer shall evaluate soil pressure considering the effective loaded area of varying load cases, foundation geometry, and soil properties.

f. Foundation Gapping

   i. Foundation designer shall ensure that the pressures developed at the foundation-soil interface satisfy the limitations set by the wind turbine manufacturer. At a minimum, the foundation designer shall ensure that gapping is limited to 50% for extreme load cases and 0% for operational load cases.

g. Piles

   i. If piles are utilized by the foundation designer, it is their responsibility to define the forces acting on the piles. The foundation designer shall additionally be responsible for performing all pile checks, such as axial, transverse, and tensile. Foundation designer shall not be permitted to allow uplift forces on piles for operational load cases. Only in extreme load cases shall tensile uplift forces in piles be allowed.

7.1.7 Foundation designer may specify ground improvements as needed if the soil below the foundation does not comply with required strength and compressibility properties.

a. Soil Substitution

   i. Existing soil below the foundation shall be removed and replaced with more suitable soils. Foundation designer shall ensure that backfill has sufficient bearing capacity and soil compressibility to dissipate pressure to deeper native soils. Soil substitution area shall be wider than the foundation footprint.

b. Stone Column & Rigid Inclusion

   i. Foundation designer shall be permitted to utilize stone column techniques as needed to supplement existing soils. If used, the design should follow international design guidelines and recommendations as provided by DNV or IEC to determine adequacy of design. Owner may request the use of a finite element analysis model to conform design approach.

c. Foundation Subsurface Void Grouting

i. If other techniques are not found suitable for the project, foundation designer may recommend void grout filling within the foundation influence zone to supplement soil strength.

7.1.8 The maximum loads (including load factors) applied to the foundations and used for design shall be determined from the structure design of the supported structure considering load cases and Applicable Standards associated with the structure type.

7.1.9 All relevant site parameters shall be identified to ensure that load effects transmitted from wind turbine are sufficiently captured in foundation design. The primary contributor is typically the wind load, however consideration shall be given, where necessary, to other factors such as snow loads, seismic loads, ground water buoyancy, etc.

7.1.10 The average wind speed may be determined using various methods as outlined in the applicable design codes. In IEC-EN 61400, which the wind turbine is typically designed to, the maximum wind speed at hub height is averaged over 10 minutes for a recurrence period of 50 years. This method may vary from other structural codes, such as ASCE 7 or IBC which rely upon wind speed gusts averaged over 3 seconds.

7.1.11 Wind turbine design is based on different classes as defined in IEC EN 61400 latest edition, which considers both average wind speed and turbulence:

Wind turbine class			I	II	III	S
V_{ave}		(m/s)	10	8,5	7,5	Values specified by the designer
V_{ref}	(m/s)		50	42,5	37,5	
	Tropical (m/s) $V_{ref,T}$		57	57	57	
A+		I_{ref} (-)	0,18			
A		I_{ref} (-)	0,16			
B		I_{ref} (-)	0,14			
C		I_{ref} (-)	0,12			

The parameter values apply at hub height and

V_{ave} is the annual average wind speed;

V_{ref} is the reference wind speed average over 10 min;

$V_{ref,T}$ is the reference wind speed average over 10 min applicable for areas subject to tropical cyclones;

A+ designates the category for very high turbulence characteristics;

A designates the category for higher turbulence characteristics;

B designates the category for medium turbulence characteristics;

C designates the category for lower turbulence characteristics; and

I_{ref} is a reference value of the turbulence intensity (see 6.3.2.3).

7.1.12 The wind turbine foundation shall be designed for load combinations which account for various design situations such as “Normal” events which are frequently expected to occur and “Abnormal” events which usually pertain to the activation of protection systems. See below for IEC EN 61400’s table of design load cases. The following load cases shall be used or more recent version, if applicable:

Design situation	DLC	Wind condition		Other conditions	Type of analysis	Partial safety factors
1) Power production	1.1	NTM	$V_{in} < V_{hub} < V_{out}$	For extrapolation of extreme events	U	N
	1.2	NTM	$V_{in} < V_{hub} < V_{out}$		F	*
	1.3	ETM	$V_{in} < V_{hub} < V_{out}$		U	N
	1.4	ECD	$V_{hub} = V_r - 2$ m/s, V_r, $V_r + 2$ m/s		U	N
	1.5	EWS	$V_{in} < V_{hub} < V_{out}$		U	N
2) Power production plus occurrence of fault	2.1	NTM	$V_{in} < V_{hub} < V_{out}$	Normal control system fault or loss of electrical network or primary layer control function fault (see 7.4.3)	U	N
	2.2	NTM	$V_{in} < V_{hub} < V_{out}$	Abnormal control system fault or secondary layer protection function related fault (see 7.4.3)	U	A
	2.3	EOG	$V_{hub} = V_r \pm 2$ m/s and V_{out}	External or internal electrical fault including loss of electrical network	U	A
	2.4	NTM	$V_{in} < V_{hub} < V_{out}$	Control system fault, electrical fault or loss of electrical network	F	*
	2.5	NWP	$V_{in} < V_{hub} < V_{out}$	Low voltage ride through	U	N
3) Start-up	3.1	NWP	$V_{in} < V_{hub} < V_{out}$		F	*
	3.2	EOG	$V_{hub} = V_{in}$, $V_r \pm 2$ m/s and V_{out}		U	N
	3.3	EDC	$V_{hub} = V_{in}$, $V_r \pm 2$ m/s and V_{out}		U	N
4) Normal shutdown	4.1	NWP	$V_{in} < V_{hub} < V_{out}$		F	*
	4.2	EOG	$V_{hub} = V_r \pm 2$ m/s and V_{out}		U	N
5) Emergency stop	5.1	NTM	$V_{hub} = V_r \pm 2$ m/s and V_{out}		U	N
6) Parked (standing still or idling)	6.1	EWM	50-year return period		U	N
	6.2	EWM	50-year return period	Loss of electrical network connection	U	A
	6.3	EWM	1-year return period	Extreme yaw misalignment	U	N
	6.4	NTM	$V_{hub} < 0,7\ V_{ref}$		F	*
7) Parked and fault conditions	7.1	EWM	1-year return period		U	A
8) Transport, assembly, maintenance and repair	8.1	NTM	V_{maint} to be stated by the manufacturer		U	N
	8.2	EWM	1-year return period		U	A

7.1.13 Wind turbine foundation design shall include considerations of manufacturer's loads which shall be located in manufacturer's calculation report. Loads are to be provided for each relevant design load case as determined by the manufacturer and shall be provided with and without applicable safety factors.

7.1.14 At a minimum, seismic design loads shall be considered according to IEC-EN 61400, which specifies that the ground accelerations shall be considered for a 475-year return period. If necessitated by local relevant codes, more severe parameters should be applied.

7.1.15 Partial safety factors to be used in load combinations are defined in IEC-EN 61400 and are shown below:

Unfavourable loads		**Favourable loads**[15]
Type of design situation (see Table 2)		**All design situations**
Normal (N)	**Abnormal (A)**	
1,35[a]	1,1	0,9

[a] For design load case DLC 1.1, the partial load factor shall be $\gamma_f = 1,25$.

If for normal design situations the characteristic value of the load response $F_{gravity}$ due to gravity can be calculated for the design situation in question, and gravity is an unfavourable load, the partial load factor for combined loading from gravity and other sources may have the value

$$\gamma_f = 1,1 + \varphi\zeta^2 \text{ and } \varphi = \begin{cases} 0,15 \text{ for DLC 1.1} \\ 0,25 \text{ otherwise} \end{cases}$$

$$\zeta = \begin{cases} 1 - \left|\dfrac{F_{gravity}}{F_k}\right|; & \left|F_{gravity}\right| \le \left|F_k\right| \\ 0; & \left|F_{gravity}\right| > \left|F_k\right| \end{cases}$$

For design load case DLC 2.1, the partial load factor may be calculated from the following expression if the mean time between failures (MTBF), in years, for the considered failure mode has been evaluated (see 7.4.3.2):

$$\gamma_f = \begin{cases} 1,35 & \text{MTBF} \le 10 \\ 1,71 - 0,155\ln(\text{MTBF}) & 10 < \text{MTBF} \le 50 \\ 1,10 & \text{MTBF} > 50 \end{cases}$$

For design load case DLC 2.5, the partial load factor shall be 1,2.

The guidance provided in IEC-EN 61400 shall be considered as a minimum standard for design. It is the designer's responsibility to ensure that local governing design codes do not present more severe parameters for design. The designer should refer to AWEA-ASCE – Recommended Practice for Compliance of Large Land-based Wind Turbine Support Structures for additional guidance on reconciling IEC 61400 with local design codes.

7.1.16 Seismic load combinations shall be performed as outlined in IEC-EN 61400. In general, seismic loads shall be combined with operational wind loads and the highest of the following shall control:

a. mean loads during normal power production determined at rated wind speed

b. loads during emergency stop at rated wind speed

c. loads during idling or parked condition at no wind and rated wind speed

Note that IEC-EN 614000 states that a partial safety factor of 1 for seismic load evaluation.

7.1.17 Operational and fatigue loads, as provided by the wind turbine manufacturer, shall be utilized by the designer for the serviceability limit state check.

7.1.18 The foundation designer shall be responsible for performing the following checks in addition to other conventional checks that are typically performed in reinforced concrete design. This list is not intended to be all-encompassing, but rather to convey the owner's expectations for the calculation package.

a. Raft Check

i. Foundation designer shall ensure that foundation has sufficient capacity to prevent punching failures where the pedestal connects to the raft.

ii. Foundation designer shall ensure that foundation has sufficient capacity to prevent shear and flexural failure at critical cross sections along the raft.

iii. Foundation designer shall ensure that minimum reinforcement requirements, as outlined in ACI 318 and possibly local governing codes, are satisfied by the design.

iv. Foundation designer shall ensure that the maximum characteristic shear resistance is determined based on the ratio between the reinforcing radial bars in tension and the concrete section is lower than 1% using Paulay & Priestley formulas.

v. Foundation designer shall ensure that steel shear reinforcement is sufficient for resisting the entirety of the external shear where concrete shear resistance is exceeded.

b. Tower Connection Check

i. The turbine manufacturer will provide loading, layout, and size of anchor bolts. It is the foundation designers' responsibility to identify the length of anchor bolt needed to resist the loads.

ii. Foundation designer shall ensure that the concrete and grout in the vicinity of the tower connection is sufficient to resist the compressive forces of the tower to prevent compression crushing failure (failure of region in contact with tower), spalling failure (failure of region adjacent to region in contact with tower), and splitting failure (delamination in deeper layers due to tensile forces).

c. Fatigue Checks

i. Foundation designer shall verify that the grout below the tower flange, concrete below the grout, concrete in vicinity of embedded plates, reinforcement bars, and concrete at critical raft cross sections are sufficient for the fatigue loading expected due to the dynamic loading of the tower.

7.1.19 It is the owner's preference that the shape of the foundation be circular. Other geometries must be approved by owner prior to design phase.

7.1.20 For shallow foundations, the thickness of the raft along the perimeter shall not be less than 12 inches in granular soil and 20 inches in granular soil. If foundation designer can provide sufficient evidence that a thinner section is acceptable, owner may permit thinner sections at foundation edge.

7.1.21 If piles are utilized, the minimum center to center distance of piles shall be three times the diameter. The minimum pile center to foundation edge distance shall be 20 inches.

7.1.22 For deep foundations, the thickness of the raft along the perimeter shall not be less than “20 inches + pile radius” or 1 meter, whichever is more restrictive.

7.1.23 Concrete cover, rebar lapping, and bar bundling shall be performed according to applicable codes.

7.1.24 Foundation designer shall clearly locate and callout the position of all conduits to avoid clashes during installation.

7.1.25 Foundation designer shall propose method of routing conduits for owner approval prior to design.

7.1.26 At a minimum, anchorage bolts shall have an embedment length into the foundation of at least 5.25 ft.

7.1.27 Foundation designs shall neglect or degrade soil strength properties at the top of the foundation as a result of frost or disturbance during drilling per recommendations of the geotechnical engineer.

7.1.28 All exposed foundation edges shall have a 0.75-inch chamfer.

7.1.29 All foundations and slabs-on-grade shall have a minimum projection of 6 inches above ground level, except that concrete pier-type foundations shall have a minimum projection of 12 inches of concrete above ground level.

7.1.30 All foundation design shall be performed in accordance with the recommendations outlined in the project specific geotechnical report.

7.1.31 Foundation designer shall utilize provisions in project specific geotechnical report related to prevention of frost heave.

7.1.32 Substation foundation designs shall be compliant with all applicable OSHA requirements.

7.1.33 Substation foundation designs shall be compliant with ACI 318, ACI 336, AISC Manual of Steel Construction, and ASCE Manual No. 113.

7.1.34 Substation foundations for control houses, step-up transformers, firewalls, etc. shall comprise of drilled piers, cast in place mat foundations, etc.

7.1.35 Foundation designer shall consider oil spill retention as needed. Oil retention basins shall extend a minimum of 5 ft. beyond the perimeter of oil-bearing parts. The oil retention basin shall be sized for the full volume of oil within equipment, plus 10 minutes of flow from a firehose (500 gpm) and 6 inches of additional freeboard and shall comply with all EPA and state requirements.

7.1.36 Substation foundation stability checks shall be performed with unfactored loads. The minimum permissible safety factors for resisting forces shall be as follows:

- Overturning & Sliding, FS = 1.5

- Soil Bearing Capacity, FS = 3.0

7.1.37 Structure foundations shall be surveyed and staked prior to excavation.

7.1.38 When performing backfill load calculation, designer shall consider minimum load factors of 0.90 and 1.35 when load is considered favorable and unfavorable, respectively. Designer shall not be permitted to rely upon additional backfill higher than the original topography without prior approval from the owner.

7.1.39 Foundation designer shall specify minimum backfill material properties such as grading, plasticity, lift thickness, compaction, etc. Backfill material at a minimum should comply with conventional backfill soil expectations, such as the following:

a. absence of organic materials

b. approximate density of 120 lbs./ft.

c. soil compaction of at least 95% of maximum density as outlined in ASTM D1557

7.2 Design Working Life

7.2.1 The design working life of the structural works (including Turbine Foundations) shall be a minimum of 30 years.

7.3 Concrete

7.3.1 Concrete materials shall be in accordance with the requirements set forth in Table 1 (*Summary of Requirements for Concrete Materials*) herein, at a minimum.

7.3.2 A nominal slump at the point of delivery shall be as shown in Table 2 (*Slump Requirements*) herein, as tested in accordance with ASTM C143.

Table 1: Summary of Requirements for Concrete Materials

Material	Material Requirements
Cement	ASTM C150, Type I, II, or V (as required)
Water	Clean, potable, and free from injurious amount of oil, acid, alkali, organic matter or other deleterious substances.
Coarse aggregate	Crushed stone, washed gravel, or other acceptable inert granular material conforming to ASTM C33, ACI 318
Fine aggregate	Clean natural sand, ASTM C33, ACI 318
Fly ash	ASTM C618; determined by Seller and approved by Owner
Air-entraining agent	ASTM C260
Chemical admixture	ASTM C494; determined by Seller and approved by Owner
Plasticizer	ASTM C494 / ASTM C1017; determined by Seller and approved by Owner
Form oil	Light colored paraffin oil or other acceptable non-staining material
Curing agent	ASTM C309; determined by Seller and approved by Owner
Floor sealer	ASTM C1315; determined by Seller and approved by Owner
Concrete repair	Determined by Seller and approved by Owner
Compound	Determined by Seller and approved by Owner
Joint sealant	ASTM C1193; determined by Seller and approved by Owner
Non-shrink grout	Determined by Seller and approved by Owner
Pre-formed joint filler	Determined by Seller and approved by Owner
Concrete	Minimum concrete compressive strength to be determined by Seller and subject to Owner review and approval.
Grout	Minimum grout compressive strength to be determined by Seller and subject to Owner review and approval.

Table 2: Slump Requirements

Description	Minimum (inches)	Maximum (inches)
Turbine Foundations	2.0	5.0
Reinforced walls and footings	2.0	5.0
Slabs on-grade	2.0	4.0
Drilled piers (dry, uncased, or permanent casing drill method)	4.0	6.0
Drilled piers (temporary casing drill method, wet and dry)	6.0	8.0
Drilled piers (slurry displacement drill method)	7.0	9.0

7.3.3 Cast-in-place concrete shall be in accordance with the latest applicable requirements of the ACI, ASTM, and CRSI, at a minimum.

7.3.4 Ready-mixed concrete manufacturing and delivery shall conform to ASTM C94.

7.3.5 Concrete for foundations shall have a specified compressive strength of not less than 5,000 psi.

7.3.6 Concrete mix designs and concrete placement procedures shall be approved by Owner prior to use.

7.3.7 Aggregates shall be tested per ASTM C33 for potentially reactive materials. If such test results indicate that aggregates are reactive, an alkali-silica reaction ("**ASR**") mitigation plan shall be provided.

7.3.8 Concrete admixtures may be used to improve the performance of the concrete however shall be approved by the owner prior to use. Utilization of admixtures shall conform to ASTM C494 guidelines.

7.3.9 Concrete shall be placed only in the presence of a duly-authorized representative of Seller.

7.3.10 Concrete placement shall not be permitted when weather conditions or other pertinent factors prevent proper placement and consolidation.

7.3.11 Concrete shall be placed at a sufficient rate to ensure that lifts below have not taken initial set before fresh concrete is deposited. In any event, concrete shall be placed within 45 minutes after mixing. This period may be extended to 90 minutes provided that the combined air temperature, relative humidity, and wind velocity are such that the plasticity of the fresh concrete is satisfactory for placement and consolidation, and that the specified mixing water is not exceeded. Concrete which has partially set shall not be re-tempered but shall be discarded.

7.3.12 Concrete requirements shall be adjusted for hot weather:

(1) Hot weather concreting shall be in accordance with ACI 305R.

(2) When hot weather conditions exist that would materially impair the quality or strength of concrete, the concrete shall be placed in compliance with ACI 305R and as herein specified.

(3) Ingredients shall be cooled before mixing to maintain concrete temperature at time of placement below 90°F.

(4) Mixing water may be chilled or chopped ice may be used to control the concrete temperature, provided the water equivalent of the ice is calculated to the total amount of mixing water.

(5) Reinforcing steel shall be covered with water-soaked-burlap if it becomes too hot, so that the steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.

(6) Retarding admixtures shall not be used unless otherwise accepted in mix designs.

7.3.13 Concrete requirements shall be adjusted for cold weather:

(1) Cold weather concreting shall be in accordance with ACI 306R.

(2) After the first frost and until the mean daily temperature in the vicinity of the Work falls below 40°F for more than 24 hours, the concrete shall be protected against freezing for not less than 48 hours after it is placed.

(3) Whenever the mean daily temperature in the vicinity of the Work falls below 40°F for more than 24 hours, the concrete shall be maintained at a temperature not lower than 50°F for at least 72 hours after it is placed and shall be protected against freezing for five (5) days immediately following the 72 hours of protection at 50°F. This continuance of protection against freezing shall be such that the drop-in temperature of any portion of the concrete will be gradual and will not be lower than 40°F in 24 hours.

(4) When artificial heat is employed, special care shall be taken to prevent the concrete from drying.

(5) The use of calcium chloride will not be permitted.

(6) A non-corrosive, non-chloride set accelerating admixture may be used when approved by Owner.

(7) Concrete damaged by freezing shall be removed and replaced at Seller's expense.

(8) Concrete shall not be permitted to freeze for at least seven (7) consecutive days following placement.

7.3.14 The maximum aggregate size for concrete shall not exceed 1.5 inches. However, it is the designers' responsibility to ensure that the maximum aggregate size is compatible with the design and layout of rebar or other inserts. The designer shall evaluate the concentration of rebar and inserts to ensure that aggregate size does not affect the free flow of wet concrete, creating issues such as concrete segregation which should be avoided.

(1) Smaller maximum aggregate size, such as 0.75 inches, may be necessary for pumped or tremie concrete.

(2) Rounded aggregates may be necessary to produce desired workability.

7.3.15 All exterior exposed concrete shall have an air content of 4.5 percent (4.5%) to 7.5 percent (7.5%).

7.3.16 Designer shall at a minimum evaluate exposure categories C1 and C2 as outlined in ACI 318 (latest edition) when performing concrete design. Designer shall evaluate more rigorous exposure categories if necessitated by local conditions.

7.3.17 Concrete shall be conveyed from mixer to forms as rapidly as practicable without segregation or loss of ingredients. Concrete shall be placed in forms nearly as practicable in final position to avoid re-handling.

7.3.18 Chutes, if used, shall slope sufficiently to ensure flow of properly proportioned concrete and must be kept free of hardened or partially set concrete.

7.3.19 Concrete shall be carried in at such a rate that the concrete is at all times plastic and flows readily into the spaces between the bars. No concrete that has partially hardened or been contaminated by poor material shall be used nor shall re-tempered concrete be used.

7.3.20 Immediately after depositing, concrete shall be compacted by agitating thoroughly in an approved manner to force out air pockets. The mixture shall be worked into corners around reinforcement and inserts to prevent formation of voids. Tapping or other external vibration of forms will not be permitted. Care shall be used in use of vibrators to prevent segregation of sand pockets or bleeding. Vibrators shall be moved continuously in and out of concrete, keeping stationary only a few seconds in any position. Vibrators shall not be used to transport concrete within forms.

7.3.21 For concrete poured within forms and not involving drilled pier construction, concrete shall not drop freely over five (5) feet in unexposed work or over three (3) feet in exposed work. Where greater drops are required, tremies, concrete pump, or other approved methods shall be used.

7.3.22 Concrete may be dropped into drilled piers installed using the dry method under the conditions that concrete shall not hit any reinforcing bars or sidewalls and that concrete with all aggregates shall be able to flow freely into the spaces between the reinforcing bars. Vibration of concrete falling more than 20 feet is not required. The concrete shall be placed in the pier in one continuous operation unless agreed otherwise by Owner.

7.3.23 For concrete involving massive structures, including Turbine Foundations, concrete mix or construction procedure shall be modified such that excessive heat produced by hydration shall be prevented.

7.3.24 Cast-in-place concrete, at Seller's option, may be placed by pumping in accordance with ACI 304; however, it shall use a specifically designed mix for pumping concrete, as fine aggregate gradation and water and cement content are more critical and different from the regular concrete mix. The mortar used for lubricating the pumping equipment shall be discarded.

7.3.25 Concrete shall not be conveyed through aluminum or aluminum alloy pipes.

7.3.26 Maximum water/cement ratio: 0.45.

7.3.27 Joints:

(1) A good bond and watertight joint are required at construction joints.

(2) Joints shall be obtained by adequately preparing and protecting the surface of the first pour or lower part of the construction joint.

(3) Joint surface shall be level and reasonably rough, clean, moist and some aggregate particles should be exposed. Any laitance or soft layers shall be removed from the top surface of the hardened concrete.

(4) Turbine Foundations shall not have joints, unless approved by Owner and only for the base and pedestal interface in a spread footer foundation.

7.3.28 All fins and other surface projections shall be removed from all formed surfaces.

7.3.29 All surfaces are to be at the specified elevation and left true and level.

7.3.30 Surfaces that will be exposed shall be cleaned and rubbed to produce a smooth, uniform surface that is free of marks, voids, surface glaze, and discoloration. Slab foundations shall receive a light broom finish. Care shall be taken to see that all excess water is removed before making any finish.

7.3.31 The unformed surfaces of concrete shall be screened and given an initial float finish followed by additional floating and troweling as required. Precaution shall be taken by Seller to protect the finished surface from stains and abrasions.

7.3.32 The removable ends of all form ties shall be removed and the recesses resulting from such removal shall be filled with dry patching mortar.

7.3.33 "Cure & Seal 1315 UV" curing compound, manufactured by Symons Corporation, or an approved equal, shall be applied to all outside foundations to a depth of 12 inches below final ground grade.

7.3.34 Concrete shall be protected from loss of moisture for at least seven (7) consecutive days by membrane curing compound and the curing medium shall be maintained to prevent detrimental loss of water from the concrete for the duration of the entire curing period.

7.3.35 Unhardened concrete shall be protected from heavy rains, flowing water, excessive heat, or mechanical damage. Finished surfaces shall be protected from stains, abrasions, or physical damage.

7.3.36 Defects:

(1) Defects in formed concrete surfaces shall be repaired within 24 hours, and defective concrete shall be replaced within 48 hours, after the adjacent forms have been removed.

(2) All concrete which is porous, honeycombed, or otherwise defective shall be repaired.

(3) Defective concrete shall be repaired by chipping out the unsatisfactory material to a minimum depth of 0.5 inches and placing new concrete, which shall be formed with keys, dovetails, or anchors to attach it securely in place with Owner approval.

(4) Concrete surfaces, including structural concrete, that contain defects which adversely affect durability, strength, and/or appearance shall be repaired by a method approved by Owner or replaced.

7.3.37 Concrete testing:

(1) Prepare concrete test cylinders conforming to ASTM C31 and ASTM C192 prior to the first pour of each day, and at a rate of not less than one set of cylinders for each 50 cubic yards or fraction thereof and not less than one set for each foundation or structure. Strength assessment of concrete test cylinders shall conform to the procedures as outlined in ASTM C39.

(2) Field slump tests in accordance with ASTM C143 shall be performed prior to the pour from each truck. Designer shall clearly indicate slump range and requirements on the construction drawings. Adjustment or fixing of concrete *in situ* shall not be allowed.

(3) Air content, concrete temperature, and air temperature tests shall be performed prior to the pour from each truck. All testing shall be done in accordance with the requirements of ASTM C231 (air) and ASTM C1064 (temperature).

(4) Electronic copies of concrete test reports shall be provided to Owner within 72 hours of testing but not less than 24 hours in advance of commencing Wind Turbine Generator erection activities at the relevant Wind Turbine Generator location. In the event of failure of any concrete test, Owner shall be immediately notified, and a repair/remediation plan shall be provided.

7.4 Grout

7.4.1 Nonmetallic, shrinkage-resistant grout shall conform to ASTM C1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time. Grout shall be selected such as to have high fatigue resistance as is needed due to the inherent dynamic loading involved with a wind turbine. Grout shall also be selected to be suitable for the expected temperature fluctuations during both construction and design life of structure.

7.4.2 Designer shall calculate the necessary grout compressive strength and indicate on the design drawings the minimum grout resistance needed prior to tensioning the anchor bolts.

7.4.3 Grout mix designs, grout specification sheets, grouting plans, and grouting procedures shall be approved by Owner prior to use.

7.4.4 Grout testing shall be performed in accordance with ASTM C579 to ensure adequate strength. Additional testing shall be performed in accordance with ASTM C881 to ensure adequate bonding to concrete. Sufficient grout cubes shall be taken to allow for, at a minimum, 1-day, 2-day, 3-day, 7-day, and 28-day testing, plus two (2) additional cubes per sample for accelerated or delayed testing.

7.4.5 Grout test reports shall be provided to Owner within 72 hours of testing, and for Turbine Foundations, at least at least 24 hours in advance of commencing or continuing (as is the case with grouting of tower base sections) Wind Turbine Generator erection activities at the relevant Wind Turbine Generator location. In the event of failure of any grout test, Owner shall be immediately notified, and a repair/remediation plan shall be provided.

7.4.6 Grouted surfaces that contain defects which adversely affect durability, strength, and/or appearance shall be repaired by a method approved by Owner or they shall be replaced.

7.5 Forms

7.5.1 Forms shall be designed to produce hardened concrete having the shape, lines, and dimensions indicated on the drawings.

7.5.2 Forms shall be substantial and sufficiently tight to prevent leakage and shall be properly supported and braced to maintain position and shape. Forms for all exposed surfaces shall produce smooth, dense, and true finishes free of fins, imperfections, or other defects.

7.5.3 Forms shall be cleaned and oiled before concrete is placed. Oil is to be applied before reinforcement is placed.

7.5.4 Formwork for walls, columns, sides of beams, gravity structures, slabs-on-ground, and other vertical-type formwork not supporting the weight of concrete shall remain in place for at least 24 hours after concrete placement is completed.

7.5.5 Formwork supporting weight of concrete and shoring shall not be removed until structural members have acquired sufficient strength to safely support their own weight and any construction or other superimposed loads to which the supported concrete may be subjected.

7.5.6 Forms may be of wood, plywood, concrete-form-grade hardboard, metal or other acceptable material, which will produce smooth, true surfaces.

7.5.7 Metal forms shall have smooth surfaces free from any pattern, irregularities, dents, or sags.

7.5.8 Commercial formulation form-coating compounds shall be used that will not bond with, stain, nor adversely affect concrete surfaces, nor impair subsequent treatments of concrete surfaces requiring bond or adhesion, nor impede wetting of surfaces to be cured with water or curing compound.

7.5.9 Form ties shall be factory-fabricated, adjustable-length, removable or snap-off metal form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal. For concrete that will be exposed, provide ties so portion remaining within concrete after removal is at least 1.5 inches inside concrete. Form ties shall not leave holes larger than one (1.0) inch in diameter in concrete surfaces.

7.5.10 Remove forms in a manner to avoid damage to the structure, with particular care for corners and edges.

7.6 Drilled Piers

7.6.1 All drilled piers shall be designed consistent with the primary load application, either as laterally loaded piers or as compression/uplift piers.

7.6.2 Circular shafts shall be dug by means of a power-driven rotary bucket or auger type drilling rig.

7.6.3 Diameter and depth of drilled piers shall be as needed to resist overturning moments and designed to ensure compliance with foundation performance criteria such as pier rotation and deflection.

7.6.4 Drilled pier performance criteria shall be limited by 1 degree of total rotation, 0.5 degrees of non-recoverable rotation, 1 inch of total deflection, and 0.5 inches of non-recoverable deflection.

7.6.5 Unfactored loads shall be used for determination of foundation performance.

7.6.6 A minimum safety factor of 1.25 shall be utilized during comparison of ultimate strength for overturning/pull out with factored design loads.

7.6.7 Drilled piers shall have a nominal projection of 12" and shall be crowned to prevent ponding.

7.6.8 A steel lining shall be used for soil conditions that make it necessary to protect personnel, prevent cave-ins, or hold out ground water. Linings shall be withdrawn concurrent with placement of concrete in such a manner as to prevent formation of rock pockets or ground water mixing with concrete. Concrete shall have sufficient head above bottom of lining being withdrawn to hold out water and maintain shaft diameter.

7.6.9 Concrete reinforcement shall be placed in dry pier excavation, unless otherwise approved by Owner, clear of all loose earth, gravel, and rock.

7.6.10 Concrete shall be placed in continuous operation to top of pier elevation, using an elephant trunk, concrete pump, or other approved method. Time delays between shaft drilling and concrete placement shall be minimized particularly in unstable and/or granular type soils prone to sloughing or caving.

7.6.11 When it is necessary to place concrete under water, a tremie pipe or concrete pump shall be used. The lower end of the tremie pipe shall be kept submerged in the concrete throughout concrete placement.

7.6.12 All methods used to design, and construct drilled piers shall be in accordance with ACI 336.1.

7.6.13 Permanent casings shall not be used without prior approval by Owner.

7.6.14 The volume of concrete required for each drilled shaft shall be plotted on a graph of concrete volume versus depth.

7.6.15 In locations where drilled pier foundations are impractical or cannot be constructed due to cost, soil, environmental, access or permitting considerations, alternate foundation types will be allowed with the approval of Owner. Alternate foundation types may include spread or block footings, direct embedded, vibratory caissons, socketed, rock anchors, grouted, grouped piles with pile cap (e.g., concrete filled pipe piles, auger cast-in-place piles, H-piles), micro-pile, and other similar items. The selection of the foundation type and construction methods should consider site disturbances, access and long-term drainage and erosion control.

7.7 Reinforcing Bar

7.7.1 All reinforcing steel, including welded wire mesh, shall be accurately located and held in position using proper reinforcing steel supports, spacers, and accessories in accordance with ACI SP-66 "*Detailing Manual*" and CRSI's "*Manual of Standard Practice*".

7.7.2 At time of placing concrete, all reinforcing shall be free of loose rust, scale, oil, paint, mud or other coatings which may destroy or reduce the concrete bond.

7.7.3 All reinforcing bars shall conform to ASTM A615 and have a minimum yield strength of 60 ksi.

7.7.4 Where not otherwise specified or shown by the written dimension, the minimum coverage of the concrete over the steel shall be as follows:

(1) Concrete cast against and permanently exposed to earth: 3 inches.

(2) Formed concrete exposed to earth or weather: 2 inches.

(3) Concrete in beams and columns not exposed to ground or weather: 1.5 inches.

(4) Concrete slabs and walls not exposed to weather: 1.5 inches.

7.8 Anchor Bolts

7.8.1 The threads on the upper end of each anchor bolt shall protrude sufficiently to satisfy the Requirements and adequately complete tensioning activities. Threads and nuts shall be protected with corrosion protection material.

7.8.2 Prior to setting anchor bolts, the threads on the upper end of each anchor bolt shall be given a light coat of oil or grease to prevent adherence of concrete.

7.8.3 When installed, anchor bolts shall be cleaned and the portions to be embedded in concrete shall be cleaned and free of oil or other deleterious substances which would adversely affect the bond between the bolt and concrete, unless otherwise specified by the Turbine Supplier.

7.8.4 During the concrete finish and clean-up, concrete adhering to the portions of the anchor bolt extending above finished concrete grade shall be removed giving attention to concrete at the finish grade line which would prevent base plates from seating fully on the finished concrete elevation.

7.8.5 Anchor bolts shall be properly located, accurately positioned, and maintained securely in place before placing of concrete.

7.8.6 Unless otherwise required by the Turbine Supplier, anchor bolts, nuts, and washers shall comply with the following:

(1) Anchor bolts: ASTM A615 or A722, Grade 150.

(2) Nuts: ASTM A563, heavy hex carbon steel.

(3) Washers: ASTM F436, hardened carbon steel.

(4) Finish: Not used.

7.8.7 Anchor bolt ring-plates shall be fabricated by Seller as needed following the templates provided by the Turbine Supplier. Embedment rings shall be new material.

(1) Embedment ring shall be minimum 1.5-inches thick, ASTM A36 Grade 36 or ASTM A572 Grade 50, and new material (not reused).

(2) Template rings shall be minimum 1.5-inches thick, ASTM A36 Grade 36 or ASTM A572 Grade 50.

7.9 Tolerances

7.9.1 Anchor bolts, concrete piers, and flat slabs shall be set carefully and maintained at the lines and elevations within the following tolerances, unless otherwise specified by the Turbine Supplier:

(1) Location of concrete piers with respect to foundation center: ±1/4 inch.

(2) Distances between bolt centers in the same foundation: ±1/8 inch.

(3) Elevation at top of anchor bolts and flat slabs: -0 to +1/4 inch.

(4) Angular deviation from vertical (i.e., out of plumb): 1/16 inch in 1 foot.

(5) Distance between anchor bolt centers between adjacent foundations for a structure: ±1/4 inch.

(6) Horizontal angular alignment (i.e., rotation) of anchor bolt group: ±1°.

(7) Flat slab deviation from level: 1/16 inch in 4 feet.

7.10 Structural Steel Fabrication and Connections

7.10.1 Structural steel shall be fabricated and assembled in shop to greatest extent possible.

7.10.2 Specific structural steel materials shall comply with the following, at a minimum:

(1) W-shapes: ASTM A992/A992M (50 ksi yield strength).

(2) Channels, angles-shapes: ASTM A36/A36M.

(3) Plate and bar: ASTM A36/A36M.

(4) Cold-formed hollow structural sections: ASTM A500, Grade B structural tubing.

(5) Steel pipe: ASTM A53/A53M, Type E or S, Grade B.

(6) Weight class: standard.

(7) Finish: galvanized.

(8) Welding electrodes: comply with AWS requirements.

7.10.3 Galvanizing repair paint shall be SSPC-Paint 20 ASTM A780.

7.10.4 Design and fabrication shall be according to AISC's "*Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design*".

7.10.5 High-strength structural steel shall be identified according to ASTM A6/A6M and maintain markings until structural steel has been erected.

7.10.6 Materials shall be marked and match-marked for field assembly.

7.10.7 Structural-steel assemblies shall be completed, including welding of units, before starting galvanizing operations.

7.10.8 High-strength bolts shall be shop installed according to the RCSC's "*Specification for Structural Joints Using ASTM A325 or A490 Bolts*" for type of bolt and type of joint specified.

7.10.9 Weld connections shall comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding Work.

7.10.10 Backing bars or runoff tabs shall be removed, back gouged, and ground steel smooth.

7.10.11 Built-up sections shall be assembled and welded by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "*Code of Standard Practice for Steel Buildings and Bridges*" for mill material.

7.10.12 Weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel shall be verified that they will limit distortions to allowable tolerances.

(1) Butt welds shall be ground flush.

(2) Exposed fillet welds shall be ground or filled to smooth profile.

(3) Exposed welds shall be dressed.

7.10.13 Zinc coating shall be applied by the hot-dip process to structural steel according to ASTM A123/A123M.

7.10.14 Vent holes shall be filled and ground smooth after galvanizing.

7.11 Testing and Quality Control

7.11.1 All testing described herein shall be performed by an independent, experienced third party. Seller shall notify Owner of all testing schedules at least 30 days in advance of testing activities.

7.11.2 All structural works shall be tested to demonstrate they meet stated design criteria and are fit for purpose.

7.11.3 Structural works testing shall include the following, at a minimum (for the avoidance of doubt, additional Turbine Foundation testing requirements are specified in Section 6.13 herein):

(1) Concrete and grout properties (strength, slump, air content, temperature).

(2) Compaction.

7.11.4 Copies of testing reports shall be submitted to Owner within 10 days of completing such test. Testing reports shall include a summary of testing procedures and acceptance criteria.

8.0 COLLECTION SYSTEM SPECIFICATIONS

8.1 General Provisions

8.1.1 The Collection System Circuits shall be installed only within parcels that are leased by the Project and clearly defined by ALTA survey

8.1.2 The Collection System Circuits shall be designed and constructed to a high level of reliability and shall meet or exceed the requirements set forth by the interconnection utility.

8.1.3 The Collection System Circuits shall be designed and constructed in accordance with the Project Electrical Studies, as defined below:

(1) NERC PRC Studies: The entire wind plant from the collector substation down to the individual turbine needs to be incorporated into all applicable NERC PRC analysis required for a Bulk Electric System (BES rated) generating facility. This includes but is not limited to PRC-019, 024, and 025.

(2) Load Flow Study: load flow study with power flow analysis for the collection system circuits. Final report shall include a table showing cable ampacity and percent loading per cable section corresponding to the Project one-line diagram. Cable ampacity shall not exceed 90 percent of the rated value, based on Project Site-specific thermal resistivity. All external heat sources shall be considered, including parallel circuits. Thermal design shall account for actual field soil samples and backfill requirements (native or engineered).

(3) Short Circuit Study: short circuit analysis of collection system circuits, Substation, and transmission interconnection line, including secondary values on WTGs. The short circuit analysis and study shall be utilized in Seller's electrical designs to support relay coordination study and equipment specification.

(4) Annual Energy Loss Report: electrical losses evaluation, including estimate of annual energy losses for Project design based upon fully-loaded conditions and Project Site-specific wind distribution data, respectively. Such analysis shall be sufficient to demonstrate that the Electrical Loss Limit (see Exhibit A) is not being exceeded, and shall be based upon Project-specific cabling and transformer specifications, Project Site-specific soil conditions, Project Site-specific wind data, and other similar considerations.

(5) Reactive Compensation Study: reactive power flow report, including power factor study at Point of Interconnection. The study shall identify reactive compensation required to meet the Technical Specifications, including the requirements of interconnection for power factor and voltage regulation, and including any capacitor bank and/or reactor requirements. The study shall include varying combinations of active power (no load, partial load, full load) and voltage (min. 0.95 to 1.05 pu) at the Point of Interconnection.

(6) Harmonic Analysis Report: power quality analysis or harmonic monitoring at the Point of Interconnection and Substation shall be used to determine the harmonic resonance and flicker conditions within the Project, and demonstration that the Project design meets the harmonics distortion requirements in the Technical Specifications (including IEEE 519), including any necessary filtering or mitigation to be provided by Seller. If the Transmission system is found to be source of the harmonics, the Transmission Operator shall be responsible for the required mitigating actions.

(7) Concentric Induced Voltage Report: analysis to calculate the maximum induced voltage on the collection system circuit shield wires.

(8) Insulation Coordination Report: study to ensure the insulation coordination requirements of IEEE C62.22-2009 have been satisfied within the Project electrical design, including proper application of surge arresters to safeguard electric power equipment within the collection system circuits against hazards of abnormally-high voltage surges of various origins.

(9) Transient Overvoltage Report: study to confirm any system modifications required to adequately limit transient overvoltage on the collection system circuits, including determination of the transient overvoltage levels on the collection system circuits after feeders have been isolated from the Substation due to a line-to-ground fault, and determination of the maximum energy required to be absorbed by each surge arrester on the collection system circuit feeders.

(10) WTG Ground Grid Report: analysis of WTG grounding design to verify the adequacy of the proposed design and the safety of personnel working in or around the WTG. The study shall confirm that the grounding system maintains touch and step voltages within tolerable limits, and shall be prepared in accordance with the procedures, data, and recommendations given in IEEE 80). The study shall determine the ground potential rise with respect to remote earth, and Turbine Foundations shall be modeled as they are constructed (i.e., if not solidly bonded (e.g., using wire ties), they should be modeled accordingly).

(11) Arc Flash Study: arc flash hazard analysis of the Equipment, including all energized equipment in the WTGs, collection system circuits, and O&M Building. This analysis shall be performed in accordance with the latest version of NFPA-70E and IEEE 1584. Study shall inform incident energies for labels and PPE requirements. Arc flash stickers shall be prepared by Seller based on these results. Seller shall provide the stickers and detailed location guidance on where stickers are to be applied.

(12) Protection Coordination Study: relay and protection equipment coordination study, including detailed calculations, one-line and three-line diagrams, fuse curves, coordination curves, protected equipment data, and relay set points. This study shall include the WTG equipment (including switchgear) and collection system circuits. A narrative philosophy statement shall be submitted for comment before completing the coordination study. The relay settings shall be coordinated with that of the WTG's switchgear. The applicable trip curves and settings will be sent to the Turbine Vendor for review.

8.1.4 Each individual collector circuit shall be limited in generation capacity by the ampacity at nominal collection voltage in local soil conditions of a single 1250 kcmil conductor per phase from the substation to the first turbine in the circuit. The total nameplate capacity shall not exceed 30 MW per collector substation circuit breaker. This fixed, project specific voltage and ampacity will determine the maximum power and thus the maximum number of turbines allowable on each circuit. Owner does not permit parallel conductor runs in this case. Certain scenarios will permit the useage of 1500 kcmil conductor if the 1250 kcmil conductor will not meet the ampacity requirements based on the given soil and/or conductor arrangement conditions. Such scenarios will be reviewed and approved by owner prior to final collection design.

8.1.5 Access to the Collection System Circuits shall be from existing roads or new access roads within the permitted area. Exact Collection System Circuit routing shall be determined, however, the preferred routing shall be to parallel the access roads and crane paths as much as possible, so long as such routing does not increase the required number of crane breakdowns. When not practical or efficient to parallel the access roads, the Collection System Circuit shall be routed in a straight line, shortest distance as much as possible within the lease requirements of all parcels.

8.1.6 All manufacturer installation instructions for the installation of all Collection System Circuit components shall be obtained and followed.

8.1.7 Collection system and turbine naming convention shall follow owners standard below and matched on all references, including but not limited to engineering reports and studies, drawings and SCADA.

(1) Feeders numbering shall always start at 1 and end in the total number of feeders at the given plant.

(2) Turbine reference will be three parts with hyphens in between each part.

(a) The first part will be the 2 or 3 character site identifier. Example TB Flats 1 would be TB1. Site identifier to be coordinated with owner before finalizing.

(b) The second part will be the feeder reference in which that turbine is placed.

(c) The third part will be the turbine number starting with the first turbine closest to the substation and incrementing to each turbine thereafter towards the end of the string. Therefore each feeder will have turbines 1 through n (n being total number of turbines in each feeder) for the third part of the turbine reference.

(3) Any OEM turbine SCADA naming limitations need to be documented, addressed and approved by the owner before finalizing.

8.2 Design Working Life

8.2.1 The design working life of the Collection System Circuits shall be a minimum of 30 years.

8.3 Civil Works Requirements

8.3.1 All civil works for the Collection System Circuits shall comply with the applicable specifications in Section 6.0 *(Civil Works Specifications*).

8.3.2 Excavation by blasting for the Collection System Circuits is prohibited.

8.3.3 Trench widths shall be kept to a minimum to allow sufficient space for equipment installation.

8.3.4 The trench bottom shall be firm for the entire length and width.

8.3.5 Trenches shall be kept free from water.

8.3.6 Conduit and cable shall not be placed on frozen ground.

8.3.7 All splice pits (if used) and backfill shall be compacted to a minimum of 85 percent (85%) of standard proctor density, unless otherwise noted on the design drawings.

8.4 Power Cabling

8.4.1 All Collection System Circuit power cabling shall be 34.5-kV, three (3)-phase, 60 Hertz.

8.4.2 Cables should adhere to AEIC CS8-13 and the latest versions of ANSI/ICEA S-94-649 "Standard for Concentric Neutral Cables Rate 5 through 46kV" and S-97-682 "Standard for Utility Shielded Power Cables Rated 5Through 46kV.

8.4.3 Notwithstanding the following sentence, all underground Collection System Circuit cabling shall be direct buried at a depth of at least 48 inches below grade. All crossings, including road and utility crossings, shall be installed in conduit and buried at a depth of at least 48 inches below grade.

8.4.4 All Collection System Circuit cables shall be UL listed.

8.4.5 Collection system Circuit cable shall be of a discharge-free design and suitable for direct burial, installation in duct and exposure to sunlight on an alternating current, three-phase, 34.5-kV nominal, 60-Hertz power system.

8.4.6 Allowable conductor sizes are 1/0 AWG through 1250 kcmil. . 1500 kcmil useage shall be reviewed by owner and permitted only under unique scenarios stemming from Ampacity constraints.

8.4.7 All central conductors shall be Class B stranded. No more than one (1) conductor per cable shall be allowed. Conductor material shall be aluminum or copper.

8.4.8 A sufficient amount of cable slack shall be provided to allow installation of elbows and termination of the cables to the appropriate junction box and/or Wind Turbine Generator switchgear terminal and permit ready disconnection of the elbows and mounting on the parking stands. Such slack shall allow for the installation / service disconnection of connectors, dead breaks, and other similar devices.

8.4.9 Excess slack shall be provided to allow re-termination in the event of failure. The excess slack at each Wind Turbine Generator location shall be in the form of a maintenance loop. Sufficient cable length shall be provided such that the cables may be re-terminated at least two (2) times after installation.

8.4.10 All Collection System Circuit power cabling shall be provided with terminators and labels. Labels shall be permanently attached at both ends. Labels shall be sequentially numbered.

8.4.11 If underground splices are permitted by Owner, underground splices shall be identified using a domed post installed on the surface at the point of the splice (the domed post shall be offset ten (10) feet from the plane of the collector line on a plane that is perpendicular to the plane of the collector line), splices shall only be performed by a skilled, qualified craft worker, and all underground splice work shall be videotaped; the coordinates of each splice shall be recorded and noted within the As-Built Drawings. The KMZ file will additionally need to have the coordinates indicating location of all splices in the as-built copy.

8.4.12 All underground 34.5 kV splices shall be shear bolt style and made by 3M. Preferred splice kit is 3M Cold Shrink QS-III. Any deviation from this must be reviewed and approved by owner.

8.4.13 Bedding material shall be installed around all buried Collection System Circuits to provide physical and/or thermal protection for buried cable. All trench bedding and/or backfill materials shall be screened and visually inspected for materials in excess of two (2) inches. All bedding and/or backfill material shall be composed of materials that are native to the Project Site. Such materials shall be free of debris, roots, organic matter, frozen matter, coal, ashes or cinders.

8.4.14 Cable marking tape shall be furnished and installed in all trenches. Such tape shall be metallic and detectable. Marking table shall be placed 12 to 18 inches above cable.

8.4.15 Excessive bending of cabling shall be avoided, and the manufacturer recommended bending radius shall not be exceeded.

8.4.16 All above ground cable access such as junction boxes, transformers or switchgear shall have fault indicators installed on all phases with a minimum of 8 hours operating time if a fault does occur.

8.4.17 All crossings, including road and utility crossings, shall be marked on each side using a cable marker.

8.4.18 Domed posts shall be placed along the underground cable trench at the following locations:

(1) All crossings (road, pipeline);

(2) Every underground splice location (see Section 8.4.11 above)

(3) When the path of the collector line deviates from the path of a parallel road (when a road uses an "S" turn on the side of a hill, but the collector line takes a shortcut over steep grade).

8.4.19 BIL voltage rating: 200 kV or as approved by Owner on a case-by-case basis.

8.4.20 Maximum short-circuit conductor temperature: 250°C.

8.4.21 Reel management plan for all cable sizes and fiber optic cables must be created and adhered to by Seller to minimize splices. The reel management plan shall be available to owner upon request. The reel management plan shall be updated as necessary during the installation to reflect any changes or corrections to line lengths. Planned splice locations shall be reviewed and approved by owner. To minimize splices, it may be preferable to pull cable some distance through a bore provided pulling tension does not exceed manufacturer's specifications. Any anticipated cable shortages shall be brought to owner's attention immediately. Provide trenching plan ten (10) days prior to trenching activities.

8.5 Fiber Optic Cabling

8.5.1 Fiber optic cable may be installed in the same trench as the Collection System Circuit power cabling.

8.5.2 Refer to Section 9.0 (*Communications System Specifications*) for additional requirements.

8.6 Pad-Mount Transformers

8.6.1 If not supplied internal to the Wind Turbine Generator, each Wind Turbine Generator location shall include a medium-voltage, pad-mount transformer. Such transformer shall be sufficiently sized to allow the full Wind Turbine Generator capacity to be delivered.

8.6.2 Pad-mount transformers shall be in accordance with the requirements set forth in Table 3 (*Summary of General Requirements for Pad-Mount Transformers*) herein, at a minimum.

Table 3: Summary of General Requirements for Pad-Mount Transformers

Description	Value
Quantity	1 per Wind Turbine Generator
Type	Oil filled, hermetically sealed, outdoor installation
Voltage ratio	MV/LV ratio varies by connection voltage and Wind Turbine Generator
Phases	3
Windings	2 (MV, LV)
Ambient Temp Conditions	-25°C to 50°C
Steady state temperature rise	65°C above ambient
Frequency	60 Hz
Impulse levels	150 kV (General), 200 kV (Windings)
Vector group	Grounded wye/delta (unless required otherwise for interconnection or WTG operation)
Harmonics	Core and laminations shall tolerate harmonic content according to THD distribution from turbine/inverter vendor
Cooling	ONAN
Tapping range	±5%, 2.5% steps, manual control
Paint finish	Munsell Green
Guaranteed losses	Not used
Temperature gauge with alarm	Required (analog or digital alarm acceptable)
Pressure level indicator with alarm	Required (analog or digital alarm acceptable)
Pressure relief device with alarm	Required (analog or digital alarm acceptable)
Oil sampling valve	Required (to be located on the end of the drain valve inside the LV compartment)
Filling orifice	Required
Tank ground tag	Required
Oil level indicator	Required
Grounding	Solid (MV source) Un-grounded delta (LV) (Actual grounding configuration is project specific and should be coordinated between the utility requirements and the turbine vendor requirements)

8.6.3 Pad-mount transformers shall be fitted with LV breakers and in-line, medium-voltage rated, current-limiting fuse protection per phase utilizing suitably rated, oil-immersed, current-limiting fuses. The selection of these fuses shall be such as to ensure:

(1) Compliance with the requirements of C37.47, or IEC equivalent.

(2) Short circuit protection of the MV transformer winding.

(3) That degradation of the fuses or mechanical support failure does not occur as a result of the flow of repeated transformer magnetizing in-rush currents.

(4) Ease of replacement following an in-service operation.

8.6.4 Enclosure:

(1) The pad-mount transformer shall include a fully enclosed, transformer mounted, MV and LV termination, steel cabinet, suitable for outdoor installation, as per ANSI C57.12.28. The cabinet must be so designed as to fully enclose all cable tails, cable terminations, grounding tags and transformer fittings within a tamper and rodent resistant, secure enclosure.

(2) The cabinet shall extend to floor level, fully shrouding all cable tails, having the facility for being directly bolted to the supporting concrete plinth. The cabinet depth shall be 24 inches.

(3) The MV and LV compartments shall be partitioned such that access to each compartment is via a separate door. External access shall be available through the LV compartment door only, with access to the MV compartment door lock being available within the LV compartment. The doors shall be fitted with an all steel, robust, tamper proof, three point (i.e., top, mid, and bottom) integral locking system. Each door shall have the facility of being securely locked shut via the application of a dedicated pad lock.

(4) The transformer name plate and all transformer indication fittings (e.g., oil level indicator, oil temperature indicator) shall be located within the LV compartment, while all transformer operational fittings (e.g., tap changer switch, isolation switch etc.) shall be located within the MV compartment.

(5) The cabinet doors shall be fitted with anti-close stays designed such that both doors can be held open at right angles. The anti-close stay design shall be sufficiently strong enough to withstand the prevailing wind conditions.

8.6.5 Foundations / vaults:

(1) Pad-mount transformers shall be installed with a fiberglass box pad.

(2) Box pads shall be installed level and plumb, and set on concrete with a rock base. Excavations shall be filled with a minimum 2,000 psi slurry mix.

8.7 Junction Boxes

8.7.1 Junction boxes shall be stainless steel or fiberglass.

8.7.2 Junctions boxes shall be installed level and plumb, and set on concrete with a rock base, with excavations filled with a minimum 2,000 psi slurry.

8.7.3 Junction boxes shall be clearly marked with an appropriate high-voltage sign identifying the junction box number and Collection System Circuit number.

8.7.4 Junction boxes shall meet the requirements of ANSI C57.12.28, including water resistance.

8.7.5 The coordinates of each junction box shall be recorded and noted within the As-Built Drawings as well as the updated KMZ file.

8.7.6 Junction boxes shall be lockable with a padlock.

8.7.7 No medium-voltage cable run shall exceed 8,500 feet for concentric round wire neutrals and 10,000 feet for flat strap neutrals without a sectionalizing junction box.

8.7.8 Junction boxes are to be installed in proximity to existing roads, service roads, and project equipment easements for ease of access when servicing is required.

8.7.9 Junction boxes shall have cable support brackets installed for all conductors sized 500 KCMIL and above to support weight of the cable and relieve strain on the bushing termination.

8.8 Overhead Installation

8.8.1 All Collection System Circuits shall be installed underground.

8.9 Surge Arrestors

8.9.1 Surge arrestors shall be provided at the end of each string of Wind Turbine Generators. Surge arrestors shall be 35-kV class, 600A, 30kV/24.4MCOV equipment meeting the requirements of ANSI C62.11 for Station Class installation in a 60-Hertz outdoor installation.

8.9.2 Surge arrestors shall be provided in pre-molded rubber elbows.

8.9.3 Surge arrestors shall provide overvoltage system protection in an insulated, fully shielded, submersible, dead-front device.

8.10 Grounding

8.10.1 Grounding connections at junction boxes and pad-mount transformers (if any) shall be bolted to facilitate separation of grounds for continuity testing and ground mat testing.

8.10.2 Ground rods shall be incorporated into the grounding system. Ground rods shall be copper-clad, 5/8-inch diameter, 10-foot-long rods at a minimum.

8.10.3 Turbine Foundations shall include a grounding grid. The design and construction of the grounding system in such foundations shall meet or include the following requirements, at a minimum:

(1) Requirements set forth by Turbine Supplier.

(2) Incorporate the recommendations and minimum requirements set forth in the geotechnical engineering report.

(3) Proper grounding of equipment and structures.

(4) Installation of adequate ground for personnel safety, including touch and step potentials (to be demonstrated by Seller via calculations in the grounding study).

(5) Proper grounding for lightning and surge protection.

(6) Incorporate local resistivity measurements.

(7) A ground resistance <= 2 Ω.

8.10.4 All local requirements and the NESC shall be adhered to in the grounding design and construction.

8.10.5 Meteorological towers shall be independently grounded; meteorological tower grounding shall not be interconnected to the Wind Turbine Generator grounding system.

8.11 Bollards

8.11.1 Bollards shall be installed around every junction box and pad-mount transformer (if any), respectively. Bollards shall be installed no closer than four (4) feet from the junction box or pad-mount transformer (if any).

8.11.2 Bollards shall be a minimum three (3)-inch diameter steel pipe, concrete filled for equipment protection, painted safety yellow, and extend five (5) feet above grade.

8.11.3 Bollards shall include two (2) embedded galvanized steel eye bolts in each bollard at an elevation of forty-two (42) inches above grade that is sufficient to allow for the connection of lengths of chain.

8.12 Conduit

8.12.1 Conduit size shall be in accordance with ANSI / NFPA 70, at a minimum.

8.12.2 The location of all conduit shall be surveyed and recorded within the As-Built Drawings.

8.12.3 Non-metallic conduit shall be protected from sunlight.

8.12.4 The interior surface of all conduits shall be smooth to prevent damage to the cables. When cable is pulled into a duct, a suitable pulling lubricant shall be used.

8.12.5 HDPE conduit shall be SDR13.5 or heavier if needed to avoid damage when pulling into the bored hole. HDPE shall be one continuous length or connected with fused joints.

8.12.6 Use suitable temporary plugs or caps to protect installed conduit against entrance of dirt, moisture, and debris.

8.12.7 All above-ground power and communications cabling shall be installed in conduit. All below grade crossings, including road and utility crossings, shall be installed in conduit. Conduit shall be installed from each Wind Turbine Generator to each pad-mount transformer (if any).

8.12.8 All conduit materials required shall be furnished new and undamaged in accordance with the following requirements, at a minimum:

(1) Duct: polyvinyl chloride, Schedule 40 PVC in accordance with NEMA TC-2.

(2) Couplings: plastic, for use with duct previously specified and “Duct-to-steel” adapters as required, including joint cement.

(3) Spacers: plastic high impact, interlocking, base and intermediate type

(4) Factory bends and sweeps: Schedule 40 PVC, 3-foot minimum radius (or greater if required to not violate the minimum bending radius of the cable being installed in it).

(5) End bells: plastic.

(6) Plugs: plastic, high impact, tapered to fit end bell provided.

(7) Duct binder: hemp or sisal twine coupling.

8.13 Connectors and Fittings

8.13.1 Connectors and fittings shall be of the proper size and design to assure permanent, secure, and low-resistance connections.

8.13.2 Connectors and fittings shall be all welded or swaged type for aluminum tubing connections and shear bolt or puddle-welded type for aluminum cable connections.

8.13.3 Tubular aluminum welded or swaged splicing sleeves shall be used for necessary splices in aluminum tubing.

8.13.4 For connections between aluminum tubing and cable, use a welded or swaged tubing-to-terminal pad connector and a compression-type cable-to-terminal pad connector on the end of the cable.

8.13.5 Flexible terminal types shall be furnished where tubing connections are made to bushing studs of transformers, breakers, and other equipment. Expansion-type connectors shall be used with internal ball-type alignment guides.

8.13.6 For electrical pad connections, stainless steel hex-bolts, hex-nuts, flat washers, and Belleville washers shall be provided. Belleville washers shall have a minimum compression rating of 4,000 pounds. Bolt lengths shall be sized to provide minimal projection beyond hex nut to prevent excessive noise due to corona, but entire hex nut must be engaged.

8.13.7 For copper to aluminum connections, stainless steel bolts shall be used for copper to aluminum bar or rod connections and faced or sleeved aluminum connectors shall be used for cable connections.

8.13.8 All connections between stranded aluminum or ACSR-type conductors and equipment stud terminals shall be made with a stud-to-pad type stud connector and a compression-type cable-to-pad type conductor termination.

8.13.9 All dead-end fittings, terminals, splices, and other similar items for ACSR and other types of stranded aluminum conductor shall be tubular compression type fittings. In no case shall any type of stranded aluminum conductors be used with bolted or clamp-type fittings, except for through-type connections to surge arresters on transformers. At least five percent (5%) extra dead-end body filler plugs for each type used shall be provided.

8.13.10 Stranded and tubular copper bus work, where used, shall have connectors and fittings with a minimum of four (4) bolts or two (2) "U"-bolts on each side of each joint.

8.13.11 Fittings shall develop the full strength of the conductor and shall be capable of carrying the full current capacity of the conductor.

8.13.12 Fittings for shield wire dead ends, splices, and taps shall conform to the following:

(1) Shield wire dead-end fittings shall be compression type with bolted jumper connection. Shield wire insulators shall be located as indicated.

(2) Compression sleeves for shield wire tension splices shall be used which will develop at least ninety percent (90%) of shield wire strength.

8.13.13 "Alcoa Filler Compound" shall be furnished for application in conductor dead-end bodies and Alcoa No. 3 Electrical Joint Compound (Alnox) or approved equal for aluminum connections. At least five percent (5%) overage shall be furnished for all filler compounds furnished.

8.13.14 Bus support clamps for rigid bus shall be fixed or slip type as required to firmly support the bus but allow for temperature expansion and contraction.

8.13.15 Bolted ground connectors and flexible type grounding jumpers shall be provided for operating handles of disconnect switches.

8.13.16 All transformer and oil circuit breaker stud connectors shall be tinned bronze material.

8.13.17 All grounding connectors in contact with galvanized structures shall be tinned bronze material.

8.13.18 All compression tees are to be open type compression run and 4-hole NEMA pad tap.

8.13.19 Bundled jumpers from power circuit breakers to disconnect switches shall be furnished.

8.13.20 For disconnect switch connections, NEMA-type terminal pad connectors shall be provided with at least four (4) bolts.

8.13.21 All materials furnished shall have mechanical and electrical ratings, types, sizes, and other similar items coordinated with adjacent hardware and fittings.

8.13.22 All hardware furnished shall be static-free type.

8.13.23 Ground jumpers shall be provided direct from switch-operator ground pad to ground connector on operating handle or mechanism of switch. No other ground connection is to be made to pad. Ground mat(s) shall be furnished at each switch-operator.

8.13.24 Bus grounding stud, welded or swaged, shall be furnished as indicated.

8.13.25 Wire guides and bundle conductor spacers shall be provided as required and indicated to maintain adequate clearance and support on cable jumpers, connections, and overhead lines.

8.14 Miscellaneous Material

8.14.1 Cable accessories, terminators, dead front, load break and/or dead break elbows shall be designed and manufactured for the cable to be utilized and rated 600-amp for outdoor 34.5-kV use.

8.14.2 Dead front, load break, and/or dead break elbows shall be supplied with test ports.

8.14.3 Cable fault indicators shall be installed. The remote head shall be mounted in the cabinet wall to allow viewing from outside the cabinet. Fault indicators shall be installed at every third Wind Turbine Generator or junction box location.

8.14.4 Miscellaneous wire material such as armor rod, line guard, spacers, dampers, tension splices, compression sleeves, and jumper terminals shall be provided.

8.15 Testing and Quality Control

8.15.1 All testing described herein shall be performed by an independent, experienced third party. Seller shall notify Owner of all testing schedules at least 30 days in advance of testing activities.

8.15.2 All Collection System Circuits shall be tested to demonstrate they meet stated design criteria and are fit for purpose.

8.15.3 Collection System Circuit testing shall include the following, at a minimum:

(1) All testing specified in the Applicable Standards, including NETA.

(2) All testing reasonably recommended or required by the applicable equipment suppliers.

(3) All exposed cable sections shall be visually inspected for physical damage or manufacturing defects. Such inspections shall be performed prior to and during installation.

(4) Resistance testing on grounding grid at each Wind Turbine Generator location and junction box.

(5) Megger test of all 34.5-kV Wind Turbine Generator cables.

(6) Very low frequency ("**VLF**") test of all 34.5-kV power cabling at or below rated voltage.

(7) Final continuity tests after completion of all system connections. Acceptable continuity tests shall include a Megger test or VLF test at 100 percent of rated voltage.

(8) Partial discharge testing to be performed by Imcorp or approved equal on all cable segments All partial discharge testing shall be performed following installation of the cabling, but prior to energization.

(9) No destructive testing such as VLF Withstand test shall be permitted after Partial discharge testing is complete. Only continuity testing at or below rated voltage shall be permitted.

(10) Compaction testing shall be verified at a minimum of every 1,000 feet and at every splice pit location.

(11) Communications system testing according to <u>Section 9.0</u> (*Communications System Specifications*).

(12) Pad-mount transformer minimum testing:

(a) Transformer turns ratio ("**TTR**") on all tap positions.

(b) Insulation resistance test (i.e., Megger), including winding-to-winding and winding-to-ground measurements.

(c) Winding resistance test.

(d) Insulation power factor test.

(e) Oil testing prior to energization and at least 30 days following energization, respectively.

(f) No-load and load loss test.

(g) Temperature rise test, to be performed on one (1) randomly selected unit.

(h) Dissolved gas analysis, to be performed on every purchased unit, plus one (1) additional DGA test before the temperature rise test listed above. Any costs incurred by removing or replacing transformers due to abnormal DGA results or any delay due to removing or replacing transformers will be the responsibility of the Seller.

8.15.4 Copies of testing reports shall be submitted to Owner within 10 days of completing such test. Testing reports shall include a summary of testing procedures and acceptance criteria.

9.0 COMMUNICATIONS SYSTEM SPECIFICATIONS

9.1 General Provisions

9.1.1 The Communications System shall be designed with data continuity and reliability as priority.

9.1.2 All monitoring and control devices and systems shall be suitably zone protected against lightning electromagnetic impulses in accordance with IEEE C37.90.1.

9.1.3 The Communications System shall be compliant with all Applicable Standards, including NERC Functional Model Registered Entity function, NERC Reliability Standards, Regional Entity Standards, approved regional variances, and/or FERC Orders as defined by NERC/FERC orders and Owner interpretation. Further, the Communications System shall comply and be designed to work in accordance with applicable system operator approved protocols, operating guides, standards, business practice manuals, and/or approved rules. In so far as either a state utility commission or provincial authority has instituted additional regulations, the communications system should be designed to accommodate where no conflict exists with NERC or FERC. Design should include parameters for operating under conditions specified by rules stated hereto as well as capability to function on an evidentiary basis.

9.1.4 The design deliverables shall include but not limited to, integrated control and monitoring systems and communication networks schedule, description and technical specifications of monitoring and control systems, SCADA architecture, fiber optic design, SCADA points list, bill of materials, fiber patch panel drawings, logic diagrams and functional control diagrams.

9.1.5 All Communications System design and construction shall conform to the Turbine Supplier's requirements.

9.2 Design Working Life

9.2.1 The design working life of the Communications System equipment shall be a minimum of 30 years.

9.3 Civil Works Requirements

9.3.1 All civil works for the Communications System shall comply with the applicable specifications in Section 6.0 *(Civil Works Specifications*).

9.3.2 Excavation by blasting for the Communications System is prohibited.

9.3.3 Trench widths shall be kept to a minimum to allow sufficient space for equipment installation.

9.3.4 The trench bottom shall be firm for the entire length and width.

9.3.5 Trenches shall be kept free from water.

9.3.6 Conduit and cable shall not be placed on frozen ground.

9.3.7 All splice pits (if used) and backfill shall be compacted to a minimum of 85 percent (85%) of standard proctor density, unless otherwise noted on the design drawings.

9.3.8 Backfill shall be free of debris and sharp objects.

9.4 System Functionality

9.4.1 The Control and Monitoring systems shall be designed to meet the Turbine Vendor's drawings and specifications, Interconnection Agreement requirements, PPA requirements and Owner's design guidelines and standards.

9.4.2 The Communications System shall be capable of centrally and remotely monitoring, controlling, and recording the performance of the permanent meteorological towers, Wind Turbine Generators, wind turbine supplier SCADA and other critical sensors.

9.4.3 The Communications System design shall include configuration files and a comprehensive data points list and protocol specification for communications between all Project components requiring communications, data transfer, and control monitoring using the fiber network integrated into the Communications System. Such configuration files shall have the ability to be configured by Owner, and Seller shall furnish development application software for each configurable device.

9.4.4 The Communications System shall include the necessary equipment (hardware and software) for the exchange of signals with Project Substation equipment to support grid monitoring. Seller is responsible to provide design and drawings, supply, install and test all necessary Ethernet and fiber optic cable networks to maintain all communications.

9.4.5 The Communications System shall include the necessary equipment (hardware and software) for the exchange of signals with the permanent meteorological towers to support data monitoring.

9.4.6 The Communications System shall include the necessary equipment (hardware and software) for the exchange of signals and integration of any required reactive compensation devices (e.g., capacitor banks, reactors).

9.4.7 Upon loss of utility power interconnection or failure of utility power, restart of the instrumentation and control system to a fully functioning condition should require no local manual operations. Synchronization shall be performed automatically.

9.4.8 The equipment IP addresses networking security shall be aligned to Owner standards and recommendations.

9.5 Fiber Network

9.5.1 Fiber optic cable shall be installed in the same trench as the Collection System Circuit power cabling and will be used for all turbine-to-turbine runs, turbine to meteorological tower runs and for all homeruns to the site substation

9.5.2 When fiber cables are installed in a trench, the fiber cable shall be placed in conduit or continuous innerduct; the fiber cable shall be rated for underground use; and there shall be a suitable locating cable installed in the innerduct/conduit. Innerduct shall have a minimum diameter of 1.25 inches.

9.5.3 Fiber optic shall be separated from any power cables when co-located in a trench.

9.5.4 All fiber cables shall consist of a minimum of 12-strand single mode fiber. All fiber runs shall be single-mode fiber, or as otherwise required to maintain a minimum of at least one (1) gigabyte bandwidth throughout the backbone of the system.

9.5.5 If metallic armored fiber optic cable is used, protection from induced voltage shall be installed.

9.5.6 All fiber cables shall be designed with a minimum of fifty percent (50%) spare fiber, and at least an additional six (6) feet of fiber cable supplied at each end.

9.5.7 All communications cables, including fiber cables, shall be appropriately labeled with a permanently attached label at both ends. Labels shall be sequentially numbered.

9.5.8 The fiber system shall be designed for a minimum of five (5) dB system margin.

9.5.9 The fiber system design shall be a fiber ring topology or a "daisy-chained" system.

9.5.10 Conduits for fiber entry into the Wind Turbine Generator areas shall include a pull string for pulling the cable.

9.5.11 All splices shall be fusion splices.

9.5.12 Maximum attenuation:

(1) 0.36 dB/km at 1310 nm

(2) 0.22 dB/km at 1550 nm

9.5.13 Terminations shall be completed with either an approved fiber optic pigtail kit or with approved mechanical connectors and an approved fanout kit.

9.5.14 Data collection loops shall be designed so that a loss of a power circuit does not cause a loss of data collection from the Turbines during the power outage.

9.6 Monitoring and Control Requirements

9.6.1 Design and installation of the Communications System shall be provided with all hardware, telemetry, communication and other requirements as required by the interconnection utility.

9.6.2 The Wind Turbine Communications System shall be provided with the following supervisory screens, at a minimum.

(1) Wind Turbine Generator status, including the following:

(a) Wind Turbine Generator status (e.g., online, offline for maintenance, curtailed) for each unit

(b) Wind Turbine Generator generation level for each unit

(c) Total Project power

(d) Atmospheric conditions

(2) Permanent Meteorological Tower Data:

(a) Wind Speed

(b) Wind Direction

(c) Turbulence

(d) Temperature

(e) Pressure

9.6.3 The Wind Turbine Supplier Power Plant Controller shall include control functionality for the following, at a minimum:

(1) Active power

(2) Reactive power

(3) Frequency

(4) Voltage

(5) Power factor

(6) Noise-related operations

9.7 Reporting and Storage Requirements

9.7.1 All reporting shall be in Generation Availability Data System ("**GADS**"), wind format.

9.7.2 SCADA system reporting shall include, at a minimum, the following for the permanent meteorological towers and Wind Turbine Generators:

(1) Performance parameters, availability, operation counters, faults, and alarms

(2) Browsing and filtering of historical data

(3) Creation of pre-defined and custom reports

(4) Interface and operational procedure for interaction with existing Owner assets as defined by Owner

9.7.3 All stored data and generated reports shall be exportable as ASCII and Microsoft Excel formats.

9.7.4 The system shall not permit unwarranted tampering with or changing of raw data or functionality.

9.7.5 Seller shall design and provide connectivity and data sharing form/to the Interconnection utility.

9.8 Data Storage Requirements

9.8.1 All data monitored by the Communications System shall be recorded and stored. Local controllers shall have sufficient buffer for at least 30 days of data storage in the event of power loss.

9.8.2 Historical data shall be stored in an SQL database or Owner-approved equivalent for the life of the Project. Data shall be stored in the database as no higher than 1-minute averages, with accompanying statistical values including, but not limited to, minima, maxima, and standard deviation. All data shall be retrievable.

9.9 Data Integration

9.9.1 Seller shall include the design with the standardization and synchronization required by the Owner's control center or Plant SCADA to integrate the new wind site including naming convention, alarms configuration, point definitions, HMI screens, ISO, PPA requirements, WTG models, Substation model, etc.

9.9.2 Provide all hardware and software necessary to interface and transmit all required monitoring and control data from/to substation Owner's SCADA system (RTAC), WF SCADA and the other communication devices of Owner's Control Center.

9.9.3 Testing and commissioning of the integration shall be included as a milestone on the plan schedule.

9.10 Testing and Quality Control

9.10.1 All testing described herein shall be performed by an independent, experienced third party. Seller shall notify Owner of all testing schedules at least 30 days in advance of testing activities.

9.10.2 All communications system equipment shall be tested to demonstrate it meets stated design criteria and is fit for purpose.

9.10.3 Communications system testing shall include the following, at a minimum:

(1) All testing specified in the Applicable Standards, including NETA.

(2) All testing reasonably recommended or required by the applicable equipment suppliers.

(3) All exposed cable sections shall be visually inspected for physical damage or manufacturing defects. Such inspections shall be performed prior to and during installation.

(4) Verify all alarms, indications and analog quantities are communicated and received properly by the RTU and displayed correctly on the HMI.

(5) Verify all communication channels (intra- and inter-Project Substation), including Project Substation LAN, operate as expected.

(6) Verify fiber optic system performance (power losses, splice or connector losses, etc.) using optical domain reflectometer ("**OTDR**"). All such testing shall be done with an OTDR in both directions of the strands. For single-mode fiber, test both directions at 1310 nm and 1550 nm.

(7) All fiber optic cable shall be visually inspected and OTDR-tested prior to installation. OTDR testing shall be coordinated with the Substation Communication System testing.

(8) Provide system functionality and compatibility at the control room / O&M Building.

(9) Test each cable and strand on every fiber run from termination to termination.

(10) Provide entire Project Site testing to ensure proper operation of all data points into the component gateways and testing of all data points provided to third parties with that party.

9.10.4 Copies of testing reports shall be submitted to Owner within 10 days of completing such test. Testing reports shall include a summary of testing procedures and acceptance criteria.

10.0 ERROR! REFERENCE SOURCE NOT FOUND.WIND TURBINE GENERATOR OFFLOADING AND ERECTION SPECIFICATIONS

10.1 General Provisions

10.1.1 Wind Turbine Generator erection shall follow a "reference" approach, wherein complete erection of the first Wind Turbine Generator shall occur prior to erecting any subsequent Wind Turbine Generators. Such initial Wind Turbine Generator erection shall be reviewed and approved by Owner and the Turbine Supplier before continuing Wind Turbine Generator erection activities, and such approval shall not be unreasonably withheld or delayed. The "reference" Wind Turbine Generator, once accepted, shall serve as a model finished product for all subsequent Wind Turbine Generator erections.

10.1.2 Wind days shall be actively minimized by scheduling Wind Turbine Generator erection activities at times of day when wind speeds are projected to be lowest.

10.1.3 Wind Turbine Generators shall be erected such that the tower door orientation is downwind of the of the prevailing wind direction.

10.1.4 Each crane, including the main erection crane(s) and any base/mid crane(s), shall be equipped with redundant anemometers at Wind Turbine Generator hub height for measurement of wind speeds. Wind speeds shall be recorded from these instruments prior to the start of all lifting activities, and measurements shall be recorded on a Seller-furnished data logger. Handheld anemometers shall also be furnished to determine safe wind speeds for all other operations. All such wind data shall be shared with Owner upon request.

10.1.5 Wind Turbine Generator cleaning:

(1) All exterior and interior Wind Turbine Generator surfaces shall be cleaned that are designed to accept pressure washing; light brushing with mild, biodegradable detergent shall be performed as necessary. For areas not allowing a pressure wash a thorough wipe down with appropriate cleaning agents are required. Following cleaning, all surfaces shall appear clean.

(2) All washing, including runoff, shall be in accordance with the applicable permits and other Requirements.

(3) Seller shall maintain cleanliness in the erected towers during performance of the Work. Final cleaning shall be performed prior to the Mechanical Completion walk down.

10.2 Procedures

10.2.1 Transportation, offloading, storage, and erection of Wind Turbine Generators shall be performed in accordance with the applicable instructions provided by the Turbine Supplier and the specifications provided herein, including critical lift plans.

10.2.2 Seller is responsible for supplying all straw bales, anchors, tie downs and other general supplies for staging Turbine components at Turbine foundation sites.

10.2.3 Seller is responsible to provide support to Turbine Vendor's component delivery trucks, assist with breakdown of shipping fixtures and trailers, and assist with loading of component shipping fixtures and hardware onto such trucks for removal from the Project.

10.2.4 Cooperating with the Owner and Supplier to mitigate demurrage to the maximum extent practical. In the event, the Seller is directly responsible for the demurrage the Owner shall cooperate to mitigate the demurrage to match the delivery cadence of the WTG Supplier to the maximum extent practical for the Seller to minimize additional demurrage.

10.2.5 Seller is responsible unwrapping or removing protective coverings on Turbine Equipment as a part of the inspection and rewrapping and replacing any protective coverings on Turbine Equipment after the inspection.

10.2.6 If electrical or other components are sealed prior to arrival and the seal must be broken to meet inspection and installation requirements, Seller will re-cover such components. Seller will reseal using methods other than shrink wrap.

10.2.7 All rigging shall be stamped, load tested and inspected regularly in accordance with OSHA requirements, including any rigging supplied by Turbine Vendor.

10.2.8 The Seller shall assist trucking company with breakdown and preparation for return to port of the shipping trailers including providing support with breakdown of shipping fixtures, loading the specialty supports, cradles and shipping fixtures for return to vendor.

10.2.9 Seller shall inspect all Turbine components for damage upon arrival at the Site and report such damage to Owner within twenty-four (24) hours of arrival on the Project Site.

10.2.10 Seller shall maintain a detailed inventory of all Turbine components received, inspected, unloaded and installed at all times. Seller is responsible for collecting, organizing by final placement, and electronically scanning all Material Receiving Reports, Bills of Material, and/or packing lists in the job books as appropriate. Seller shall note the date and time of receipt, condition, and quantity of all materials received.

10.2.11 Seller shall use inspection reports supplied by the Turbine Vendor and Owner for reporting on the condition of all components received.

10.2.12 Seller shall track times and dates of component arrival, assist in determining component damage upon receipt, and assist in coordination of repairs prior to components being installed.

10.2.13 Mechanical completion of each Wind Turbine Generator, including documentation of progress on Turbine Supplier-furnished forms, shall be successfully achieved in accordance with the instructions set forth in the installation manual and mechanical completion checklists provided by the Turbine Supplier.

10.2.14 All rigging utilized for the transportation, offloading, or erection of Wind Turbine Generators shall be rated; inspected daily and monthly; and load tested in accordance with Applicable Standards or other more rigorous requirements set forth in the HSSE Plan, as defined in this specification. Inspection reports shall be maintained at the Project Site and available for review by Owner.

10.2.15 Primary delivery point is the Turbine Pad adjacent to the WTG foundation.

10.2.16 Create lift plans for all crane lifts. A copy of the lift plans shall be kept in the crane at all times. At a minimum, the lift plan shall be consulted before the first pick of its type for the crane for that day.

10.2.17 Seller shall install stairs, tower ladders, steel tubular towers, safety wires, platforms (and cut switchgear service penetrations in basement platforms), platform extensions, lights, switchgear, meteorological and support equipment and all tower and appurtenances. Seller shall install locks on access doors once tower installation has commenced.

10.2.18 Seller is responsible for supplying grease and bolt caps for exterior foundation anchor bolts. Owner or Turbine Vendor shall install grease and bolt caps as per the Turbine Vendor specifications.

10.2.19 Seller is responsible for all installation tooling. This includes, but is not limited to, Skidmore testing equipment, hydraulic torque wrenches, hand tools, etc. Testing certificates and calibration records for these tools shall be maintained on site and made available for inspection by Owner and Turbine Vendor.

10.2.20 Seller shall supply labor and equipment to perform touch up painting as required and in accordance with Turbine Vendor's instructions.

10.2.21 Seller shall supply and install permanent FAA lights at designated locations including wiring and field testing. FAA lights are to be installed per the FAA approved lighting plan.

10.2.22 Seller shall procure and install temporary FAA lights on Owner supplied mounting brackets. Temporary FAA lights shall be installed on those Turbines required to have permanent FAA lights and shall remain operational until the Turbines are energized.

10.2.23 Supply and install concrete footings at exterior WTG stairs, including grounding for stairs.

10.2.24 Providing all temporary surfaces (mats, hard standing, etc.) for safe and efficient offload, storage and erection, in accordance with crane manufacturer and WTG Supplier requirements.

10.2.25 Coordinating all crane crossing of temporary overhead and underground utilities. This includes all necessary crane break downs that may be needed.

10.2.26 All offloading and installation of wind turbine components shall be completed during safe working wind speeds.

10.2.27 Seller shall provide standstill maintenance (i.e., freewheeling) of WTGs during construction, if necessary.

10.2.28 Seller shall provide (via Turbine Vendor) technical advisors at the Project Site to provide advice, consultation (including answering questions), and clarification regarding the Turbine Vendor manuals, specifications, and other WTG-related technical documents. Such technical advisors shall be available during the loading, offloading, assembly, erection, installation, storage, and achievement of mechanical completion of the Turbine Equipment.

10.2.29

10.3 Testing and Quality Control

10.3.1 All testing described herein shall be performed by an independent, experienced third party. Seller shall notify Owner of all testing schedules at least 30 days in advance of testing activities.

10.3.2 Structural bolting will be installed in accordance with the applicable specification, design drawing, and ASTM/AISC standards.

10.3.3 Flange bolt torque requirements will be specified by the foundation structural design engineer. All flange bolts may be electronic or hydraulic torque wrench. All torque tools are to be inspected daily.

10.3.4 Bolts, washers and nuts required a visual check prior to final tightening to ensure all have been properly installed. After each bolt has been tightened, a torque mark must be made on bolt to ensure bolt has been torqued to specified value.

10.3.5 After final torque has been completed, a 10% check of flange bolts must be done. If a single bolt moves more than 20% (1/2 Flat Movement) during the check, a 100% re-torque is required. Upon completion bolts must be remarked for torque.

10.3.6 After verifying proper installation of blades, bolts, and washers' blades must be tensioned to specified value. The blade studs will be tensioned in accordance with the WTG manufacturer's specified procedure

10.3.7 All Wind Turbine Generator electrical wiring shall be tested to demonstrate it meets stated design criteria and is fit for purpose.

10.3.8 Wind Turbine Generator testing shall include the following, at a minimum:

(1) All testing specified in the Applicable Standards, including NETA.

(2) All testing reasonably recommended or required by the applicable equipment suppliers.

(3) Structural works testing for grout properties, in accordance with Section 7.0 (*Structural Works Specifications*) herein.

(4) All exposed cable sections shall be visually inspected for physical damage or manufacturing defects. Such inspections shall be performed prior to and during installation.

(5) Megger test of all 34.5-kV Wind Turbine Generator cables.

(6) Final continuity tests after completion of all system connections. Acceptable continuity tests shall include a Megger test or VLF test at 100 percent of rated voltage.

11.0 METEOROLOGICAL TOWER SPECIFICATIONS

11.1 General Provisions

11.1.1 References to "meteorological towers" herein shall be understood to include both permanent and temporary meteorological towers, unless explicitly stated otherwise.

11.1.2 Meteorological towers shall be sized and constructed appropriately to allow instrumentation to be placed at Wind Turbine Generator hub height. A side-by-side (i.e., goalpost) anemometer orientation, as shown in IEC 61400-12-1, shall be utilized; such side-by-side anemometers will be mounted at Wind Turbine Generator hub height on each permanent meteorological tower. Similarly, any height provided by a foundation for the temporary meteorological tower shall be taken into consideration relative to the final constructed hub height of the Wind Turbine Generator.

11.1.3 Meteorological towers shall be designed and fabricated to the latest EIA/TIA-222-FS Structural Standards for Steel Antenna Towers and Antenna Supporting Structures and according to other Applicable Standards.

11.1.4 Meteorological towers shall be painted / marked in accordance with the Applicable Standards and applicable permits.

11.1.5 All meteorological tower designs, including foundation design, shall be approved by Owner prior to procurement of such equipment or materials.

11.1.6 All meteorological towers shall incorporate a safety climb cable.

11.1.7 Sufficient grounding and lightning protection per IEC 61400-12 shall be installed on all meteorological towers, including lightning finials. Meteorological towers shall be independently grounded; meteorological tower grounding shall not be interconnected to the Wind Turbine Generator grounding system.

11.1.8 All anemometers shall be type "first class", heated sensors. All anemometers shall be calibrated in accordance with MEASNET's Anemometer Calibration Procedure and performed by a MEASNET-certified organization.

11.2 Design Working Life

11.2.1 The design working life of the permanent meteorological tower equipment shall be a minimum of 30 years.

11.3 Civil Works Requirements

11.3.1 All civil works for the meteorological towers shall comply with the applicable specifications in Section 6.0 *(Civil Works Specifications*).

11.4 Structural Works Requirements

11.4.1 All meteorological tower foundations shall be designed and constructed in accordance with the applicable structural works specifications in Section 7.0 (*Structural Works Specifications*).

11.5 Temporary Meteorological Towers

11.5.1 Temporary meteorological towers shall be either self-supported (non-guyed) or guy-wire-supported, galvanized lattice structures, each designed and certified for maximum wind and ice loading for the Project Site conditions.

11.5.2 Temporary meteorological towers shall be installed at a location at the Project Site to be specified by Owner. Care shall be taken by Seller to ensure that the constructed elevation of the temporary meteorological towers and the hub height anemometers is identical to the final hub height elevation of the respective Wind Turbine Generator at that location.

11.5.3 Temporary meteorological towers shall not be fenced.

11.5.4 All guy wires shall include avian protection, including bird diverters.

11.5.5 Each temporary meteorological tower shall include the following minimum instruments:

(1) Two (2) cup anemometers at Wind Turbine Generator hub height in a goal-post configuration.

(2) One (1) cup anemometer at mid-blade height.

(3) One (1) cup anemometer at lower-blade height.

11.5.6 Each temporary meteorological tower shall include the following auxiliary equipment:

(1) One (1) NEMA 4X fiberglass enclosure for data logger and auxiliary equipment.

(2) One (1) data logger. Each shall be Campbell Scientific.

(3) One (1) radio. Each shall be Campbell Scientific.

(4) Signal surge protection terminals. Each shall be Phoenix Contact, type Termitrab 24V.

11.5.7 Each temporary meteorological tower shall include the following other equipment:

(1) One (1) obstruction light, including mounting bracket. The light shall be mounted below the goal post

(2) Grounding and lightning protection, including lightning finial.

(3) Instrumentation booms.

(4) Cabling.

(5) H-frame equipment rack.

(6) Safety climb cable.

(7) Temporary power supply for data logger and aviation lights.

11.6 Permanent Meteorological Towers

11.6.1 Permanent meteorological towers shall be self-supported (non-guyed), galvanized lattice structures, each designed and certified for maximum wind and ice loading for the particular Project Site conditions.

11.6.2 Permanent meteorological towers shall be installed at a location at the Project Site to be specified by Owner.

11.6.3 Seller shall design, furnish, construct, and install permanent meteorological towers according to the following schedule and based on the number of WTGs installed.

No. of WTGs Installed	No. of Permanent Met Towers
Less than 50	2
51 to 100	4
101 to 150	6
151 to 200	8
201 to 250	10
251 to 300	12

11.6.4 All permanent meteorological tower locations shall be fenced.

(1) Fencing shall be placed to allow a minimum of ten (10) feet of free space around the tower base.

(2) At least one (1) walk gate shall be installed at each permanent meteorological tower. The walk gate shall be a lockable, single-hung, 4-foot-wide, swing-gate for personnel access.

(3) All fencing and gates shall comply with the minimum specifications in Section 3.12? (*Fencing, Walls, and Gates*) herein.

11.6.5 Each permanent meteorological tower shall include the following instruments:

(1) Two (2) cup anemometers at Wind Turbine Generator hub height in a goal-post configuration.

(2) One (1) cup anemometer at mid-blade height.

(3) One (1) cup anemometer at lower-blade height.

(4) One (1) vertical anemometer near Wind Turbine Generator hub height (below goal post).

(5) Two (2) wind direction sensors near Wind Turbine Generator hub height (below goal post).

(6) One (1) temperature / relative humidity sensor with radiation shields near Wind Turbine Generator hub height (below goal post).

(7) One (1) barometric pressure sensor near Wind Turbine Generator hub height (below goal post).

(8) One (1) temperature / relative humidity sensor with radiation shields at 10 meters above ground level.

(9) One (1) precipitation sensor.

11.6.6 Each permanent meteorological tower shall include the following auxiliary equipment:

(1) One (1) NEMA4X fiberglass enclosure for data logger and auxiliary equipment.

(2) One (1) data logger. Each shall be Campbell Scientific

(3) Signal surge protection terminals. Each shall be Phoenix Contact, type Termitrab 24V.

11.6.7 Each permanent meteorological tower shall include the following other equipment:

(1) Two (2) obstruction lights, including top- and mid-level, and including mounting brackets. The top-level light shall be mounted below the goal post.

(2) Grounding and lightning protection, including lightning finial.

(3) Instrumentation booms.

(4) Cabling.

(5) H-frame equipment rack.

(6) Fiber patch panel.

(7) Safety climb cable.

(8) Temporary power supply for data logger and aviation lights (if a power performance test (i.e., power curve test) is performed.)

11.7 Power Performance Testing Requirements

11.7.1 Proposals shall include an option price for a power performance test (i.e., power curve test).

11.7.2 Owner can request a power performance test be performed in the time period between the commissioning of the first Wind Turbine Generator and one year after the Project's commercial operation date. If a power performance test is performed, installation of the meteorological towers shall be installed in a commercially reasonable time after the owner has made the request and the test shall meet all requirements of the Wind Turbine Generator OEM. At least three (3) months of data collection shall be assumed to be required from the time that each meteorological tower is installed until the time it is removed.

11.7.3 If a power performance test (i.e., power curve test) is performed, meteorological towers shall be constructed in sets of two, or one permanent meteorological tower and one temporary meteorological tower, in order to maximize data collection time for Owner's site calibration (see Section 11.5 herein).

11.7.4 If a power performance test (i.e., power curve test) is performed, upon completion of data collection for the power performance test site calibration and at the request of Owner, temporary meteorological towers shall be decommissioned and removed, including any temporary foundations and fencing. All equipment and instrumentation from the decommissioned towers shall be returned to Owner at a location requested by Owner. For the avoidance of doubt, and unless explicitly approved by Owner, Wind Turbine Generators may only be installed (including earthwork and construction of Foundations) *after* the temporary meteorological tower at the respective Wind Turbine Generator location has been removed.

11.8 Meteorological Tower Obstruction Lighting

11.8.1 All meteorological towers shall be provided with aviation obstruction lights, including top- and mid-level as required, and including all mounting assemblies, GPS controller, and photocell as required by the Federal Aviation Administration and all other Applicable Standards, including US DOT-FAA Advisory Circular No. AC 70/7460-1K: *Obstruction Marking and Lighting*.

11.8.2 Meteorological tower aviation obstruction lights shall be programmed to blink in unison, including with those aviation obstruction lights that are installed on the Wind Turbine Generators.

11.8.3 Aviation obstruction lighting equipment shall be designed for continuous operation.

11.8.4 Aviation obstruction lights shall be FAA Type L-864 (single, red, flashing configuration).

11.8.5 Obstruction lighting shall incorporate an uninterruptible power supply capable of supplying back-up power for at least one (1) hour.

11.8.6 Obstruction lighting for all permanent met towers shall be integrated with the lighting for the Wind Turbine Generators in the FAA lighting plan for the Project.

11.9 Communications

11.9.1 All permanent meteorological towers shall be connected to, and communicate with, the Communications System and allow data recording and storage through the data archival features of the Communications System.

11.9.2 Communication from each permanent meteorological tower to the Communications System shall be via fiber optic circuit. Such communication path shall follow the same route as the Collection System Circuits in order to minimize disturbed area.

11.10 Power

11.10.1 Permanent power supply for each permanent meteorological tower shall be taken from the nearest Wind Turbine Generator or Collection System Circuit. Such permanent power supply path shall follow the same route as the Collection System Circuits in order to minimize disturbed area and shall be marked on the as built drawings and be protected with direct burial tape.

11.11 Testing and Quality Control

11.11.1 All testing described herein shall be performed by an independent, experienced third party.

11.11.2 All meteorological tower equipment shall be tested to demonstrate it meets stated design criteria and is fit for purpose.

11.11.3 Meteorological tower testing shall include the following, at a minimum:

(1) All testing specified in the Applicable Standards.

(2) All testing reasonably recommended or required by the applicable equipment suppliers.

(3) All meteorological tower foundations shall be tested in accordance with Section 7.11 (*Testing and Quality Control*) herein.

(4) All exposed cable sections shall be visually inspected for physical damage or manufacturing defects. Such inspections shall be performed prior to and during installation.

(5) Resistance testing on grounding grid at each tower location.

(6) Final continuity tests after completion of all system connections. Acceptable continuity tests shall include a Megger test or VLF test at 100 percent of rated voltage.

(7) Verify all alarms, indications and analog quantities are communicated and received properly by the RTU and displayed correctly on the HMI.

(8) Verify all communication channels operate as expected.

11.11.4 Copies of testing reports shall be submitted to Owner within 10 days of completing such test. Testing reports shall include a summary of testing procedures and acceptance criteria.

12.0 O&M BUILDING REQUIREMENTS

12.1 General Provisions

12.1.1 The O&M Building shall be steel constructed at a location at the Project Site to be approved by Owner. Ideally within one mile of a state highway.

12.1.2 The O&M Building location and access road shall be a minimum of 300 meters away from any wind turbine generator for safety.

12.1.3 The O&M Building shall be designed and constructed such that it is ADA compliant, including parking, doorways, bathrooms, kitchen, and other building features throughout.

12.1.4 The O&M Building shall comply with all Turbine Supplier requirements for the building, including office quantity, furnishings, warehouse requirements, and other similar items.

12.1.5 The O&M Building shall be completed and ready for occupancy no later than the first wind turbine meeting final commissioning status. Minor punch list items will be agreed upon.

12.2

12.2.1 All manufacturer installation instructions for the installation of all O&M Building equipment and components shall be obtained and followed.

12.2.2 Seller shall be responsible for obtaining all the permits for a fully functional O&M building. This may include but not limited to building permit, certificate of occupancy, water permit, leach field permit, electrical services, right of ways, security etc.

12.3 Design Working Life

12.3.1 The design working life of the O&M Building shall be a minimum of 30 years.

12.4 General Building Requirements

12.4.1 General:

(1) The operations and maintenance building shall have the outer dimensions and indicative layout shown in Figure 1 (10,000 square feet). Material and color (interior/exterior) samples shall be compiled for Owner's review.

(2) Building shall be a steel clear span structure design.

12.4.2 Metal building:

(1) The main frames shall be clear span.

(2) The sidewall columns shall be tapered with inset girts.

(3) The bay spacings shall be 20 feet on center.

(4) Primer color shall be standard red.

(5) Arkema's KYNAR 500 24-gauge architectural wall panels, or Owner-approved equal, shall be applied to all exterior walls. Architectural panels shall have semi-concealed fasteners. The Premium 70 finish coating system shall have a superior high-build primer application that is then coated with premium fluorocarbon coating that contains seventy percent (70%) KYNAR 500 resin.

(6) Closure strips, sealing tape, and joint sealants shall be furnished and utilized as needed to complete the metal building erection per industry standard.

(7) To ensure weather tightness and rodent control, a finished base angle at the bottom of each wall sheet shall be included.

(8) Provision for thermal expansion movement of the standing seam panels shall be accomplished by the use of clips with a movable tab.

12.4.3 Roof:

(1) The roof pitch shall be 1½:12.

(2) The roof covering shall be American's 24-gauge Aluminum Coated Steel 360º Seamless Roof System or Owner-approved equal. The panels shall be 20-feet wide with 3-inch-high crown. The high crown shall include factory-applied, all-weather mastic. The panel overlaps shall be seamed mechanically to ensure weather tightness of the roof system.

(3) Deluxe eaves which match the rake of the building shall be included.

(4) Dektite boot flashings at 4-inch to 12-inch pipe penetrations shall be provided.

(5) Gutters and downspouts shall be furnished and installed. Splash blocks shall be included at all downspouts. Downspouts shall not drain onto sidewalks or aprons, and rain water shall not cross sidewalks.

12.4.4 Doors:

(1) Doors for the O&M Building shall be furnished according to the schedule set forth in Table 4 (*O&M Building Door Schedule*) herein, at a minimum.

Table 4: O&M Building Door Schedule

Room	Type	Qty	Size [ft]	Door Type	Frame Type	Lock Function	Panic Hardware	Closer	Fire Rated	Lite Size	Kick Plates
Offices	Interior	TBD	3 x 7	Wood	Metal	Keyed	No	No	No	8"x24"	No
Meeting Rm	Interior	TBD	3 x 7	Wood	Metal	None	No	No	No	8"x24"	No
Break Room	Interior	TBD	3 x 7	Wood	Metal	Push/Pull	No	Yes	No	8"x24"	Yes
Bathrooms	Interior	TBD	3 x 7	Wood	Metal	Push/Pull	No	Yes	No	None	Yes
Comm	Interior	TBD	3 x 7	Metal	Metal	Keyed	No	Yes	60 min.	8"x24"	Yes
Shop	Interior	TBD	3 x 7	Metal	Metal	Keyed	No	Yes	60 min.	8"x24"	Yes
Shop	Exterior	TBD	3 x 7	Metal	Metal	Key Card	Yes	Yes	No	8"x24"	Yes
Front Entry	Exterior	TBD	3 x 7	Metal	Metal	Key Card	Yes	Yes	No	8"x24"	Yes
Overhead	Roll-Up	TBD	12 x 16	Metal	Metal	Yes	No	No	No	None	No

(2) Exterior doors:

(a) Overhead doors shall be 16-foot by 16-foot doors, with vinyl seal on both sides of track, hood baffle, reversing "Feather Edge", and take-up reel. Each door shall be motor operated, and openers shall come with one (1) three-stage (open/stop/close) push button. Bollards shall be installed on each side of the overhead door(s) and shall meet the specifications included in Section 12.4.1 herein.

(b) Exterior doors shall be 3-foot by 7-foot commercial-grade, insulated-steel service doors with ball-bearing hinges, hydraulic closer, latch guard, weather-stripping, self-sealing sweep, ADA-compliant aluminum threshold, and keyed lockset.

(c) All door jambs shall be completely flashed to give door opening a finished appearance.

(d) All exterior doors shall be equipped with key card readers, as further described in Section 12.4.19 herein.

(e) All exterior doors shall be equipped with a SCADA-integrated intrusion alarm. Such alarms shall be programmed to provide immediate silent notifications in the event of after-hours and/or non-card-reader access.

(f) Panic hardware shall be provided on any door, including those listed as "No" in the applicable column of Table 15, where local fire codes require they be installed.

(g) All exterior steel doors shall be painted.

(h) Ramps shall be suitable to provide a smooth, gradual transition from grade elevation to the shop floor. Max 3%. Ramps shall be constructed with materials compatible with the shop floor loadings. All exterior leading into the shop areas shall have housekeeping pads. Pads shall be 6' x 4' with no more than a 1% rise entering the building.

(3) Interior doors:

(a) Interior doors shall be 3-foot by 7-foot by 1.75-inch-thick flush solid-core birch doors. All interior doors shall be installed in primed hollow metal frames with three (3) 4.5-inch by 4.5-inch commercial hinges. The frames shall be painted, and the doors shall be stained and varnished.

(b) All doors with push/pull hardware shall include kick-plates installed on push sides.

(c) All wood doors shall be commercial grade.

(d) All interior doors shall have medium-duty commercial lever locksets.

(e) All interior doors and woodwork shall be stained and varnished. All interior hollow metal doors and door frames shall be painted.

(f) Doors shall be fire rated as per design requirements and applicable standards

(4) Door hardware:

(a) Door bumpers shall be provided on every door.

(b) Door keying shall be provided on every door. Bathroom doors shall include dead bolt.

(c) Windows shall be installed in all doors, except restrooms.

(d) Kick plates shall be installed in all doors.

12.4.5 Windows:

(1) 4-foot by 5-foot aluminum horizontal slider windows, equal to Plyco Model M3025, shall be provided in the following quantities:

(a) Offices: 1 per interior office, 2 per corner office.

(b) Meeting room: 2.

(c) Break room: 1.

(d) Warehouse: 2.

(2) Window frames shall be thermally broken with standard color.

(3) Operable units shall include screens.

(4) Exterior windows shall be glazed with tinted insulated glass and argon gas filled.

12.4.6 Room schedule:

(1) The building shall include all rooms set forth in the schedule in Table 5 (*O&M Building Room Schedule*) herein, at a minimum, including the requirements set forth therein.

Table 5: O&M Building Room Schedule

Room	Floor	Base	Walls	Nominal Ceiling Height	Ceiling Type
Common area Offices Break room Meeting room	Vinyl composition tile	4-inch vinyl	Painted drywall	8'0"	2x4 acoustical tiles
Comm	Anti-static vinyl composition tile	4-inch vinyl	Painted drywall	8'0"	2x4 acoustical tiles
Bathrooms	Glazed ceramic/ porcelain tile,	4-inch glazed ceramic/ porcelain tile	Ceramic tile/ painted drywall	8'0"	2x4 vinyl covered sheetrock
Shop	Sealed concrete,	Not applicable	26 ga. white liner (steel)	17'0"	Exposed structure

12.4.7 Flooring:

(1) All tile shall be waxed.

(2) All tile and grout shall be sealed.

(3) Vinyl composition floor tile shall be 12-inch by 12-inch by 1/8-inch tile adhesive applied to concrete floors. Base shall be 4-inch high, vinyl base adhesive applied to walls with covered profile.

(4) Ceramic/porcelain tile shall be set by the thin-set method. Anti-fracture membrane at control joints in floors for bathroom areas shall be provided.

(5) Ceramic/porcelain wall tile in bathrooms shall be 5-foot high on all sides, with painted drywall above.

12.4.8 Casework, countertops, and windowsills:

(1) Cabinets shall be installed in the break room. Wall cabinets and hardware shall be wood veneer MDF-type, Owner approved. Cabinets shall be both counter height and overhead.

(2) Countertops shall be installed in the breakroom. Countertops shall be Corian, or Owner-approved equal.

(3) Wall Length counter in the computer room at suitable height for computer keyboard applications (approximately 28" high)

12.4.9 Walls:

(1) All drywall shall be 5/8-inch, taped, sanded, and textured.

(2) All bathroom walls shall have 5/8-inch moisture-resistant drywall with at least two (2) coats of semi-gloss latex applied.

(3) Three (3)-foot wainscot shall be applied along all exterior walls.

(4) A 26-gauge steel liner panel to approximately 8-feet high shall be used along the exposed shop wall. A 2-inch by 2-inch galvanized base angle to attach liner panel at the concrete floor shall be provided.

(5) Walls shall be fire rated as per design requirements and applicable standards

(6) Vapor retarder: not required for walls.

(7) Retractable wall requirements: not used.

12.4.10 Ceilings:

(1) All ceiling tile shall be Armstrong Cortega or Owner-approved equal.

(2) The ceiling over the electrical storage, storage, and shared workshop shall be covered with 2-inch by 8-foot beams at 16 feet on center with one (1) layer of 7/16-inch OSB over the top. This shall be designed as a dust cover and not a mezzanine.

12.4.11 Signage:

(1) A 6-inch plastic vinyl building address and numbers on the front of the building shall be furnished and installed.

(2) Men's and women's restroom signs shall be furnished and installed.

(3) Handicap (ADA compliant) and visitor parking sign(s) on steel posts in front of the handicap stalls shall be furnished and installed.

(4) Interior signage, as required by the Applicable Standards and other requirements, shall be furnished and installed.

12.4.12 Bathroom accessories:

(1) Toilet partitions shall be installed between each toilet. Partitions shall be wall- and ceiling-mounted with baked enamel finish complete with door, latch, rubber stop, and coat hook at each stall.

(2) Standard mirrors in toilet rooms shall be approximately 36 inches by 40 inches in size. Such mirrors shall be furnished and installed in each bathroom.

(3) Paper towel dispensers and toilet paper holders shall be furnished and installed.

(4) Handicap grab-bar hardware shall be furnished and installed.

(5) Liquid soap dispensers shall be furnished and installed.

(6) Hot and cold running water to the bathrooms and kitchen

(7) At least eight (12) lockers shall be furnished and installed in the men's bathroom. At least four (4) lockers shall be furnished and installed in the women's bathroom. Each locker shall measure at least 8 feet by 12 inches by 12 inches and each in standard manufacturer's colors. One (1) hardwood bench shall be furnished and installed in front of each set of lockers.

12.4.13 Appliances:

(1) The following appliances shall be installed in the kitchen / break room:

(a) Microwave.

(b) Refrigerator with ice maker.

(c) Oven.

(d) Dishwasher.

(2) All appliances shall be new, unused, white, and Maytag (or Owner-approved equal).

(3) A temperature and humidity-controlled kitchen area with, electric oven, microwave oven, 25 Cu. Ft side by side refrigerator, counter and double sink. Cupboards and drawers to be provided beneath the counter and wall-mounted cupboards above the sink.

12.4.14 Bollards:

(1) Bollards shall be a minimum 3-inch-diameter steel pipe, concrete filled for equipment protection, painted safety yellow, and extend five (5) feet above grade.

12.4.15 Aprons and sidewalks:

(1) HVAC pads shall have minimum dimensions of 4 feet by 4 feet by 4 inches. Pad not to be placed under roof eve where snow damage would occur.

(2) A concrete slab shall be installed along the length of the O&M Building near the exterior shop door and roll-up doors. Such slab shall be designed to accommodate AASHTO HS44-20 loading.

(3) All aprons and sidewalks shall be reinforced concrete with a broom finish. Minimum thickness shall be 4 inches by 4 foot wide.

(4) Sidewalk and curb at handicap stall shall be sloped per ADA requirements for handicap access.

(5) Sidewalks and aprons shall have 4-inch ABS sleeve under the structure every 15 feet, at a minimum.

12.4.16 Parking and driveways:

(1) The asphalt parking area shall be sufficient to simultaneously accommodate parking for at least 10 vehicles and allow deliveries to the O&M Building front entry and warehouse.

(2) All car parking areas shall be shaped and graded for drainage. Parking shall be designed for pull through parking except by building.

(3) Wheel stops and lighting shall be provided for the parking area.

(4) A concrete slab shall be poured in the parking lot to accommodate ADA parking requirements. Parking lot striping and handicap symbol shall be painted on the concrete paving.

12.4.17 Freight loading and unloading area:

(1) A 200-foot by 200-foot asphalt area shall be installed to accommodate loading and unloading of freight from delivery trucks in the front side of building.

(2) The loading and unloading area should allow access to the overhead doors of the maintenance shop.

12.4.18 Fencing and gates:

(1) The O&M Building perimeter shall be fenced.

(2) At least two (2) vehicle gate shall be installed at the O&M Building. The vehicle gate shall be a double-hung, 8-feet high, 20-foot-wide (minimum), motorized, rolling gate. At least 10 remote-entry devices shall be supplied and programmed by Seller for Owner's use.

(3) At least one (1) walk gate shall be installed at the O&M Building. The walk gate shall be a lockable, single-hung, 4-foot-wide, swing-gate for personnel access.

(4) All fencing and gates shall comply with the minimum specifications in Section 3.12 (*Fencing, Walls, and Gates*) herein.

12.4.19 Electronic security system:

(1) For all access control components, the subcontractor must be "Software House" certified.

(2) Vehicle access control system: not used.

(3) Personnel access control system:

(a) This system shall be installed for all man doors and vehicular gates. The system shall consist of stand-alone distributed smart panels that make the access decision and must have a stand-alone storage database capability that is downloaded routinely to the central computer database. The master computer or any other computer unit that has the proper password must be able to query it. The unit must have different levels of password control to access the data or program the unit.

(b) The card system must use a proximity or RFID card.

(c) This system must have anti-passback capabilities to prevent multiple use of the card in a short time frame. This can be accomplished through read-in and read-out card readers with a timeout feature that prevents multiple uses at the same reader with in a user-defined time frame.

(d) This system must be able to work in a local area network and/or wide area network environment and allow access from other computers on the network.

(e) The software must be capable of providing an audit trail of all who have accessed the database and all changes made by an individual.

(4) Security CCTV system:

(a) For purposes of the Proposal, a CCTV system will not be installed, although Seller shall install conduits and gang boxes (including covers for gang boxes) and leave appropriate space for future installation.

12.4.20 Garbage enclosure:

(1) The O&M Building shall include a separate, detached garbage enclosure. The enclosure shall be installed at an Owner-approved location.

(2) The enclosure shall be constructed of treated wood.

(3) The enclosure shall be 10-feet high on all sides and shall include at least 12 inches of clear space between the dumpster and enclosure in all directions.

(4) The front of the enclosure shall include a solid screening gate on a metal frame with hinges and a center latch. Such gate shall swing out to an angle greater than 90 degrees and create an opening wide enough to allow a truck to easily access the dumpster. Pins shall not be required to hold gates open while the dumpster is being accessed.

12.4.21 Oil storage building:

(1) The O&M Building shall include a separate, detached building for oil storage. The building shall be installed at an Owner-approved location.

(2) The oil storage building shall have dimensions of at least 12-feet by 32-feet, with a minimum interior area sufficient for the storage and convenient access of up to ten (10) 55-gallon drums of oil.

(3) The oil storage building shall have a metal frame.

(4) The oil storage building shall include solid walls on three (3) sides, with one (1) roll-up door on the final side.

(a) The door shall be sliding type or roll-up type.

(b) The door shall be furnished with a keyed lockset.

(c) The door shall be wide enough to permit the safe and comfortable entry by a standard, loaded forklift.

(5) The oil storage building shall have a ramped entry on the door side, sufficient to allow forklift access and with a minimum 5-foot concrete slab extension.

(6) A concrete floor shall be installed throughout the interior of the oil storage building.

(a) The floor shall include concrete curbs on all sides, each at least 6-inches high. The floor shall be concrete with an oil containment cast into the building foundation with 2% slope draining to single low point which is accessible for future pumping.

(b) A non-skid composite grate shall be furnished and installed above the concrete floor.

(c) The concrete floor shall be safely sloped towards a Seller-installed sump pit in the rear corner of the building, which shall include a Seller-furnished and Seller-installed sump pump. The pump shall be used to manually remove effluent as needed; automatic discharge is not expected.

(d) The concrete floor (including the floating grate) shall be designed with sufficient structural capacity to simultaneously support the load of a standard, loaded forklift and other stored materials. At least 15,000 pounds of floor load capacity shall be provided. Shape building site, pad and surrounding area to match site drainage plan.

(7) The oil storage building shall have a metal roof which shall be slanted away from the door side and which shall be designed with similar loading criteria as was used for the O&M Building. The roof pitch for the oil storage building shall match the roof pitch utilized on the O&M Building.

(8) The oil storage building shall have power, heating, and lighting installed and operable.

(9) The oil storage building shall include ventilation for chemical storage.

(10) The interior of the building shall have at least 10 feet of clearance from floor to ceiling, or more if necessary, to permit safe forklift access and use.

(11) One (1) eye wash station shall be furnished and installed in the oil storage building. Eye wash bottles may be substituted where they satisfy local regulations.

(12) Portable CO_2 and dry chemical fire extinguishers shall be furnished and installed in the oil storage building, in a quantity and type sufficient to ensure compliance with the Applicable Standards and other requirements. At a minimum, one (1) 10-pound ABC-type fire extinguisher (including mounting device / cabinet) shall be installed in the building.

(13) Bollards shall be installed on each side of the outside of the overhead door(s) in the oil storage building.

(14) Minimum signage, exterior of oil storage building:

(a) No smoking.

(b) No open flames.

(c) Maximum floor capacity (including loaded forklift).

(d) Personal protective equipment requirements.

(e) Authorized personnel only.

(15) Minimum signage, interior of oil storage building:

(a) Eye wash station.

(b) Fire extinguisher location.

12.4.22 Storm shelter:

(1) Shelter shall be a hardened room located within the O&M building. Walls shall be filled core cement block construction with reinforcement. Ceiling shall be concrete panels or reinforced structural components capable of sustaining tornado force winds. Tornado Shelter shall be designed in accordance with tornado shelter standards. The shelter shall be integral to the building and shall be easily accessed by employees in the event of a tornado.

12.5 Civil / Structural Requirements

12.5.1 All civil works for the O&M Building shall comply with the applicable specifications in Section 6.0 *(Civil Works Specifications*).

12.5.2 All O&M Building foundations shall be designed and constructed in accordance with the applicable structural works specifications in Section 7.0 (*Structural Works Specifications*).

12.5.3 Excavated material shall be backfilled and compacted on the outside of the foundation walls adjacent to green areas and graded around building to provide proper drainage. The outside foundation walls adjacent to hard surfaces and future additions shall be filled with compacted granular fill.

12.5.4 Fill shall be compacted to at least 95 percent (95%) of the maximum density within the moisture content of two percent (2%) below optimum to two percent (2%) above optimum, as determined by ASTM Standard D698, unless a higher level of compaction is required by the geotechnical studies. Seller shall furnish compaction-testing results to Owner.

12.5.5 The O&M Building perimeter (including parking and all fenced area) shall be asphalted throughout over a compacted subgrade. Such subgrade material shall include at least six (6) inches of aggregate and shall conform to the requirements in Section 6.10 (*Crushed Rock Surfacing*) herein.

12.5.6 The O&M Building shall have a reinforced-concrete foundation covering the building footprint.

(1) Minimum concrete strength shall be 3,000 psi for footings and walls, respectively, and 3,500 psi for floors in place in 28 days.

(2) Rebar shall conform to ASTM A615. Placement shall be in accordance with ACI 318.

(3) Welded wire fabric shall conform to ASTM A185. Plain wire shall conform to ASTM A82. Placement shall be in accordance with Chapters 7 and 12 of ACI 318 and the CRSI's "*Manual of Standard Practice*".

(4) The O&M Building floor shall be a minimum six (6) inches thick.

(5) All foundations shall extend a minimum of six (6) inches above the adjacent finished grade.

(6) Concrete for equipment pads and containment areas shall be sealed with petroleum resistant sealant. All exposed concrete slabs, interior or exterior, shall have a combination sealer/curing compound, ASTM C309 or equivalent applied.

(7) Footing, wall, and floor heights shall be set with a laser transit to improve accuracy of determining heights for construction.

(8) Design of structural and miscellaneous steel shall be in accordance with the AISC's "*Manual of Steel Construction*". Design of structural and miscellaneous steel shall also be in accordance with NEMA Standard SG6, NEMA Standard TT1, and the International Code Council's "*International Building Code*", respectively.

(9) High strength bolts, nuts, and washers shall be galvanized in accordance with ASTM F2329. Bolts, nuts, and washers under 0.5 inches in diameter shall conform to ASTM A307, Grade B, ASTM A563 and ASTM F844 respectively, and shall be galvanized in accordance with ASTM F2329.

(10) Anchor bolts, anchor bolt assemblies, and concrete embedments shall be galvanized.

(11) Anchor bolts shall conform to ASTM A449, ASTM F1554, Grade 36 or A307. Anchor bolt sleeves shall conform to ASTM A501.

(12) All structural welding shall conform to the requirements of AWS Standard D1.1.

(13) Galvanizing as specified herein, shall conform to the requirements of ASTM A123, ASTM A153 or ASTM A2329 as applicable.

(14) Stainless steel shall conform to ASTM A167.

(15) Design of structural and miscellaneous aluminum shall be in accordance with the latest version of the Aluminum Association's "Aluminum Design Manual" and "Aluminum Standards and Data".

(16) Materials for structural and miscellaneous aluminum including structural shapes and plates shall conform to ASTM B209 and ASTM B308 and shall be aluminum alloy 6061-T6.

(17) Bolts and nuts shall conform to ASTM F468 and ASTM F467, respectively, and shall be aluminum alloy 6061-T6. Washers shall be aluminum-clad steel Alclad 2024-T4 or approved equal.

(18) Vapor retarder: 10 mil polyethylene placed under office floor and anywhere floor finish or coating shall be used to help reduce any moisture migration through the slab. All joints shall be taped, and all penetrations shall be repaired and taped.

12.6 Mechanical Requirements

12.6.1 The following plumbing-related items shall be provided in the quantities shown:

(1) Men's bathroom:

(a) Wall-mounted toilet (2).

(b) Urinal (1).

(c) Floating sink (1).

(d) Shower (2).

(2) Women's bathroom:

(a) Wall-mounted toilet (1).

(b) Floating sink (1).

(c) Shower (1).

(3) Kitchen:

(a) Double Sink with a pot style faucet (1).

(b) Ice maker connection with filter (1).

(4) Warehouse area:

(a) Floor sink (1).

(b) Wash sink (1).

(c) Eye wash station (1).

(d) Hot water heater (1), of sufficient size to satisfy the facility's needs.

12.6.2 Fire protection system:

(1) The fire protection system shall receive the approval of Owner's insurance carrier.

(2) Portable CO_2 and dry chemical fire extinguishers shall be furnished and installed in the building, in a quantity and type sufficient to ensure compliance with the Applicable Standards and other requirements. At a minimum, one (1) 10-pound ABC-type fire extinguisher (including mounting device / cabinet) shall be installed at every exit door, break room, and utility room, respectively.

(3) SCADA Room will have a standalone halon fire suppression system.

(4) All local alarm, detection, and suppression panels shall report status to the main fire alarm panel located in the control room.

(5) All areas of the building shall be provided with smoke and heat detectors as the form of fire detection.

(6) The following walls and door shall be fire rated for the minimum times shown, or as required by the authority having jurisdiction, whichever is greater:

(a) Interior wall between warehouse and office areas: 60 minutes.

(b) Interior doors between warehouse and office area: 60 minutes.

(c) Interior SCADA / communications room walls: 60 minutes

(d) Interior door to SCADA / communications room: 60 minutes

12.6.3 Potable water system:

(1) The potable water system shall be designed to provide potable water, both hot and cold, at the proper pressure, temperature, and flow rate to all plumbing fixtures and equipment.

(2) This shall be by service from an existing water main (if such a main exists in the area) and, if so, shall be a potable supply. If no mains supply is available, then water service shall be via a water well. Seller shall Engineer, Procure, & Construct a complete water supply solution.

(3) The potable water system shall include chlorination, charcoal filters, or other treatment as required.

(4) Incoming water line shall have sand filters with provisions to prevent fixtures from clogging with sand. System shall be engineered for pressure & water quality to meet the industry standards.

(5) All internal water piping shall meet commercial codes and be protected against drywall screws penetrating studs.

(6) Potable water piping shall be insulated as required.

(7) Potable water piping shall be sterilized in accordance with AWWA standards for disinfecting purposes prior to filling.

(8) At least two (2) insulated exterior hose bibs shall be installed.

(9) All water supply and installations shall conform with all applicable local and/or state regulations, including fire water storage for fire suppressant system.

12.6.4 Sanitary wastewater:

(1) Above and below grade water and sewer lines shall be furnished and installed per applicable building codes. Lines and installation shall be below frost line.

(2) Sanitary wastewater shall be collected from the various points of origin in the facility and diverted to a septic tank, and discharge from the septic tank shall be routed to a leach field.

(3) Septic tank and leach field shall be placed to minimize impact to the yard area and shall be clearly marked to prevent traffic from encroaching or driving over septic tank. Leach field to be placed outside the fenced area.

(4) A pumped sanitary wastewater system shall only be used if a gravity system is impractical.

(5) Floor drains shall be installed in the utility room and each bathroom.

12.6.5 Heating, ventilating, and air conditioning system:

(1) Heating elements shall be electric, propane or natural gas fired. Cooling elements shall be electric.

(2) Propane shall have 2000 gallons of fuel for building.

(3) The heating, ventilating, and air conditioning systems shall satisfy the workspace environmental requirements for personnel occupancy and equipment operation.

(4) Minimum ventilation rates shall be provided in normally occupied areas in accordance with the Applicable Standards and other requirements. In the absence of local codes, ASHRAE Standard 62 requirements shall be met. A minimum of five (5) air changes per hour of ventilation or recirculation air shall be provided for effective mixing during heat removal ventilation or air conditioning of normally occupied spaces.

(5) The air conditioning for control and electrical equipment shall be designed to meet the filtration levels as defined by ASHRAE Standard 52.

(6) Interior cooling loads for the SCADA room shall be based upon actual equipment to be installed and ASHRAE Standard requirements. This air conditioning unit shall be ceiling mounted. The A/C to the SCADA room shall be balanced (external filtered inlet and outlet), and the SCADA room door shall be sealed, to prevent ingress of dust into the SCADA room. The SCADA room shall be temperature and humidity controlled separately.

(7) HVAC systems shall be designed to maintain the indoor conditions listed in Table 6 (*HVAC Design Requirements*) herein.

   (a) Where redundancy is indicated in this table, only the major active components require backup equipment; static components such as ductwork do not require duplication.

(b) Noise criteria are indicated as NC levels or decibels. Noise criteria values are as indicated in the ASHRAE Handbook series for acoustical design criteria. Decibels are sound pressure levels, A-weighted, to a reference of 0.0002 microbar at 5 feet from the equipment as measured in a free field with a single reflecting plane.

(c) Maximum design temperatures represent the average building temperature. Cooler temperatures may occur near the ventilation inlets and higher temperatures may occur at relief and exhaust points.

Table 6: HVAC Design Requirements

Area	Outdoor Ambient Design	Indoor							
		Design Temp.		Humidity Control (%RH)	Particulate Filtration Efficiency (%)	Pressuri-zation	Redundancy (Note 3)	Noise Criteria	System Configuration
		Winter (°F)	Summer (°F)						
Communications/SCADA Room	Note 1	65	65	30-65	High	Positive	2 x 100%	NC 45	AC for personnel comfort and equipment requirements
Offices Break Room Bathrooms Meeting Room	Note 1	70	72	30-65	ASHRAE STD-62	Positive	None	NC 45	AC for personnel comfort and equipment requirements

Note 1: Site design temperatures.
Note 2: Evaporative cooler shall be designed for a minimum of 85% effectiveness. Air handler shall include a heating element.
Note 3: Redundancy is included to specify the amount of redundancy required (e.g., 2x100% requires a primary system with a 100% backup system), and None requires only a primary system.

(8) Air velocities in ducts and from louvers and grills shall be sufficiently low to maintain acceptable noise levels in areas where personnel are normally located.

(9) Thermal insulation with vapor barrier shall be provided on ductwork surfaces with a temperature below the dew point of the surrounding atmosphere to prevent vapor condensation. All ductwork used for air conditioning purposes shall be insulated; ductwork used for ventilation purposes shall not require insulation.

(10) Exhaust fans for bathrooms and locker room shall be furnished and installed. Exhaust systems shall be provided above the roof for toilet, shower and locker room areas and shall be controlled by occupancy sensors. Outdoor ventilation air shall be based on normal room occupancy or local codes, whichever is more stringent.

(11) Functional louvers at building workshop area shall be provided. Adequate overhead heaters in the workshop area

(12) Restrooms to be equipped with ceiling mounted exhaust fans vented to the exterior.

12.6.6 Insulation systems / thermal and moisture protection:

(1) Caulking and backer board, as recommended by the manufacturer and to seal exterior and interior joints at expansion joints, frames of doors, windows, and other wall openings, shall be furnished and installed.

(2) Roof insulation shall be such that an *R* value of at least 30 is achieved. Thermal blocks shall be included within the roof system.

(3) All building walls shall be insulated. Wall insulation shall be such that an *R* value of at least 19 is achieved. All interior office walls shall be insulated with 3.5-inch fiberglass batt insulation for sound control.

(4) Miscellaneous insulation for filling voids at roof eave, roof peak, door frames, window frames, and other similar areas shall be furnished and installed.

12.7 Electrical Requirements

12.7.1 General requirements:

(1) O&M Building power shall be 480-Volt, three phase if available from utility otherwise 240 Volt single-phase to meet load demand (or Owner-approved equal).

(2) All convenience outlets shall be on 20A circuits.

(3) All equipment and materials shall bear UL label.

(4) Underground conduit shall be PVC and shall conform to the specifications for conduit set forth herein.

(5) All transformers shall be installed exterior to the building.

(6) Furnish and install a fully functional emergency backup generator capable of supplying all SCADA loads, heating and cooling loads and minimal lighting within the O&M Building. Backup generator system shall be supplied complete with subpanels, wiring and an automatic transfer switch. Generator shall be propane fueled with a 1000-gallon tank. Generator sizing shall be submitted to PacifiCorp for approval. Generator shall include a properly rated outdoor Arc Flash Rated disconnect switch.

12.7.2 Communication cabling:

(1) A complete telephone and data network system shall be provided including all distribution jacks, cable, and wireless systems.

(2) Internet service shall include (i) high-speed internet service (Wi-Fi) throughout the building and (ii) broadband internet service up to the wall jacks. T1 service shall be provided (or the fastest available speed from the local service provider).

(3) Phone service shall include at least one (1) four-line phone system up to the wall jacks.

(4) Within the building the installation shall comprise one telephone jack in each office, the computer room and the SCADA room, all wired back to the SCADA room for connection to the incoming telephone service. The installation shall also comprise two CAT5 jacks in each office, and four CAT5 jacks in the conference, break, and computer rooms, together with CAT5 cabling back to the SCADA room, such that all computers can be networked. One spare conduit from the SCADA room to each office and the computer room, CAT5 cable for security mounted cameras from the top of each roller door area back to the SCADA room.

12.7.3 Interior grounding:

(1) Grounding shall be in accordance with NFPA 70/NEC. All feeder and branch circuits shall have a green-colored insulated equipment ground conductor in addition to any metallic conduit being bonded to the equipment grounding system.

(2) Ground fault protection shall be installed in receptacles in warehouse and workshop where power tools are used, and in restrooms and other locations as required by NFPA 70/NEC.

12.7.4 Exterior grounding:

(1) The facility shall have a #4/0 AWG bare copper ground counterpoise with 0.75-inch by 10-foot copper-clad steel ground rods. The counterpoise will be connected to service entrance equipment, derived source transformer secondary neutrals, telecommunications main ground bus bar, and all building columns.

12.7.5 Lightning protection:

(1) The building shall have an array of air terminals, roof conductors, and down conductors. The lightning protection system shall be interconnected to the ground counterpoise system. Requirements for the building's lightning protection system shall be as determined and recommended by NFPA 780.

12.7.6 Exterior lighting:

(1) Exterior lighting shall be provided by building-mounted, LED light fixtures at facility personnel and overhead doors. Additional building-mounted lights shall be provided to illuminate walkway and parking area. LED lights are preferred if minimum required illumination levels can be met. In lieu of LED lights, metal halide lights shall be used. Lighting levels shall meet the intensities indicated in the IES handbook and NFPA 70/NEC.

(2) Exterior lighting shall be controlled by lighting contactors with hands-off auto selector switches and photocells and should be equipped with vandal-resistant lenses.

(3) Lighting shall be provided to cover the building faces evenly and shall be directed inward from the property line.

(4) Area lighting shall supplement existing street lighting (if any) to provide a maximum level of illumination from a minimum number of fixtures. The system shall be designed to illuminate the entire area evenly, including doorways, structures, and all opening into the structures.

(5) Pedestrian and vehicle entrances that are actively used are to be provided with sufficient illumination to permit recognition of individuals and examination of credentials. All vehicle entrances must be lit so that the entire vehicle, occupants, and contents can be adequately viewed. Doorways and other recesses must be lit to eliminate shadows.

(6) Alternate circuitry must be used in the power circuits so that the failure of any one lamp does not leave a large portion of either (i) the site perimeter or (ii) critical or vulnerable areas in darkness.

12.7.7 Emergency egress lighting:

(1) The facility shall use LED fixtures with internal battery backup ballast for emergency egress locations such as corridors, hallways, and fire exits.

(2) Exit signs shall be illuminated LED type located at fire exits and required locations.

12.7.8 Interior lighting and receptacles:

(1) Lighting levels shall meet the intensities indicated in the IES handbook and NFPA 70/NEC. The facility shall use the following types of fixtures:

(a) 1-inch by 4-inch industrial LED fixtures with guards with at least two (2) lamps in storage areas and SCADA room, respectively.

(b) 2-inch by 4-inch LED fixtures with parabolic louvers with at least three (3) lamps with dual level switching in office areas, break room, and conference room, respectively.

(c) 2-inch by 4-inch high bay I-beam LED fixtures with four (4) T5 high-output linear LED lamps in workshop area.

(2) LED fixtures shall be equipped with high-efficiency electronic ballasts. Classified area lighting fixtures shall be designed to meet requirements of NFPA 70/NEC, Article 500.

(3) A lighting control system shall be used to control fixtures in office areas. The lighting control system will have local low voltage switches for local control. Offices will be locally switched .

(4) Install receptacle outlets as specified in accordance with NFPA 70/NEC.

(5) Office lighting to be flush-mount LED lighting panels (with specular reflectors) fitted in the suspended ceiling. Workshop lighting to be LED lighting units. Workshop lighting to be 400W LED units or similar.

12.7.9 Power distribution system:

(1) Service entrance conductors shall be installed to tie into the main distribution panel and terminated and tested by Seller. The MDP in the building shall be service entrance rated.

(2) Feeders shall extend from the MDP to serve general power panel boards

(3) Panel boards and associated feeders shall be sized for 20 percent (20%) spare capacity. Panel boards shall contain space for 20 percent (20%) additional spare circuit breakers.

(4) Building electrical service shall include an automatic transfer switch and pad-mounted generator. The backup service shall be sized equal to the utility service and provided with sufficient fuel to operate for a minimum of five (5) days without refueling. A propane generator is preferred over diesel including a dedicated 1000 gallon tank.

Exterior building shall have exterior 120VAC GFCI outlets; one on each exterior wall.

12.7.10 Wiring and conduit:

(1) Each length of PVC conduit furnished with coupling on one end and metal or plastic thread protector on the other end. Sizes of conduit, fittings and accessories as indicated, specified or as required by Applicable Standards or in accordance with NFPA 70/NEC requirements.

(2) Terminate all conduit runs with insulated bushings.

(3) Provide all fittings necessary for a complete installation.

(4) Lighting branch circuits, telephone circuits, fiber optic cables and intercommunications circuits shall be routed in separate conduit systems.

   (a) Lighting circuits shall be routed in electrical metallic tubing for indoor concealed areas, rigid conduit for outdoor areas, and PVC tubing or Schedule 40 PVC conduit for underground.

(5) Threaded, galvanized, rigid steel conduit or intermediate metal conduit shall be PVC tape wrapped or coated for underground use and will be used in all exposed, outdoor and hazardous locations.

(6) All conductors shall be copper.

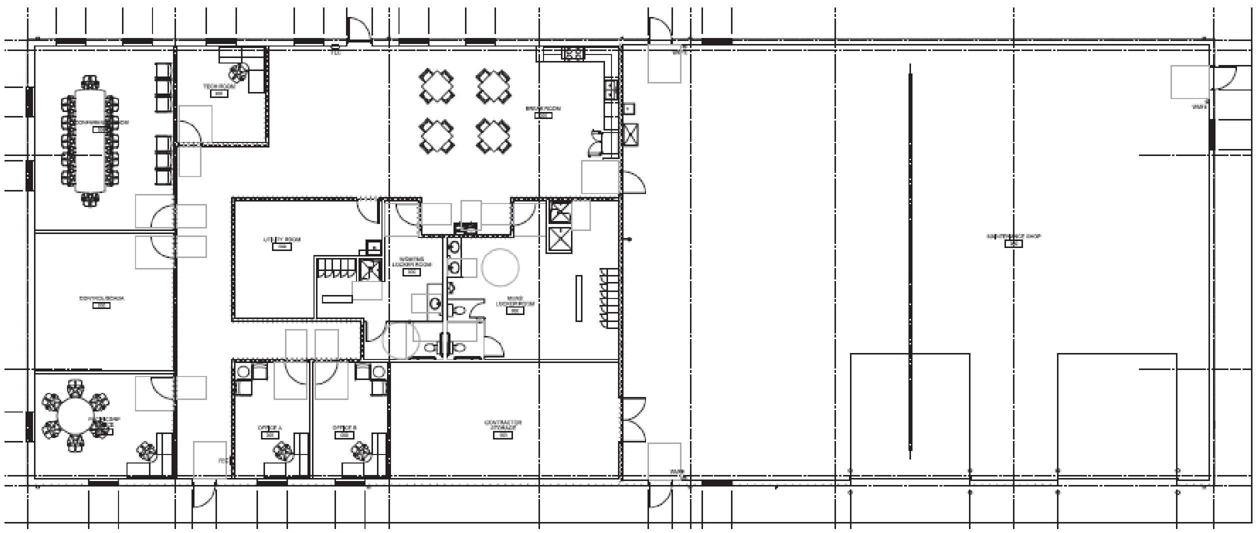
(7) All conductors #10 AWG and smaller shall be solid conductor. All conductors #8 AWG and larger shall be stranded conductor.

(8) All feeder and branch circuit wire shall be single conductor and have THWN/THHN insulation.

(9) All electrical enclosures mounted outdoors shall be NEMA 3R (minimum).

(10) Isolate emergency lighting circuit conductors from all other wiring.

Figure 1: Indicative Operations and Maintenance Building Layout



13.1 General Provisions

13.1.1 The Wind Turbine Generator, including all components, shall be capable of operating at rated capacity in a safe, reliable, and continuous manner and without undue maintenance under the meteorological conditions (e.g., temperature, air density, wind speed, salinity) of the Project and Project Site.

13.1.2 All exterior surfaces of the Wind Turbine Generator shall be white or light gray in color.

(1) RAL 9010 (pure white) or RAL 7035 (light gray) are acceptable colors.

(2) A non-glare finish shall be used.

(3) Touch-up paint shall be provided as reasonably necessary to repair any damage to Wind Turbine Generator equipment that occurs during the transportation, offloading, erection, and/or commissioning of the Wind Turbine Generators.

13.1.3 The Wind Turbine Generator (including the tower and nacelle) shall have no external markings unless explicitly listed herein.

13.1.4 Wind Turbine Generators shall be supplied with the first fill of all grease, oil, and other lubricants and consumables in the Wind Turbine Generator equipment (and confirmed, filled or topped off at the Project Site following delivery).

(1) Gearbox oil shall be fully synthetic AMSOIL or CASTROL or Owner-approved equal.

13.1.5 Turbine Supplier shall validate the Wind Turbine Generator equipment incorporated into the Work is new, unused, of good quality, consistent for use in wind generation facilities, and complies with the Requirements.

13.1.6 All Functional Groups shall be interchangeable, regardless of the suppliers or manufacturers of the Functional Group, including if such Functional Groups are furnished by different suppliers or manufacturers. For purposes this exhibit, a "**Functional Group**" shall mean a rotor blade set; hub; pitch system; main shaft; main bearing; generator; gearbox; mechanical brake; high-speed shaft coupling; internal crane; power converter; medium-voltage transformer; service lift (if elected by Owner); internal tower wiring and cabling; controller; auxiliary system; wind vane; anemometer; yaw system; cooling system; hydraulic system; tower section; switchgear; ground controller; or uninterruptible power supply, respectively.

13.2 Design Working Life

13.2.1 The design working life of the Wind Turbine Generator equipment shall be a minimum of 30 years.

13.3 Type Certificate

13.3.1 The Wind Turbine Generator shall hold current certification of compliance with IEC WT 01 / IEC 61400-1 / IEC 61400-22, either in the form of a Type Certificate or an A-Design statement of compliance (collectively, the "**Certificate**").

13.3.2 The Certificate shall be from an approved certifying entity:

(1) Germanischer Lloyd.

(2) Det Norske Veritas.

(3) TÜV NORD Group.

(4) Owner-approved equal.

13.4 Site Suitability

13.4.1 Proposals shall include an assessment of suitability of the proposed Wind Turbine Generator at the Project Site. This assessment shall include a representation from Seller confirming the suitability of the Wind Turbine Generator for the Project Site and its ability to withstand the Project Site conditions for a period of at least 30 years. Seller's impacts due to wake sector management, elevation and temperature (if any) shall be included in the suitability assessment.

13.5 Component Suppliers

13.5.1 Quality control and assurance programs, both the Turbine Supplier and their component suppliers, shall meet ISO 9001 requirements.

13.5.2 Proposals shall include a listing of all potential component suppliers that will furnish the following components for the Project. This list shall include the names of the proposed component suppliers and the country of origin for each.

(1) Rotor blades.

(2) Gearbox (if applicable).

(3) Generator.

(4) Main shaft (if applicable).

(5) Main bearings

(6) Hub.

(7) Controller.

(8) Power converter.

(9) Tower.

(10) Pitch system, including actuators and accumulators (as applicable).

(11) Yaw system, including motors and drives.

(12) Mechanical brake.

(13) Transformer (if applicable).

13.6 Rotor and Blades

13.6.1 The rotor shall be of three-bladed cantilevered construction.

13.6.2 The rotor shall be mounted upwind of the tower.

13.6.3 The rotor shall have a horizontal-axis orientation.

13.6.4 Reserved.

13.6.5 Blades shall have an integrated lightning protection system, in accordance with IEC 61400-24

13.6.6 Rotor blades shall be manufactured by an experienced component supplier in an ISO 9001 certified facility.

13.7 Hub

13.7.1 The hub shall allow access to any internal components or operating mechanisms, such as pitch bearings and blade roots.

13.8 Generator

13.8.1 Owner reserves the right to review available generator types (e.g., induction, permanent magnet generator) offered by Seller for the purpose of specifying the type to be installed in the Wind Turbine Generator.

13.8.2 The generator shall be a three-phase, variable speed, alternating current generator.

13.8.3 The generator shall have a rated frequency of 60 Hertz.

13.8.4 The generator shall operate at the manufacturer's standard voltage level.

13.8.5 The generator shall have a rated power of no less than 1,500 kilowatts and no greater than 6,000 kilowatts at the Project Site air density.

13.8.6 The generator shall be of minimum protection class IP54.

13.8.7 The generator and its internal components shall be manufactured to NEMA Class H insulation.

13.8.8 The generator shall be enclosed in a weatherproof nacelle.

13.8.9 The generator windings shall be of copper or all-welded aluminum.

13.8.10 The generator shall operate with a step-up transformer with a high-side voltage of 34.5 kilovolts. The step-up transformer can be integrated in the nacelle or located outside the base of the tower.

13.8.11 The generator nameplate shall contain the applicable information according to IEEE C50.12.

13.8.12 Generators shall be manufactured by an experienced component supplier in an ISO 9001 certified facility.

13.9 Gearbox

13.9.1 No more than one (1) gearbox shall be used in a single Wind Turbine Generator.

13.9.2 Gearboxes shall be designed in accordance with IEC 61400-4 "Design Requirements for Wind Turbine Gearboxes"

13.9.3 Production testing of the gearbox shall have been performed prior to final acceptance.

13.9.4 The gearbox shall be manufactured by an experienced component supplier in an ISO 9001 certified facility.

13.9.5 Note: if the Wind Turbine Generator does not include a gearbox (e.g., direct drive topology), this Section 13.9 in its entirety is non-applicable.

13.10 Pitch System

13.10.1 The Wind Turbine Generator shall include a pitch system for controlling the movement of rotor blades.

13.10.2 The pitch system should be capable of pitching blades independently.

13.10.3 The pitch system shall be capable of feathering the blades a full 90 degrees.

13.10.4 The pitch system shall include either hydraulic or electric actuation for pitch drives.

(1) Pitch systems employing hydraulic actuation shall include adequate spill containment or an absorption system.

(2) Pitch systems employing hydraulic actuation shall incorporate an appropriate filtration system.

(3) Pitch systems employing hydraulic actuation shall include accumulators for failsafe operation. Accumulators shall be charged with nitrogen in the factory prior to delivery onsite. Accumulator pressures shall be confirmed onsite prior to commissioning completion. Any necessary actions for proper operation of the pitch system shall be taken by the Seller or Turbine Supplier to meet safe operation.

(4) Pitch systems employing electric actuation shall include back-up power for failsafe operation. Pitch system safe operating parameters must be confirmed prior to commissioning completion.

13.10.5 Rotor blades shall be automatically pitched on a regular basis during non-operational periods to ensure a consistent distribution of lubricants.

13.11 Braking System

13.11.1 The braking system shall include both mechanical and aerodynamic brakes.

13.11.2 The braking system shall be capable of bringing the rotor to a complete stop from any operational condition and for parking the Wind Turbine Generator.

13.11.3 The braking system shall be capable of preventing rotor rotation at wind speeds up to at least the rated survival speed.

13.11.4 The braking system shall include the necessary failsafe redundancy and be designed to function even if its external power supply fails.

13.11.5 The braking system shall include a manual emergency stop function.

13.12 Yaw System

13.12.1 The yaw system shall be self-orienting.

13.12.2 The yaw system shall be capable of allowing 360 degrees of nacelle rotation.

13.12.3 The yaw system shall be capable of slewing at a rate of at least 0.5 degrees per second.

13.12.4 Owner requests the necessary failsafe system to address the following condition: external power supply failure, loss of back-up pitch system and increasing wind speeds perpendicular to the rotor plane. This condition will cause the rotor speed to increase to an uncontrollable situation.

13.12.5 The yaw system shall include an appropriately-sized torque limiter.

13.13 Nacelle

13.13.1 The nacelle shall provide adequate working space for service and maintenance activities.

13.13.2 The nacelle interior shall be sufficiently lit to provide adequate visibility for service at any hour.

(1) Nacelle lighting shall meet OSHA requirements for working environments.

(2) Lighting shall incorporate an uninterruptible power supply capable of supplying back-up power for at least one (1) hour.

13.13.3 The nacelle shall incorporate natural ventilation.

13.13.4 The nacelle shall include spill containment suitable to contain 110 percent of all grease, gear oil, coolant, and other liquids or lubricants stored in nacelle components.

13.13.5 A hatch shall be positioned in the floor or rear of the nacelle for raising or lowering equipment.

13.13.6 The nacelle floor shall have anti-slip surfaces.

13.13.7 Nacelles shall be assembled by an experienced component supplier in an ISO 9001 certified facility.

13.14 Tower

13.14.1 The Wind Turbine Generator shall be mounted on a tapered, tubular, watertight, tower. No supporting (e.g., guy) wires shall be used.

13.14.2 The tower shall be constructed of steel or concrete.

13.14.3 Reserved.

13.14.4 The tower shall be accessible through a lockable door at the base of the tower.

(1) Doors shall be protected by an intrusion alarm integrated into the SCADA System.

(2) Permanent metal stairs, including concrete pads for the stair support columns and stair landing for each Wind Turbine Generator, shall be provided if the access door is above grade level.

13.14.5 The tower interior shall be sufficiently lit to provide adequate visibility for service at any hour.

(1) Tower lighting shall meet OSHA requirements for working environments.

(2) Lighting shall be installed at the base of the tower, at all platforms within the tower, and at the top of the tower below the nacelle.

(3) Lighting shall incorporate an uninterruptible power supply capable of supplying back-up power for at least one (1) hour.

13.14.6 Welded service platforms, or other means to allow access to all components, shall be included within the tower.

(1) Duplex, interior, 120-volt alternating current, 20-amp GFI power receptacles shall be installed at the base of the tower, at all platforms within the tower, and at the top of the tower below the nacelle.

(2) Floors of all platforms shall have anti-slip surfaces.

13.14.7 A ladder shall be included in the tower for internal ascent.

(1) The tower ladder shall reach from the base of the tower to the nacelle.

(2) The tower ladder shall be made of aluminum or steel.

(3) The tower ladder shall meet all OSHA standard requirements for safety and construction.

(4) Lights shall be mounted along the ladder route inside the tower to provide adequate lighting of the tower interior.

(5) An OSHA-compliant fall arrest system shall be included that is compatible with the tower ladder. The fall arrest system shall be designed and manufactured according to the latest versions of the following standards, at a minimum: EN 353-1, EN 362, EN 363, CAN/CSA Z259 and ANSI Z359.1. The ladder fall arrest system shall include a rail or steel cable that integrates with a personnel runner.

13.14.8 Tower drawings and specifications shall clearly show maximum foundation loading, shall specify bolt torque requirements for connections and provide all bolt details including size, material and certification

13.14.9 The tower shall incorporate natural ventilation, either through louvers in the tower door or other suitable means.

13.14.10 Tower sections shall be connected using flange connections.

13.14.11 The tower shall be manufactured by an experienced component supplier in an ISO 9001 certified facility.

13.15 Climb Assist

13.15.1 A climb assist system shall be included in the Proposal as optional equipment; if a climb assist is standard equipment in the proposed Wind Turbine Generator model, the Proposal shall indicate as much. The following specifications shall apply to any climb assist that may be provided.

13.15.2 The climb assist shall be compatible with the standard tower ladder.

13.15.3 The climb assist shall provide a reduced carrying weight of at least 125 pounds (34 kg).

13.15.4 The climb assist shall meet all OSHA standard requirements for safety and construction.

13.16 Service Lift

13.16.1 A service lift system shall be included in the Proposal as optional equipment; if a service lift is standard equipment in the proposed Wind Turbine Generator model, the Proposal shall indicate as much. The following specifications shall apply to any service lift that may be provided.

13.16.2 The service lift shall be an electrically-driven man-lift capable of lifting two workers and light parts from the base of the tower to the nacelle.

13.16.3 The service lift shall have a minimum lift capacity of 500 pounds (227 kg).

13.16.4 The service lift shall meet, at a minimum, the requirements of ASME A17.1, ASME A120.1, and OSHA standard requirements for safety and construction.

13.16.5 The service lift shall have interior lights.

13.16.6 The service lift shall have an access door that can be secured from within the lift.

13.16.7 The service lift shall include external controls at the base of the tower to enable movement of the lift without an operator inside.

13.16.8 The service lift shall have controlled descent capability to enable descent at a controlled rate during power interruption.

13.16.9 The tower ladder shall be accessible from the service lift in the event of power interruption during tower ascent or descent.

13.17 Service Hoist

13.17.1 An electrically-powered service hoist shall be included in the nacelle, capable of lifting parts from ground level to the nacelle.

13.17.2 The service hoist shall have a minimum lifting capacity of 1,000 pounds (453 kg).

13.18 Power Converter

13.18.1 The Wind Turbine Generator shall include a partial- to full-power convertor capable of supplying power at constant frequency and voltage from the generator to the step-up transformer.

13.19 Thermal Conditioning System

13.19.1 A cooling system (active or passive, as appropriate) suitable for Project Site elevations and temperatures shall be included for the following, at a minimum:

(1) Generator.

(2) Power converter.

(3) Hydraulics.

(4) Gearbox (as applicable).

(5) Medium-voltage transformer (as applicable).

(6) Nacelle.

13.19.2 Liquid cooling systems shall be self-contained.

13.20 Lubrication System

13.20.1 Oil shall be maintained at a cleanliness level of at least ISO 4406 15/12.

13.20.2 The gearbox shall be lubricated with oil regularly and automatically.

13.20.3 A backup lubrication system shall be included for failsafe operation.

13.20.4 The following, at a minimum, shall be regularly lubricated with grease from an automatic lubrication unit:

(1) Blade bearings.

(2) Main bearing.

(3) Generator bearings.

(4) Yaw gear teeth

13.21 Condition Monitoring System

13.21.1 Critical Wind Turbine Generator components shall be monitored by a condition monitoring system for the purpose of targeting predictive maintenance and proactively monitoring failures.

13.21.2 On-line vibration diagnostics shall be carried out, at a minimum, on the following:

(1) Main bearing.

(2) Gearbox.

(3) Generator.

(4) Drive Train (if applicable)

13.21.3 A baseline for vibration data shall be established on every Wind Turbine Generator using no less than three (3) months of data at the beginning of life on every Wind Turbine Generator.

(1) Limits shall be set in the SCADA monitoring system for warnings and alarms using these baseline vibration characteristics. These limits shall be actively monitored.

(2) In the event that vibration limits are exceeded, the Wind Turbine Generator shall be automatically shut down in a safe and reliable manner and left in a safe configuration so inspection may be performed.

(3) Vibration data and statistics of the Wind Turbine Generator shall be retrievable from the SCADA System interface.

13.22 Meteorological Equipment

13.22.1 Each nacelle shall be supplied with primary and secondary anemometers capable of measuring wind speeds.

(1) Anemometers shall be redundant and the Wind Turbine Generator capable of operating with only one anemometer available.

(2) Reserved.

(3) Ultrasonic or three-cup anemometers are acceptable.

(4) Heaters should be included for anemometers.

13.22.2 Each nacelle shall be supplied with primary and secondary wind vanes capable of measuring wind direction. The vanes shall be redundant and the Wind Turbine Generator capable of operating with only one vane available.

13.22.3 The supplied anemometers and wind vanes shall provide control and display data for the system.

(1) The anemometers shall provide information for system shutdown in the event of excessive wind speeds.

(2) The anemometers shall provide information for system start or restart when wind speeds are within an acceptable range.

(3) The wind vanes shall provide information for yawing of Wind Turbine Generators.

13.23 Switchgear

13.23.1 A medium voltage switchgear is required at the base of each wind turbine tower when a 34.5 kV step-up transformer is located in the nacelle.

13.23.2 The Wind Turbine Generator shall include all relaying and switchgear required to assure safe and proper connection and disconnection with the Collection System Circuits, including uninterruptible power supply for safe shutdown upon loss of grid power. The switchgear shall include all enclosures, fittings, disconnect switches, fuses, breakers, and other similar or related items as necessary to adequately protect and isolate the Wind Turbine Generator equipment.

13.23.3 The switchgear shall consist primarily of a main circuit breaker, along with associated equipment.

13.23.4 All equipment and its installation shall meet, at a minimum, applicable NEMA, ANSI, and IEC standards. In the case of conflict between standards, the more stringent shall apply.

13.23.5 The medium voltage switchgear shall be gas-insulated using SF6.

13.23.6 The switchgear shall be provided in a dedicated steel enclosure and be readily accessible for inspection and maintenance.

13.23.7 The circuit breaker compartment shall have a hinged door and dead front construction.

13.23.8 No exposed buswork or cable connection shall be present with the breaker door open.

13.24 Tower Wiring and Cabling

13.24.1 The internal tower wiring and cabling shall be provided in a sufficient quantity to transfer electrical power between the Wind Turbine Generator nacelle and the down-tower switchgear, including all necessary slack and splicing quantities.

13.25 Wind Turbine Generator Obstruction Lighting

Provide an Aircraft Detection Lighting Systems (ADLS) designed to mitigate the impact of nighttime lights by deploying a radar-based system, turning lights on only when low-flying aircraft are detected nearby. The system shall automatically activate the appropriate obstruction lights until they are no longer needed by the aircraft.

The system should be designed with sufficient sensors to provide complete detection coverage for aircraft that enter a three-dimensional volume of airspace, or coverage area, around the Wind Turbine Generators.

If terrain may mask the detection signal from nearby aircraft, please identify the areas and/or Wind Turbine Generators which would be affected.

Contractor shall provide the following:

• FAA approved system
• Radar sensor, radar tower, radar electronics, Doppler processor, and connections
• Permitting support, including document submittals, agency interface and meeting support
• System must be compatible with major manufacturers' Wind Turbine aircraft detection lights.
• Pre-delivery scoping site visit to validate preliminary design
• Delivery to project site
• System installation support, start-up and on-site user training
• Digital copies of Operations & Maintenance (O&M) Manuals
• Warranty
• Technical support
• As-built engineering drawings for system, network and electrical

13.26 Lightning Protection

13.26.1 The Wind Turbine Generator shall be furnished with lightning protection designed in compliance with, at a minimum, the requirements of IEC 61400-24 and IEC 62305.

13.26.2 Lightning protection equipment should include, at a minimum, the following on every Wind Turbine Generator:

(1) Franklin rods on nacelle.

(2) Lightning receptors on hub, nacelle, and each rotor blade.

(3) Internal steel mesh in nacelle to act as Faraday cage.

(4) Fire-retardant materials within nacelle composition.

(5) Earthing system, including down-conducting system with clear electrical path to ground.

13.26.3 All metallic components within the Wind Turbine Generator shall be bonded to the Wind Turbine Generator.

13.26.4 Rotor blades shall be designed to Lightning Protection Level ("LPL") I, in accordance with IEC 61400-24.

13.26.5 Unless demonstrated by a risk analysis that a lower level is adequate, the remaining components (other than rotor blades) shall be designed to at least LPL-II, in accordance with IEC 61400-24.

13.27 Corrosion Protection

13.27.1 All ferrous materials shall be supplied with coating systems adequate to protect it from corrosion for the design life (minimum 30 years) of the Wind Turbine Generators at the Project Site location.

13.28 Extreme Weather Packages

13.28.1 The design temperature ranges for each Wind Turbine Generator shall be in accordance with, at a minimum, the most recent edition of IEC 61400-1. The Wind Turbine Generator shall employ hot weather and/or cold weather packages as necessary to maximize production opportunities.

13.29 Emergency Protection Systems

13.29.1 During power outages of any nature, the Wind Turbine Generator shall have the ability to power down, feather blades properly, and orient the Wind Turbine Generator appropriately to prevent damage by high winds.

13.29.2 Tower, nacelle, and obstruction lighting back-up power shall be provided for personnel and equipment safety during power outages.

13.30 Fire Protection

13.30.1 Fire protection should be designed to the NFPA 850 (Recommended Practice for Fire Protection for Electric Generating Plants and High Voltage Direct Current Converter Stations) standard.

13.30.2 Permanently-mounted fire extinguishers shall be included, at a minimum, in the nacelle and at the base of every tower.

13.30.3 Fire suppression equipment for the Wind Turbine Generator should be included as an option in the Proposal. Owner reserves the right to install third-party fire suppression equipment at a later date.

13.31 Grid Compliance

13.31.1 The Wind Turbine Generator shall provide a controlled and predictable power response from variations in wind and grid frequency.

13.31.2 The Wind Turbine Generator shall be compliant with the following power quality and grid interconnection standards, at a minimum:

(1) Federal Energy Regulation Commission Order 661a Appendix G, "Interconnection Requirements for a Wind Generating Plant".

(2) NERC standards including but not limited to PRC-019, PRC-024, and PRC-025.

(3) IEEE Standard 519, "Harmonic Limits".

(4) ANSI C84.1, "American National Standard for Electric Power Systems and Equipment - Voltage Ratings".

13.31.3 Voltage and Frequency ride through: The Wind Turbine Generator shall be capable of remaining in service for frequency and voltage regulations as determined by NERC ride-through for WECC region.

13.31.4 The Wind Turbine Generator shall operate within a frequency range of 60 Hertz ± 2 Hz.

13.31.5 The Wind Turbine Generator shall be capable of providing active power control through the following, at a minimum:

(1) Ramp rate control, permitting active power response up to ten percent (10%) of rated power per second.

(2) Delta control, permitting Wind Turbine Generator to be operated at specified output level (delta) below available output level.

13.31.6 Reactive power control shall be provided by the Wind Turbine Generator to assist with regulating grid voltages. The Project (inclusive of all Wind Turbine Generators) shall maintain a power factor within the range of 0.95 leading to 0.95 lagging, as measured at the point of interconnection.

13.31.7 Total harmonic distortion shall be no greater than five percent (5%).

13.31.8 Test results for IEC 61400-21 shall be provided by the Turbine Supplier.

13.32 Testing and Quality Control

13.32.1 All testing described herein shall be performed by an independent, experienced third party.

13.32.2 All Wind Turbine Generator equipment shall be tested to demonstrate it meets stated design criteria and is fit for purpose.

13.32.3 Wind Turbine Generator testing shall include the following, at a minimum:

(1) All testing specified in the Applicable Standards.

(2) All testing reasonably recommended or required by the applicable equipment suppliers.

(3) Results of all design testing / factory acceptance testing performed by the OEM shall be provided to the Owner for review. Any testing for non-Project Specific units shall be performed on components of an identical design and construction as those to be installed in Project Specific Wind Turbine Generators. As used herein, "**Project Specific**" means those items that have been specifically manufactured or furnished for the Project.

(4) All exposed cable sections shall be visually inspected for physical damage or manufacturing defects. Such inspections shall be performed prior to and during installation.

(5) Start-up, test, commission, and successfully achieve commissioning completion and substantial completion of all Wind Turbine Generators and other Wind Turbine Generator equipment, including the SCADA System and service lifts (if elected by Owner).

(6) Reliability test following commissioning completion:

(a) Minimum duration: 72 hours.

(b) Each individual Wind Turbine Generator shall maintain a minimum availability level of at least 90 percent (90%), as calculated at the end of the test, and as determined using the availability calculation in the Project availability agreement.

(c) The Wind Turbine Generators (considered in the aggregate) shall maintain a minimum availability level of at least 95 percent (95%), as calculated at the end of the test, and as determined using the availability calculation in the Project availability agreement.

(d) Each Wind Turbine Generator shall remain in continuous operation throughout the test and be available to produce.

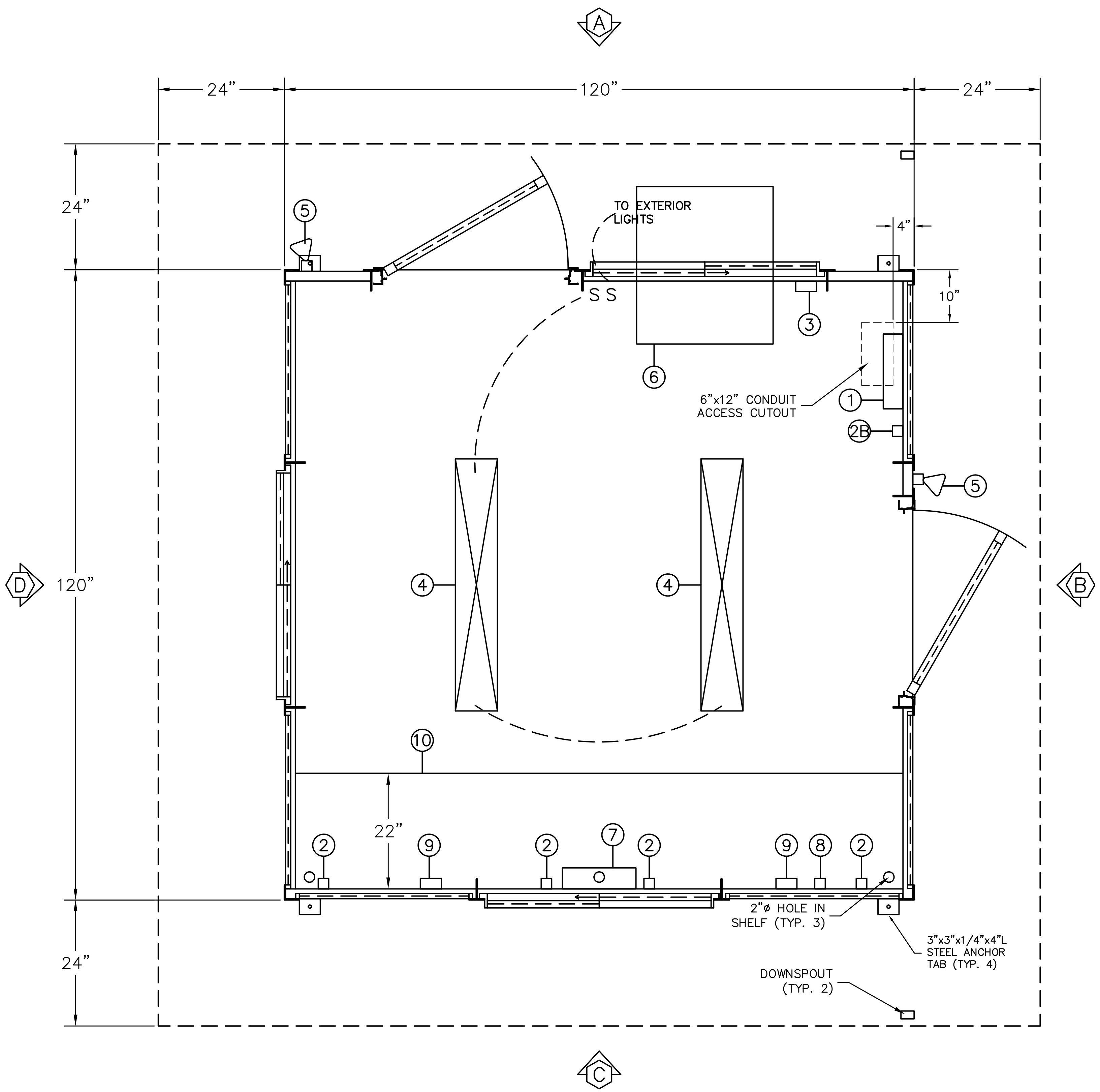
(e) Each Wind Turbine Generator shall generate at least five times the nameplate rating in MWh by the end of the test.

(f) No major mechanical or electrical issues shall occur on any Wind Turbine Generator during the test.

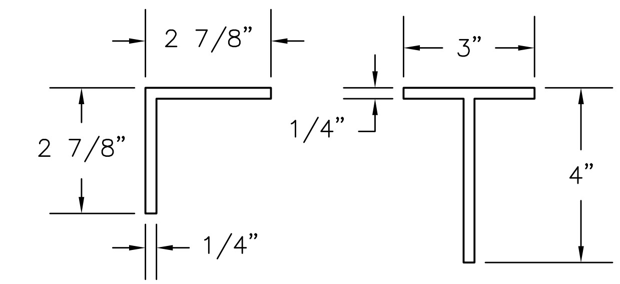
13.32.4 Copies of testing reports shall be submitted to Owner within 10 days of completing such test. Testing reports shall include a summary of testing procedures and acceptance criteria.

13.33 Observation tower(s)

13.33.1 If an observation tower(s) is required as part of project development, the tower shall be constructed similar to the building drawings in RFP APP A Wind Work Specification Observation Tower. Sufficient power and communication (fiber) equipment shall be installed to provide SCADA access at the observation tower(s). Power will be fed from the nearest WTG low voltage terminals. Observation tower Fiber will be fed from nearest WTG patch panel and follow the turbine fiber ring network to the substation where it will be patched into owners Corporate and Wind Control networks. Fiber routing and patching details to be coordinated with owner prior to final design. An access road and parking area shall be constructed to access the observation tower(s) year-round. Seller shall coordinate location of tower, communications, parking, and roads with Owner prior to construction of the tower(s).



PLAN VIEW

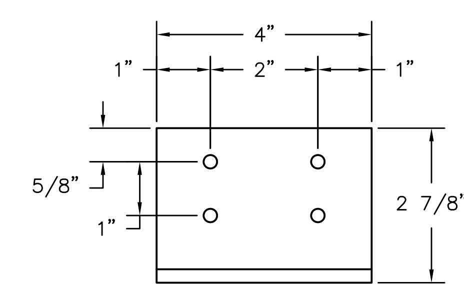


HEAVY DUTY EXTRUSION USED
ON THIS BUILDING

DURALUMINUM MODEL 120120SW BUILDING NOTES:

1 — 100 AMP, SINGLE PHASE 12 SPACE LOAD CENTER w/ MAIN BREAKER
2 — 115V DUPLEX OUTLET
2b — 115V GFI DUPLEX OUTLET
3 — 230V 30AMP SINGLE OUTLET
4 — 4' SURFACE MOUNTED LED WRAPAROUND LIGHT w/ SWITCH
5 — EXTERIOR SINGLE HEAD LED SPOT/FLOOD LIGHT w/ SWITCH
6 — 230V, 20,000 C / 13,000 H BTU THRU WALL HVAC UNIT
7 — 240V 4,800 WATT WALL MOUNTED HEATER (WIRED DIRECT)
8 — DATA/PHONE JACK w/ CONDUIT & PULL WIRE TO ACCESS CUTOUT
9 — 4"x4" J-BOX w/ CONDUIT & PULL WIRE TO ACCESS CUTOUT
10 — 22" DEEP PAINTED STEEL SHELF

* EXTERIOR STANDING SEAM ROOF w/ 24" OVERHANG, GUTTERS & DOWNSPOUTS
* CRANE LIFTING POCKETS IN BASEFRAME
* 90" INTERIOR HEIGHT
* 3070 HEAVY DUTY ALUMINUM SWING DOOR w/ HALF GLASS, ADA CLOSER, CHECK CHAIN & LEVER LOCKSET
* GLAZING: 5/8" CLEAR INSULATED TEMPERED GLASS
* INSULATION: WALLS R-10, FLOOR R-19, CEILING R-30
* STANDING SEAM ROOF COLOR: ADVISE ROOF COLOR
* INTERIOR PANEL FINISH: DIAMOND EMBOSSED ALUMINUM
* ALUMINUM TREAD PLATE FLOOR
* STANDARD CONDUIT ACCESS CUTOUT



ANCHOR TAB DETAIL

RECOMMENDED THAT EACH ANCHOR TAB BE SECURED TO MEZZANINE w/ 1/2"ø GR. 5 BOLT.

SERVICE (ASD) LOADS TO MEZZANINE AT EACH ANCHOR BOLT
T = 0.65 KIP
V = 0.30 KIP

PROJECT: FULLER ENTERPRISES CONST.
208 DELMAR
MILLS, WY 82644

CUSTOMER: FULLER ENTERPRISES
SYSTEM: DURALUMINUM
MODEL: 120120SW

PORTA-KING BUILDING SYSTEMS
4133 SHORELINE DRIVE
EARTH CITY, MO 63045
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www.portaking.com

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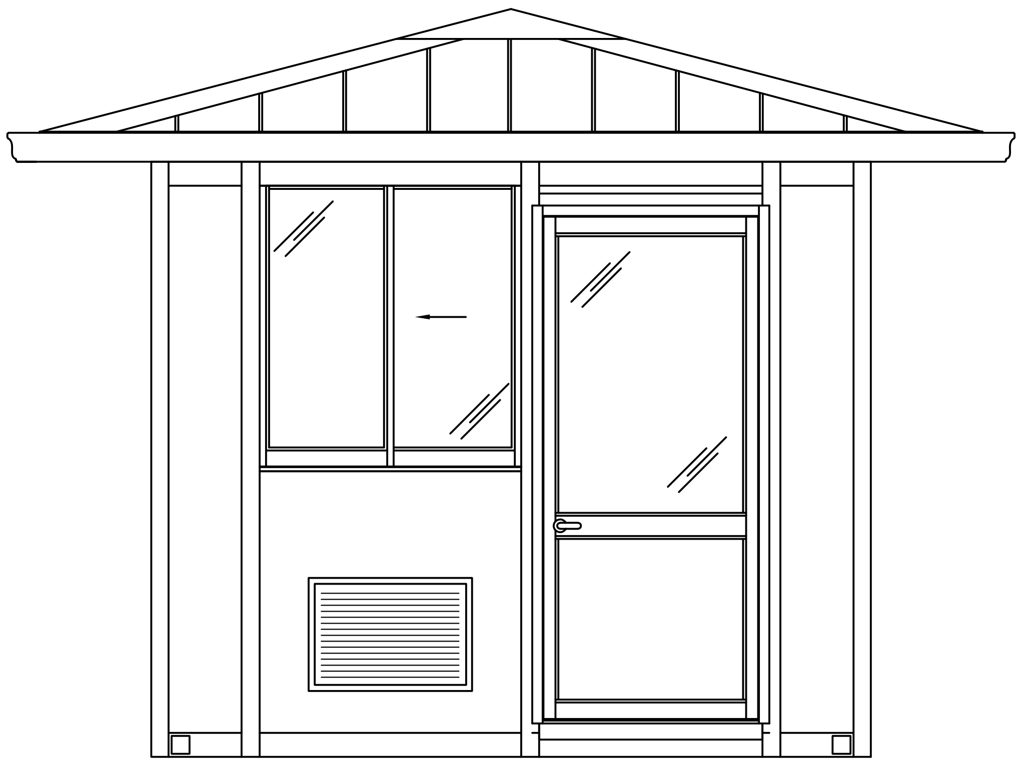
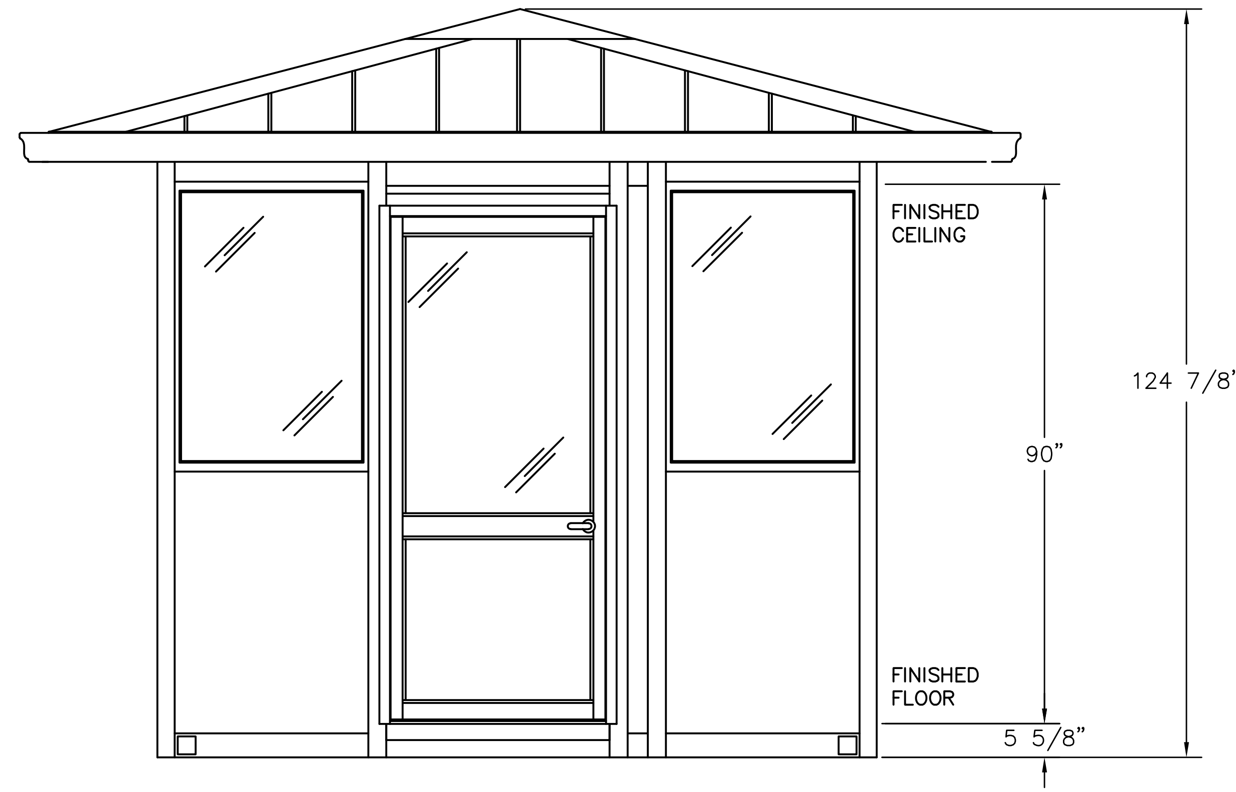
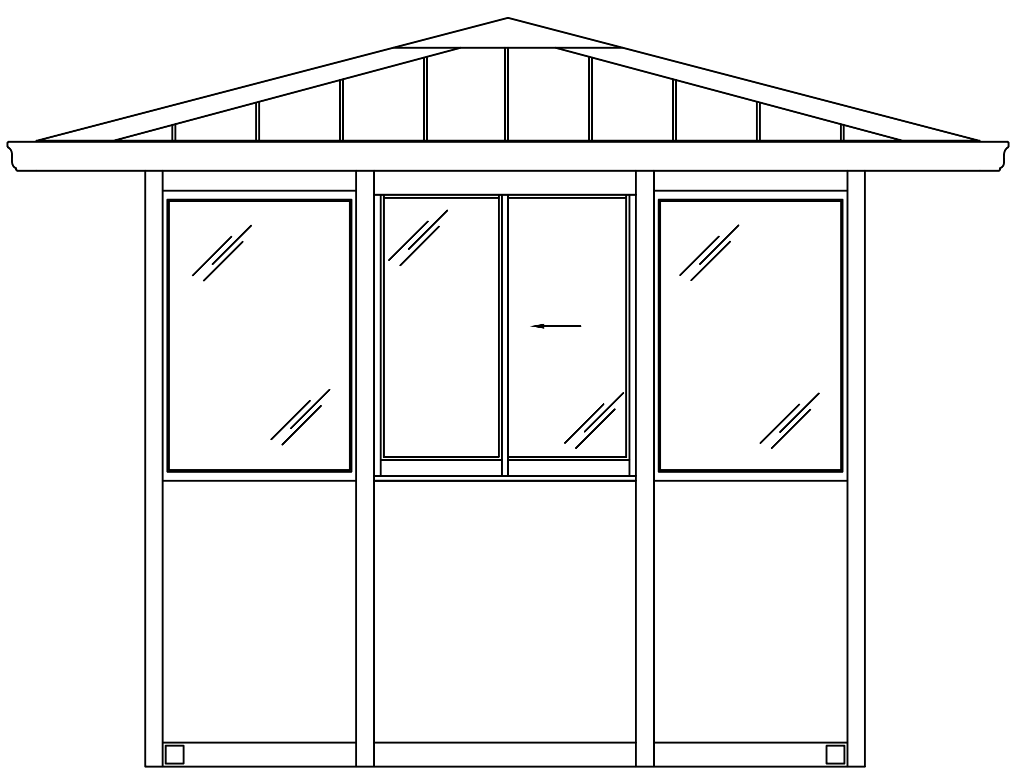
JOB:
DATE: 3-30-21
REVISED:
DRAWN BY: DGR
SHEET 1 OF 6



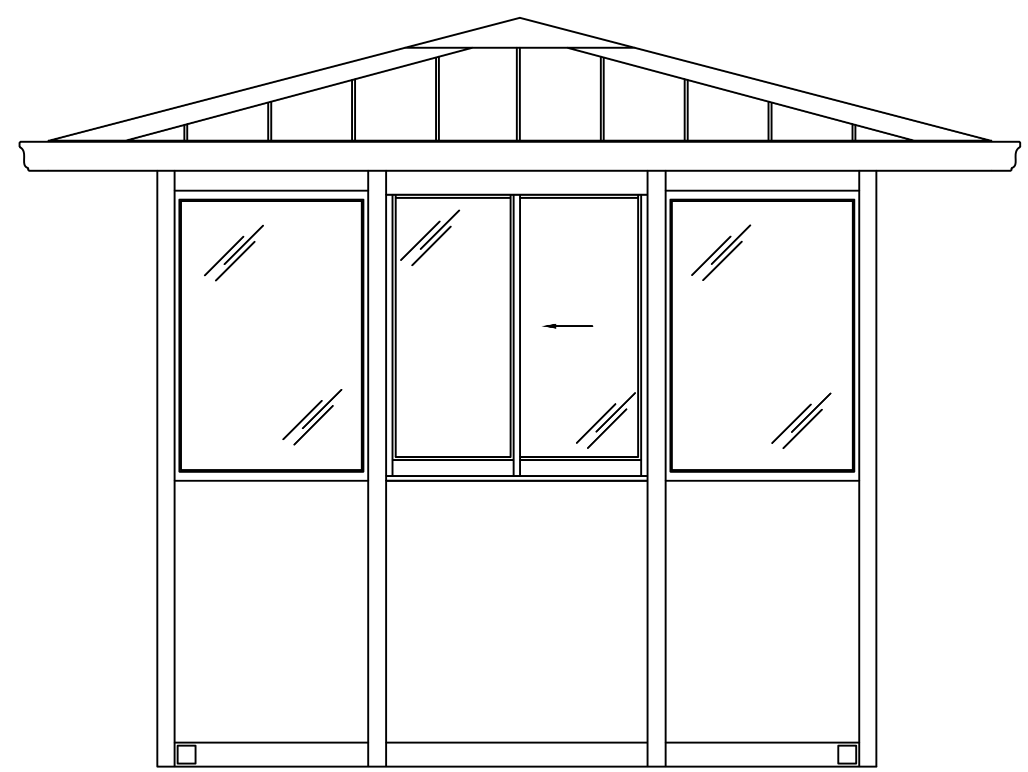
ELEVATION A



ELEVATION B



ELEVATION C



ELEVATION D

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MILLS, WY 82644

CUSTOMER: FULLER ENTERPRISES
SYSTEM: DURALUMINUM
MODEL: 120120SW

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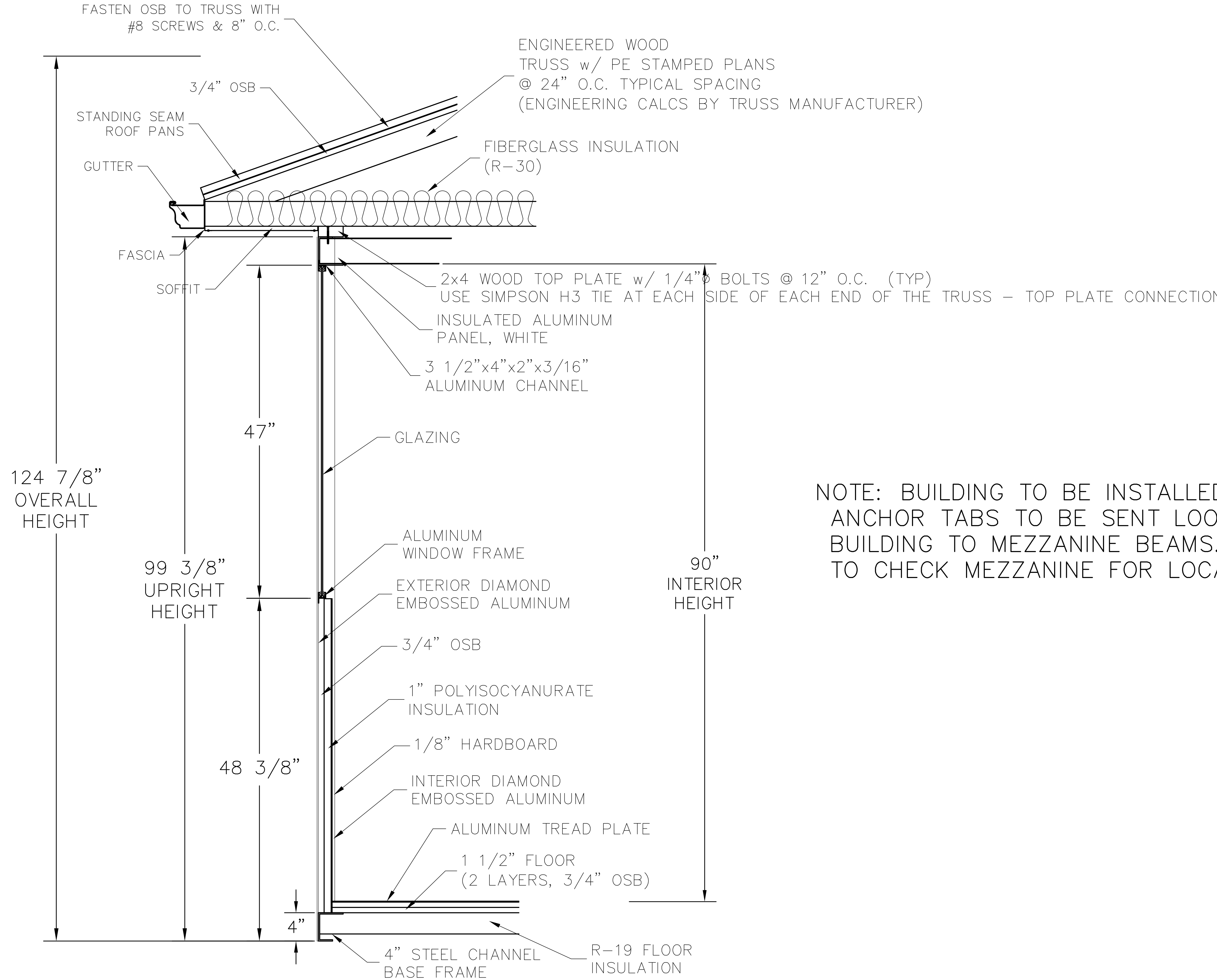

WALL SECTION DETAIL

NOTE: BUILDING TO BE INSTALLED ON MEZZANINE. ANCHOR TABS TO BE SENT LOOSE, TO ATTACH BUILDING TO MEZZANINE BEAMS. MEZZANINE ENGINEER TO CHECK MEZZANINE FOR LOCAL EFFECTS.

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CUSTOMER: FULLER ENTERPRISES
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MODEL: 120120SW

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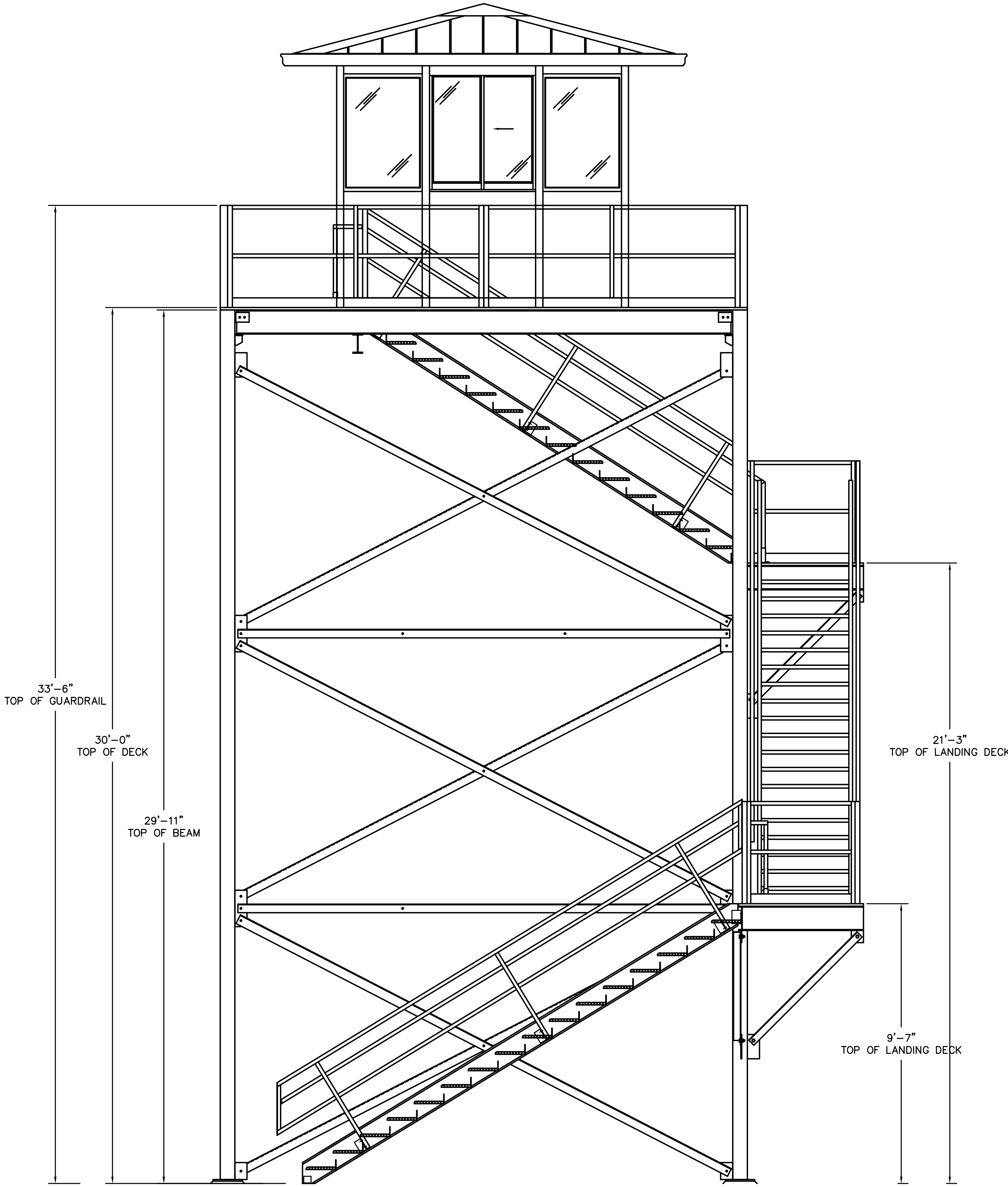
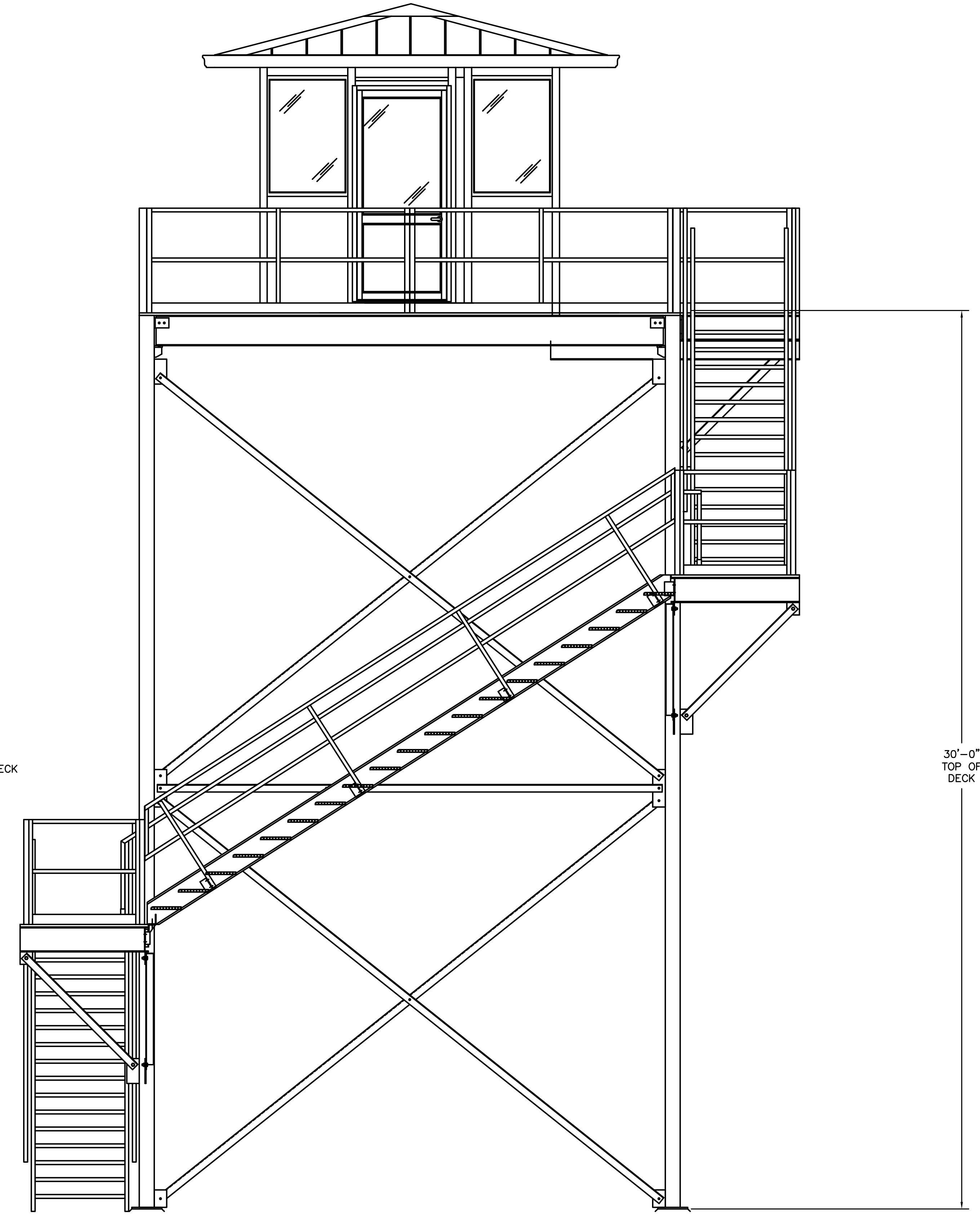


ELEVATION C w/ MEZZANINE



ELEVATION B w/ MEZZANINE

MEZZANINE AND STAIR
SEE PK-STRUCTURE DRAWINGS FOR DETAILS
MEZZANINE, STAIR, AND GUARDRAIL NOT CHECKED BY LARSON ENGINEERING.

PROJECT: FULLER ENTERPRISES CONST.
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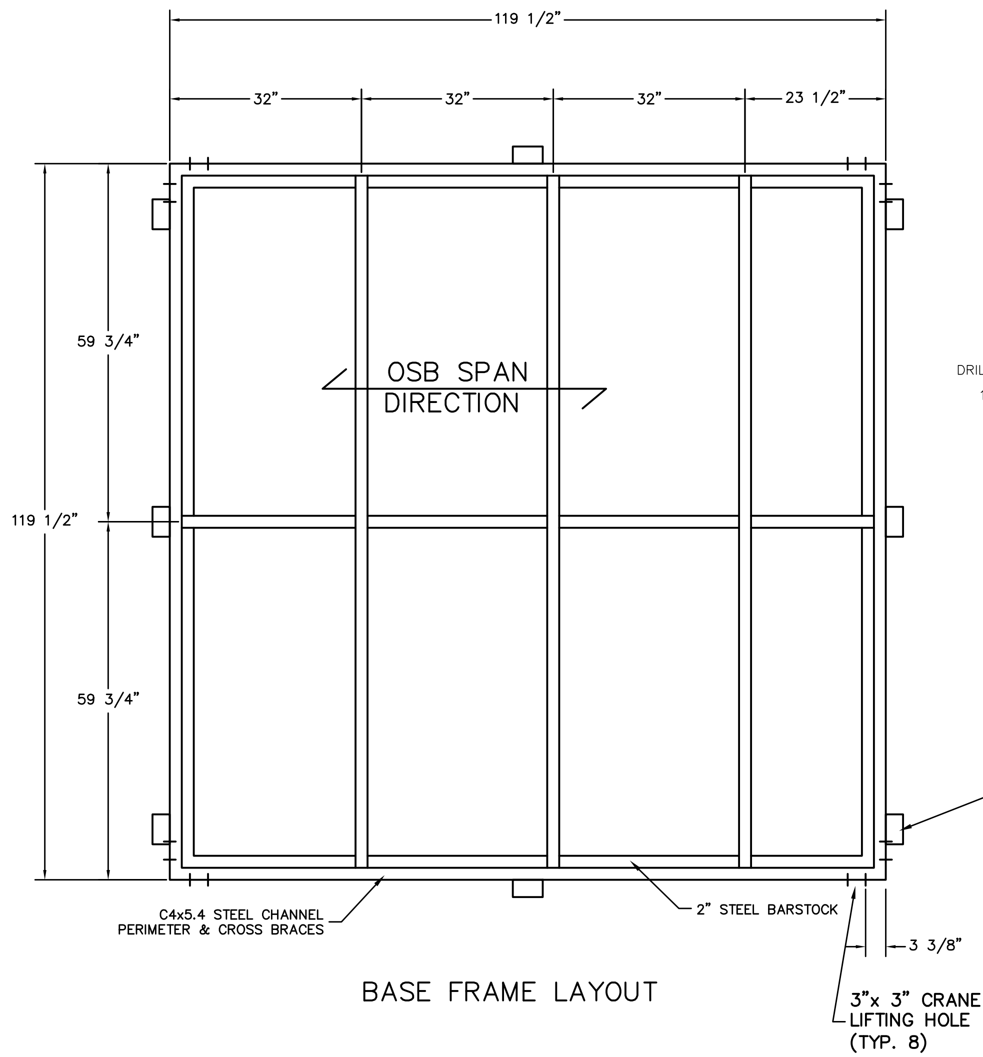
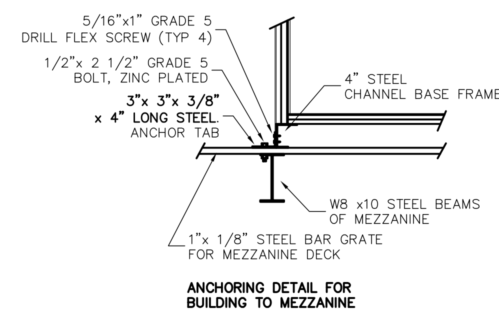
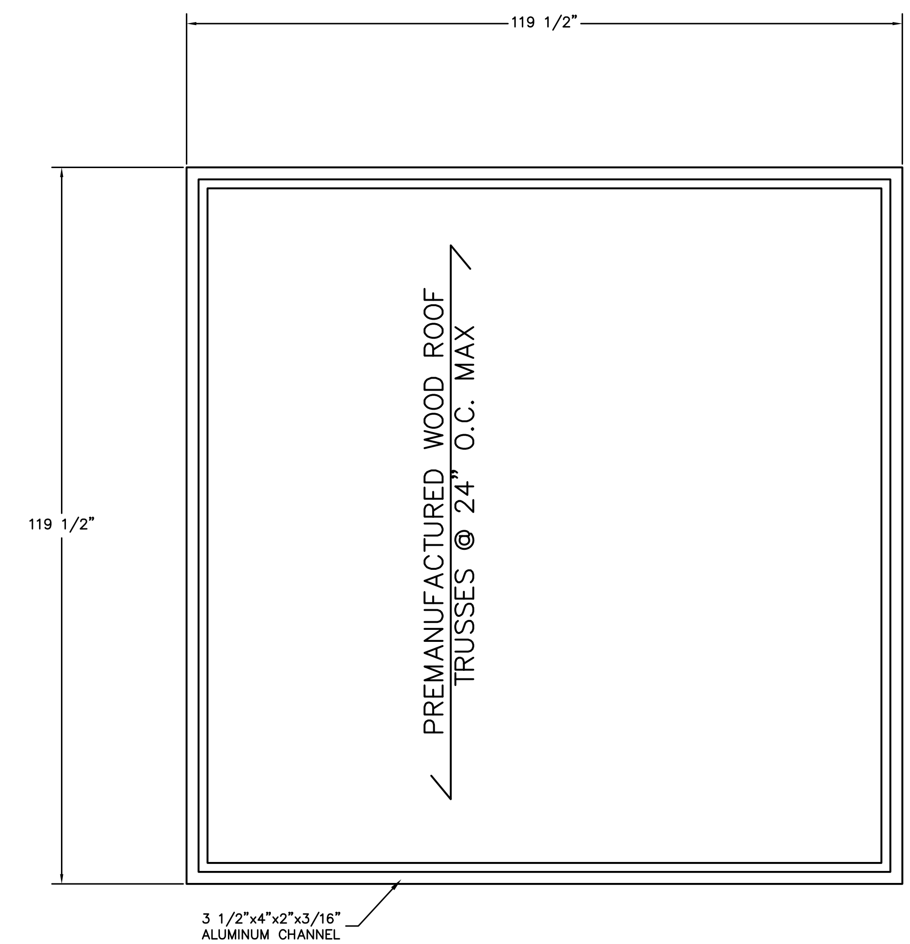
NOTE: BUILDING TO BE INSTALLED ON MEZZANINE. ANCHOR TABS TO BE SENT LOOSE, TO ATTACH BUILDING TO MEZZANINE BEAMS. MEZZANINE ENGINEER TO CHECK MEZZANINE FRAMING FOR LOCAL EFFECTS.



BASE FRAME LAYOUT



ANCHORING DETAIL FOR BUILDING TO MEZZANINE



ROOF FRAME LAYOUT

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208 DELMAR
MILLS, WY 82644

CUSTOMER: FULLER ENTERPRISES
SYSTEM: DURALUMINUM
MODEL: 120120SW

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SHEET 5 OF 6

DURALUMINUM BUILDING FRAMING NOTES :

BASE FRAMES ARE CONSTRUCTED USING
C4x5.4 STEEL CHANNEL

ROOF FRAMES ARE CONSTRUCTED USING 6063 T–6
3/16" ALUMINUM, PERIMETER CHANNEL 3 1/2"x4"x2"

BASE FRAMES AND ROOF FRAMES ARE ALL CONTINUOUS
WELDED AT ALL CORNERS AND CROSS BRACE CONNECTIONS.

VERTICAL STRUCTURAL MEMBERS, 6005 T–6, 1/4"
ALUMINUM CORNERS 2 7/8"x 2 7/8" AND TEES 3"x 4".

ASSEMBLY NOTES :

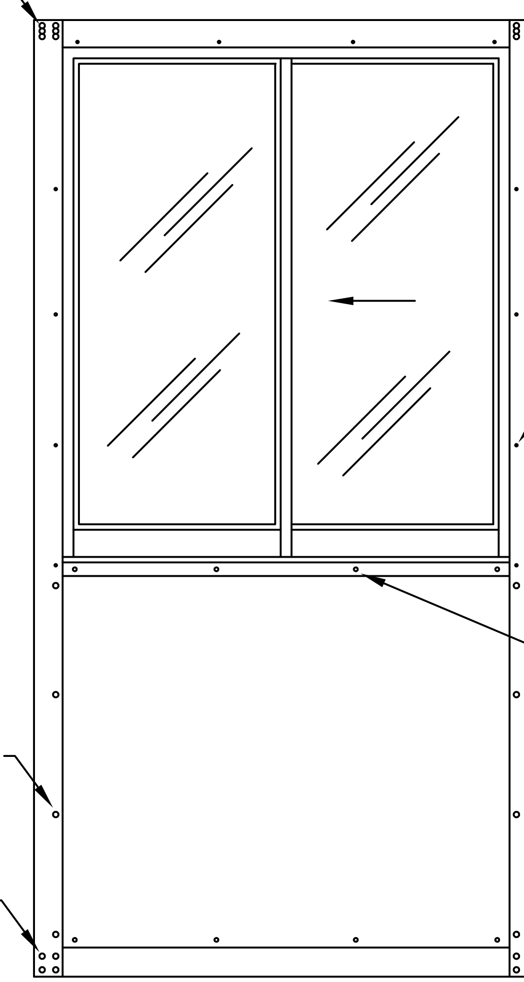
WALL PANELS, WINDOWS, AND DOORS ARE INSTALLED
BETWEEN FRAMING MEMBERS.

WINDOWS, FIXED AND SLIDING, ARE ATTACHED TO FRAMING
MEMBERS BY 1/8"DIA.x 1/2" CLOSED END POP RIVETS, 12"o.c.

WALL PANELS ARE ATTACHED TO FRAMING MEMBERS BY
1/4"DIA.x 11/16" DRIVE RIVETS, 12"o.c., AND ATTACHED TO
WINDOWS BY #8 x 5/8" TEK SCREWS, 12"o.c.

DOOR FRAMES ARE ATTACHED TO FRAMING MEMBERS BY
3/16"DIA.x 5/8" POP RIVETS, 12"o.c.

VERTICAL FRAMING MEMBERS ARE ATTACHED TO THE BASE
FRAME AND ROOF FRAME BY (6) 5/16" GRADE 5 DRILL FLEX SCREWS.



TYPICAL ELEVATION

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MODEL: 120120SW

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SHEET 6 OF 6

APPROVAL DRAWINGS ARE FOR A 18'-0 3/4" W X 30'-0" H X 18'-0 3/4" L TOWER STRUCTURES

DEALER: FULLER ENTERPRISES CONSTRUCTION

JOB NAME: PACIFICORP - CEDAR SPRINGS WIND PLANT

LOCATIONS: 460 SIXTEEN MILE ROAD
DOUGLAS, WY 82633

NOTE: THESE DRAWINGS ARE FOR LAYOUT APPROVAL ONLY, ***NOT FOR PERMIT SUBMITTAL***. ALL FIELD DIMENSIONS AND SITE CONDITIONS ARE THE RESPONSIBILITY OF THE CUSTOMER. IF P.E. SEALED DRAWINGS AND CALCULATIONS HAVE BEEN PURCHASED, THEY WILL NOT BE PRODUCED UNTIL AFTER LAYOUT IS APPROVED.

APPROVAL SIGNATURE REQUIRED

(APPROVAL IS FOR ALL PAGES IN DRAWING SET)

- [x] APPROVED AS SHOWN
- [ ] APPROVED AS NOTED
  (NOTED CHANGES MAY CAUSE REVISION PRIOR TO FABRICATION)
- [ ] REVISE AND RESUBMIT PRIOR TO FABRICATION

AUTHORIZED SIGNATURE: Ashley Fuller

DATE: 4/5/2021

IMPORTANT MANUFACTURER'S DISCLAIMERS

THE MANUFACTURER HAS DESIGNED AND ENGINEERED THIS SYSTEM SPECIFICALLY, AS STATED IN THE TOWER NOTES SECTION. VARIATIONS AND/OR MODIFICATIONS TO THE SYSTEM OR COMPONENTS WILL VOID AND NULLIFY ANY AND ALL WARRANTIES, BOTH WRITTEN AND/OR IMPLIED, AND LIABILITY FOR DEFECTS IN THIS SYSTEM AND IT'S COMPONENTS. MANUFACTURER FURTHER ACCEPTS NO RESPONSIBILITY AND/OR LIABILITY FOR OBTAINING OR MAINTAINING AN LOCAL, REGIONAL OR NATIONAL BUILDING PERMITS, INSPECTIONS OR DOCUMENTS THAT MAY BE REQUIRED.

THIS TOWER HAS (OR WILL BE) ENGINEERED STRUCTURALLY ONLY. IT IS THE RESPONSIBILITY OF THE BUYER TO VERIFY THAT WHEN THIS TOWER IS INSTALLED, THE BUILDING THAT HOUSES IT COMPLIES WITH LOCAL SAFETY CODES WHICH ADDRESS INGRESS, EGRESS, FIRE RATINGS, SPRINKLERS, ETC.

ALL INSPECTIONS TO BE ARRANGED BY AND PAID FOR BY OTHERS AND NOT PK STRUCTURES. PROJECTS THAT ARE NOT APPROVED FOR PRODUCTION WITHIN 30 DAYS FROM DATE ORDER WAS PLACED MAY BE SUBJECT TO PRICE ESCALATION BASED ON FLUCTUATIONS IN THE CURRENT STEEL MARKET.

TOWER NOTES

1) STRUCTURE:
   A) TOWER LOCATIONS: 460 SIXTEEN MILE ROAD - DOUGLAS, WY 82633
   B) THE STRUCTURE OF THIS TOWER HAS BEEN DESIGNED IN CONFORMANCE WITH THE APPLICABLE BUILDING CODE: 2018 INTERNATIONAL BUILDING CODE (2018 IBC) USING THE FOLLOWING LOADS:
      a) LIVE LOAD = 100 PSF W/ DEFLECTION LESS THAN L/360 (18'-0 3/4" X 18'-0 3/4" AREA)
      b) LIVE LOAD = 100 PSF W/ DEFLECTION LESS THAN L/360 (LANDINGS)
      c) DEAD LOAD = 15 PSF
      d) POINT LOADING: TOWER FRAMING HAS NOT BEEN DESIGNED TO SUPPORT HEAVY RACK POST/POINT LOADS. POINT LOADS UP TO 355 LBS. MAY BE SUPPORTED WITHOUT FURTHER INVESTIGATION, IF THE POSTS ARE ORIENTED SUCH THAT THE SPACING OF THE POSTS ARE PERPENDICULAR TO THE DECK SPAN. CONTACT PK STRUCTURES IF ANTICIPATED LOADS ARE GREATER THEN 355 LBS. OR IF QUESTIONS ARISE REGARDING POST LAYOUT.
      e) MAXIMUM WHEEL LOADS = 0 LBS.
      f) SEISMIC: Ss = TBD S1 = TBD Fa = TBD Fv = TBD SDS = TBD SD1 = TBD SDC = "B" SITE CAT. = D
      g) WIND LOAD: TBD MPH - EXPOSURE C
      h) GROUND SNOW LOAD: 20 PSF, ROOF LIVE LOAD = 20 PSF
2) CODE DATA:
   A) OCCUPANCY GROUP U "UTILITY AND MISCELLANEOUS" - OBSERVATION / VISION TOWER (NO PUBLIC ACCESS)
   B) FUNCTION OF SPACE: INDUSTRIAL, AREA IN SQ.FT. (INCLUDES TOP LANDING) PER OCCUPANT = 100 GROSS (346 SQ.FT. / 100 = 4)
      1) OCCUPANCY LOAD = 4
   C) SQUARE FOOTAGE OF THE STRUCTURE: = 346 SQ.FT. (INCLUDES TOP LANDING).
   D) CONSTRUCTION TYPE = IIB
   E) HEIGHT OF STRUCTURE = 30'-0"
   F) SPRINKLERS / FIRE ALARMS - NOT REQUIRED
   G) NO FIELD WELDING. DECKING MATERIAL ALSO MECHANICALLY ATTACHED.
3) FOUNDATION RESPONSIBILITY:
   A) FOUNDATIONS MAY BE EXISTING CONCRETE FLOOR SLAB OR ISOLATED CONCRETE FOOTINGS. THE STRUCTURAL CAPACITY OF THE FOUNDATION IS TO BE DETERMINED BY OTHERS USING SOUND ENGINEERING PRACTICES. THE EXISTING STRENGTH PARAMETERS OF CONCRETE, REINFORCING STEEL, AND SOIL BEARING CAPACITY SHOULD BE ANALYZED IN THE REVIEW.
   B) MAXIMUM PERIMETER COLUMN LOAD = SEE BASE PLATE LAYOUT SHEET.
   C) NON-SHRINK GROUT IS RECOMMENDED WHEN THE TOWER FLOOR IS NOT LEVEL WITH THE EXISTING SLAB ON GRADE. GROUT & GROUTING ARE THE RESPONSIBILITY OF OTHERS.
4) STRUCTURAL MATERIAL SPECIFICATIONS:
   A) FLOORING: 1" X 1/8" 19W4 SERRATED BAR GRATE - BEARING BARS ARE ON 1 3/16" CENTERS, 1 1/16" CLEAR BETWEEN BEARING BARS.
   B) WIDE FLANGE STEEL BEAM SHAPES: Fy = 50 KSI: ASTM A572-50 OR A992-50 (FOR TOWER AND TOP LANDING)
   C) TOWER TUBE COLUMNS: Fy = 46 KSI: ASTM A500 GRADE B (SEE FLOOR PLAN LAYOUT FOR SIZES)
   D) INTERMEDIATE LANDING TUBE COLUMNS: Fy = 46 KSI: ASTM A500 GRADE B (TS 2" X 2" X 3/16" WITH L 2 " X 2 " X 1/8 " A36 CONNECTION CLIPS).
   E) INTERMEDIATE LANDING PLATFORMS: MC10X8.4, A36
   F) INTERMEDIATE AND TOP LANDINGS: 1" X 1/8" 19W4 SERRATED BAR GRATE - BEARING BARS ARE ON 1 3/16" CENTERS, 1 1/16" CLEAR BETWEEN BEARING BARS.
   G) STAIRS: MC10X8.4, A36 STRINGERS WITH 1" X 3/16" 19W4 SERRATED BAR GRATE TREADS W/ CHECKER PLATE NOSING.
   H) GUARDRAIL COMPONENTS:
      - HORIZONTAL TUBES = TS 1 1/2" X 1 1/2" X 14 GA., ASTM A513-TYPE 1, Fymin = 32 KSI.
      - VERTICAL POSTS = TS 1 1/2" X 1 1/2" X 11 GA., ASTM A500 GRADE B, Fymin = 46 KSI. - MAXIMUM SPACING OF 90" ON CENTER.
      - CORNER ANGLES = L 2 1/2" X 2 1/2" X 3/16", ASTM A36, Fymin = 36 KSI.
      - END ANGLES = L 3" X 2" X 3/16", ASTM A36, Fymin = 36 KSI.
      - KICK PLATE = L 4" X 3" X 1/4", ASTM A36, Fymin = 36 KSI.
      - CONNECTION BOLT TO FLOOR FRAMING = 3/8" Ø.
      - CONNECTION BOLT AT CORNERS = 1/2" Ø.
   I) STAIR GUARDRAILS & HANDRAILS:
      - ALL TUBES EXCEPT VERTICAL POSTS = TS 1 1/2" X 1 1/2" X 14 GA., ASTM A513-TYPE 1, Fymin = 32 KSI.
      - VERTICAL POSTS = TS 1 1/2" X 1 1/2" X 11 GA., ASTM A500 GRADE B, Fymin = 46 KSI. - MAXIMUM SPACING OF 90" ON CENTER.
      - TUBES FOR EXTENDED HANDRAIL BASE = TS 1 3/4" X 1 3/4" X 14 GA., ASTM A513-TYPE 1, Fymin = 32 KSI.
   J) OTHER STRUCTURAL STEEL SHAPES & BASE PLATES: FY = 36 KSI: ASTM A36
   K) STRUCTURAL BOLTS: 1/2" DIAMETER = GRADE 5 AND 5/8" DIAMETER OR LARGER = A325 - A490 (REFERENCE DETAILS FOR CALLOUTS).
   L) ANCHORS: TO BE SUPPLIED - SEE BASE PLATE LAYOUT SHEET FOR BASE REACTIONS.
5) BOLT INSTALLATION:
   A) BOLTS FOR STRUCTURAL CONNECTIONS SHALL BE 1/2" DIAMETER GRADE 5 AND 5/8" DIAMETER OR LARGER A325 - A490 IN BEARING-TYPE CONNECTIONS, TIGHTENED UNTIL SNUG, UNLESS NOTED OTHERWISE. SNUG TIGHT IS THE TIGHTNESS THAT EXISTS WHEN ALL PLIES IN A JOINT ARE IN FIRM CONTACT AND MAY BE ACHIEVED BY A FEW IMPACTS OF AN IMPACT WRENCH OR THE FULL EFFORT OF A PERSON USING AN ORDINARY SPUD WRENCH. PLEASE NOTE THAT THE AISC DOES NOT RECOGNIZE TIGHTENING BOLTS TO A SPECIFIED TORQUE AS A SUFFICIENT MEANS OF TIGHTENING THEM. IT DOES HOWEVER RECOGNIZE THE TURN OF THE NUT METHOD AS A SUFFICIENT MEANS TO TIGHTEN BOLTS.
6) STAIR AND GUARDRAIL DESIGN:
   A) THE STAIRS, GUARDRAILS, AND STAIR RAILS INCLUDED WITH THIS MODULAR TOWER HAVE BEEN CONFIGURED IN CONFORMANCE WITH OSHA. THEY HAVE ALSO BEEN DESIGNED TO COMPLY WITH THE 2018 IBC REQUIREMENTS.
   B) IBC CODE COMPLIANCE OF THIS SINGLE MEANS OF EGRESS DESIGN ASSUMES ANY IBC OCCUPANCY TYPE EXCEPT H (HIGH HAZARD), I (INSTITUTIONAL) AND R (RESIDENTIAL) AND MAXIMUM OCCUPANT LOAD ON THE TOWER FLOOR OF 30 PEOPLE.
   C) STAIRWAY TREAD WIDTH = 36" STAIR TREAD DEPTH = 11.0" (MIN) STAIR RISER HEIGHT = 7.0" (MAX) STAIR HANDRAIL HEIGHT = 34" (MIN) STAIR TREAD MATERIAL = 1" X 3/16" 19W4 SERRATED BAR GRATE TREADS WITH CHECKER PLATE NOSING. GUARDRAIL HEIGHT = 42"
7) FINISH - ALL COMPONENTS HOT DIP GALVANIZED
8) SPECIAL INSPECTIONS PER IBC 2018, CHAPTER 17:
   A) HIGH STRENGTH BOLTING
      1) ALL CONNECTIONS CONSIDERED BEARING CONDITION AND REQUIRE PERIODIC INSPECTION, UNLESS NOTED OTHERWISE.
      2) FRAMED CONNECTIONS CONSIDERED SLIP CRITICAL AND REQUIRE CONTINUOUS INSPECTION.
   B) HILTI ADHESIVE ANCHOR INSTALLATION (HOLE CLEANING CRITICAL).
   C) CONCRETE PLACEMENT & MIX DESIGN, REBAR PLACEMENT.

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PAGE NAME: TOWER NOTES SHEET

SHEET M1 OF M11

DEALER: FULLER ENTERPRISES CONSTRUCTION

JOB NAME: PACIFICORP WIND

LOCATION: 460 SIXTEEN MILE ROAD - DOUGLAS, WY 82633

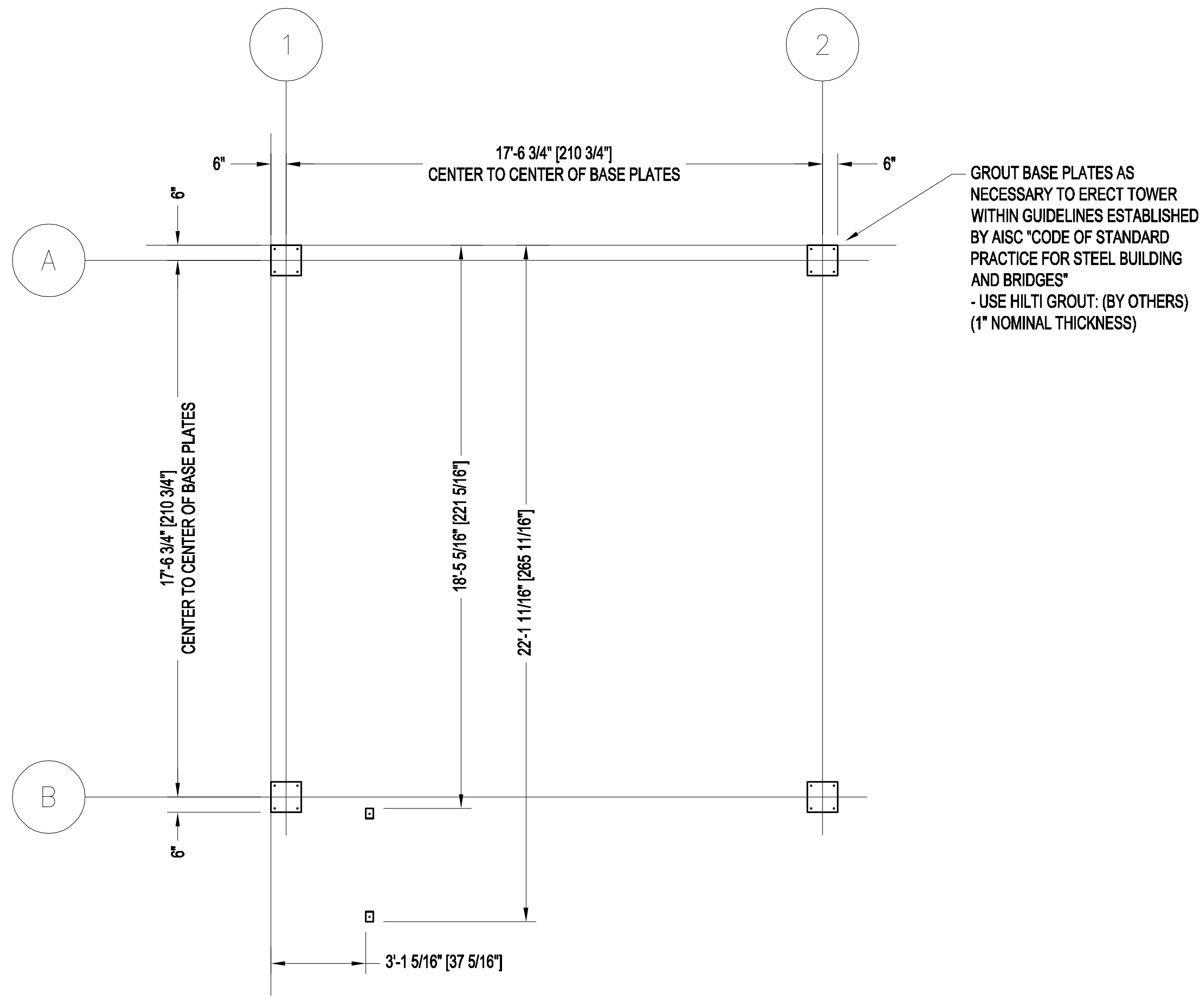
DRAWN BY: MO

DATE: 3-29-21

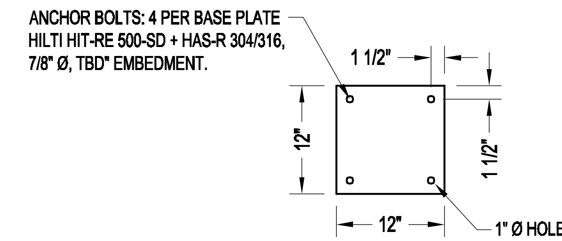
REVISED DATE:

SCALE: 3/16" = 1'-0"

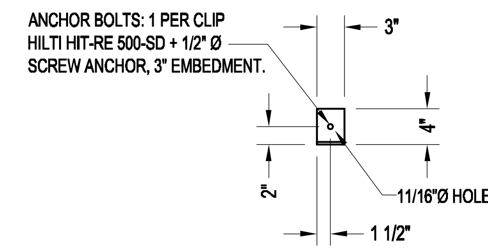
ORDER NUMBER: PK34198-10614



BASE PLATE LAYOUT



BASE PLATE: 5/8" x 12" x 12"



STAIR BOTTOM CLIP: L 4" x 3" x 1/4"

FOUNDATION REACTIONS (ALLOWABLE STRESS DESIGN) PER BASE PLATE:

- MAXIMUM UPLIFT = -TBD LBS.
- MAXIMUM DOWNWARD FORCE = TBD LBS.
- MAXIMUM SHEAR FORCE = TBD LBS.

ANCHOR BOLT REACTIONS (FACTORED LOADS) PER BASE PLATE:

- MAXIMUM UPLIFT = -TBD LBS.
- MAXIMUM DOWNWARD FORCE = TBD LBS.
- MAXIMUM SHEAR FORCE = TBD LBS.

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PAGE NAME: BASE PLATE LAYOUT SHEET

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SHEET M2 OF M11

DEALER: FULLER ENTERPRISES CONSTRUCTION

JOB NAME: PACIFICORP WIND

LOCATION: 460 SIXTEEN MILE ROAD - DOUGLAS, WY 82633

PROPRIETARY INFORMATION

DRAWN BY: MO

DATE: 3-29-21

REVISED DATE:

SCALE: 3/16" = 1'-0"

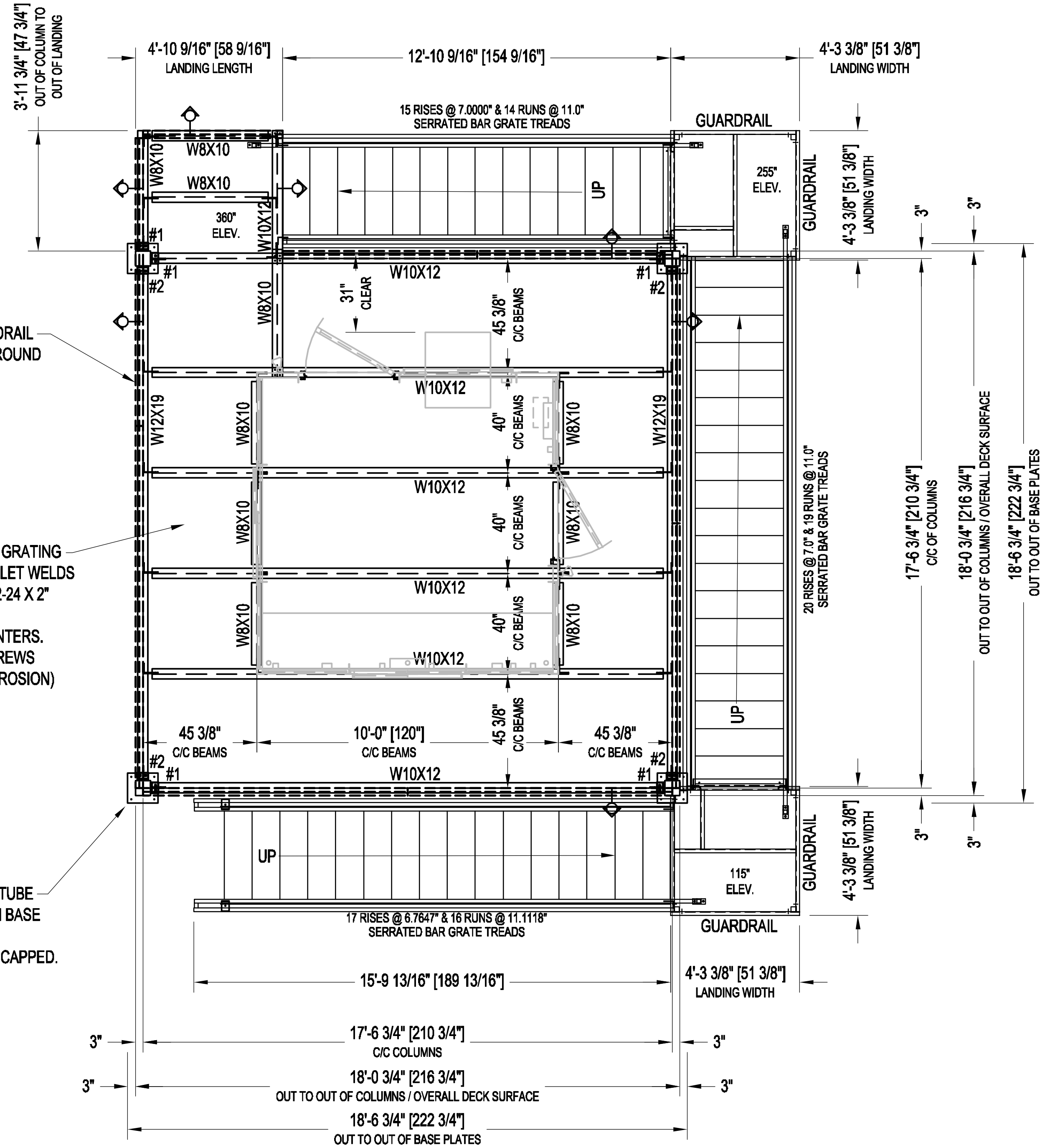
ORDER NUMBER: PK34198-10614

THIS IS AN INTEGRATED PROJECT. PLEASE CHECK MEZZANINE AND PRE-ASSEMBLED BUILDING DRAWINGS FOR ALL DETAILS THAT MAY BE APPLICABLE TO BOTH TO MAKE SURE THAT NOTHING IS MISSED IN THE ASSEMBLY PROCESS.

GUARDRAIL ALL AROUND

CONNECT SERRATED BAR GRATING TO BEAMS WITH 1/8"x1" FILLET WELDS @12" CENTERS, OR USE 12-24 X 2" TEK SCREWS AND BAR GRATE SADDLES @12" CENTERS. (TOUCH UP WELDS OR SCREWS TO MINIMIZE FUTURE CORROSION)

ALL COLUMNS ARE SQ.TUBE HSS 6" X 6" X 3/16" WITH BASE PLATES 5/8" X 12" X 12". ALL COLUMNS WILL BE CAPPED.



FLOOR PLAN LAYOUT

CRITICAL

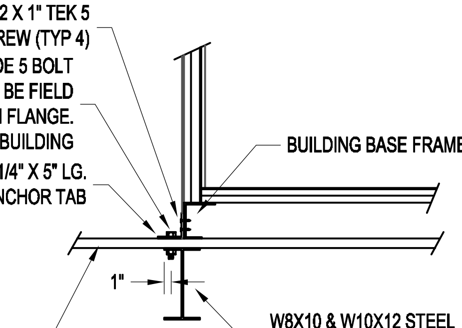
NOTE: THE BUILDING NEEDS TO BE BOLTED TO THE MEZZANINE BEAMS. ANGLE TABS WILL BE SHIPPED WITH THE PORTA-KING BLDG. THE TABS WILL NEED TO BE FIELD ATTACHED TO THE BLDG., THEN USING THE TABS AS A TEMPLATE HOLES NEED TO BE FIELD DRILLED THROUGH THE MEZZANINE BEAMS BELOW. BOLTS 2 1/2" LONG WILL BE SUPPLIED WITH THE BUILDING.

NOTE:

- HOLES FOR ATTACHING THE GUARDRAIL TO THE BEAM FLANGE AROUND THE PERIMETER OF THE MEZZANINE NEED TO BE FIELD DRILLED.

BEAM SEAT CONDITIONS:

#1 - BEARING PLATE 1/2" x 4 1/2" W/ L3"x2"x3/16"
#2 - BEARING PLATE 5/8" x 4 1/2" W/ L3"x2"x3/16"
#3 - BEARING PLATE 3/4" x 4 1/2" W/ L3"x2"x1/4"
#4 - BEARING PLATE 3/4" x 5 1/2" W/ L3"x2"x1/4"
#5 - BEARING PLATE 3/4" x 5 1/2" W/ L3"x2"x1/4" AND TRIANGULAR GUSSET.



ANCHORING DETAIL FOR BUILDING TO MEZZANINE

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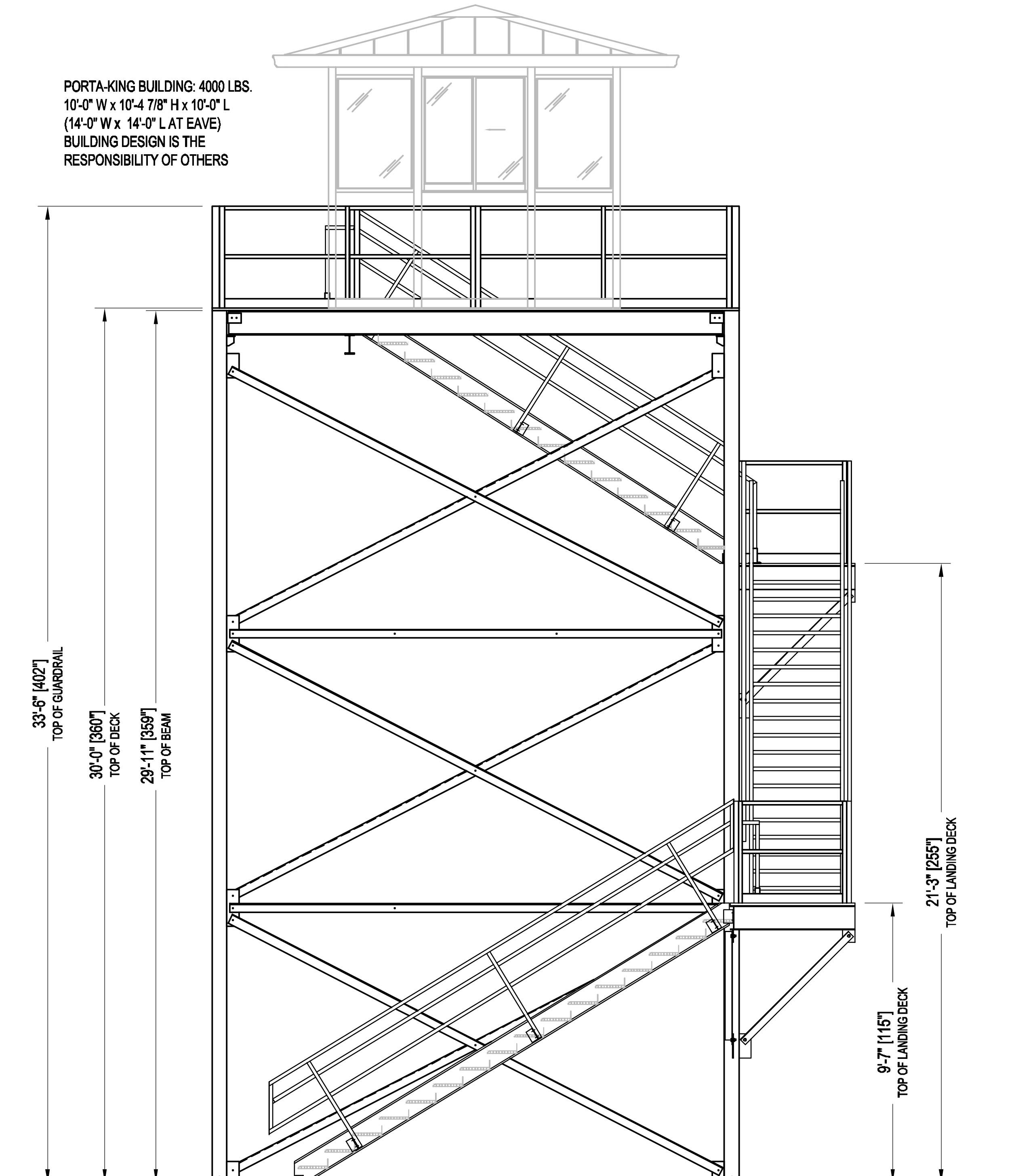
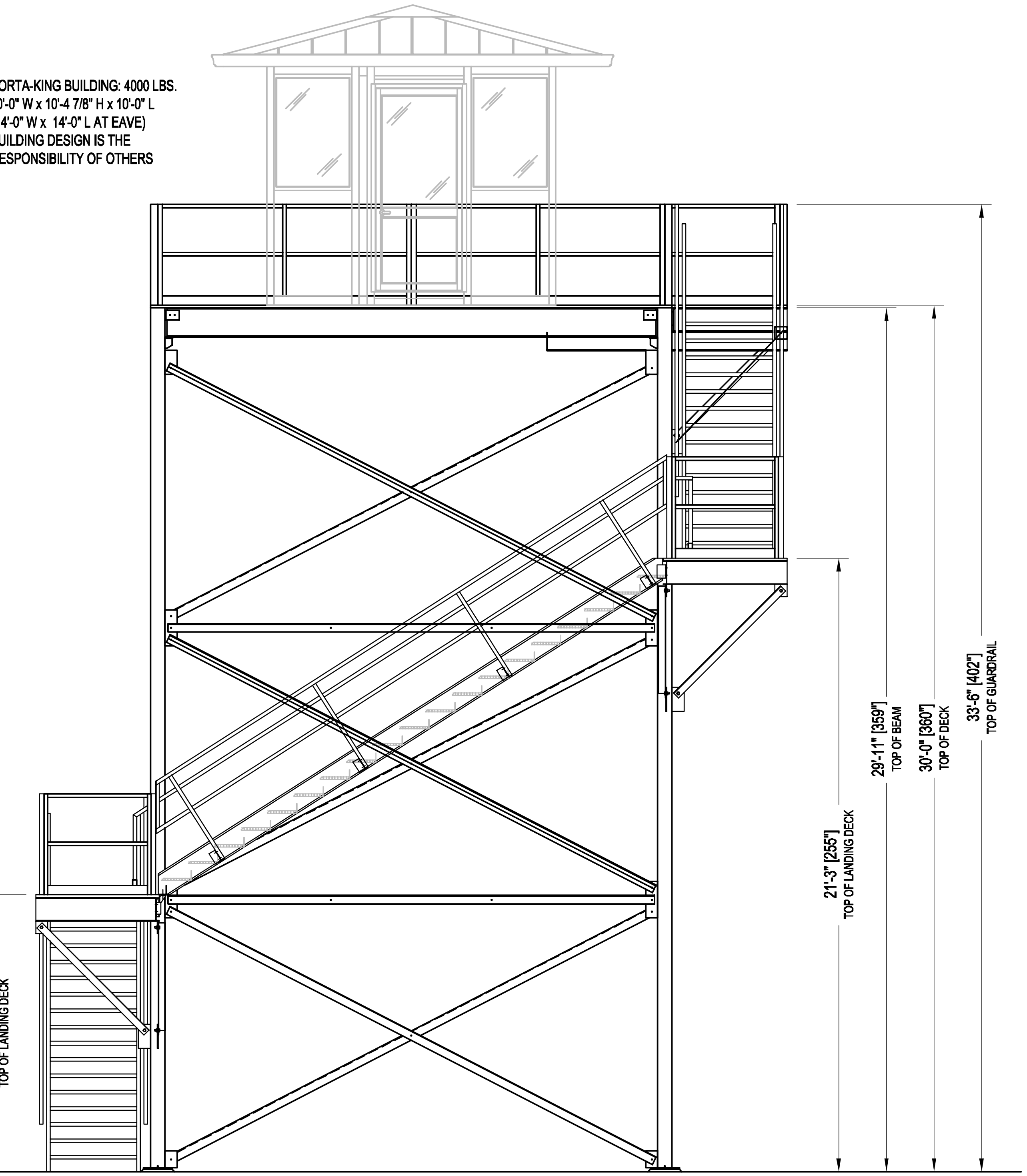
PAGE NAME: FLOOR PLAN LAYOUT SHEET

SHEET M3 OF M11

DRAWN BY:	MO
DATE:	3-29-21
REVISED DATE:	
SCALE:	3/16" = 1'-0"
ORDER NUMBER:	PK34198-10614
DEALER:	FULLER ENTERPRISES CONSTRUCTION
JOB NAME:	PACIFICORP WIND
LOCATION:	460 SIXTEEN MILE ROAD - DOUGLAS, WY 82633



SOUTH ELEVATION VIEW



EAST ELEVATION VIEW

THIS IS AN INTEGRATED PROJECT. PLEASE CHECK MEZZANINE AND PRE-ASSEMBLED BUILDING DRAWINGS FOR ALL DETAILS THAT MAY BE APPLICABLE TO BOTH TO MAKE SURE THAT NOTHING IS MISSED IN THE ASSEMBLY PROCESS.

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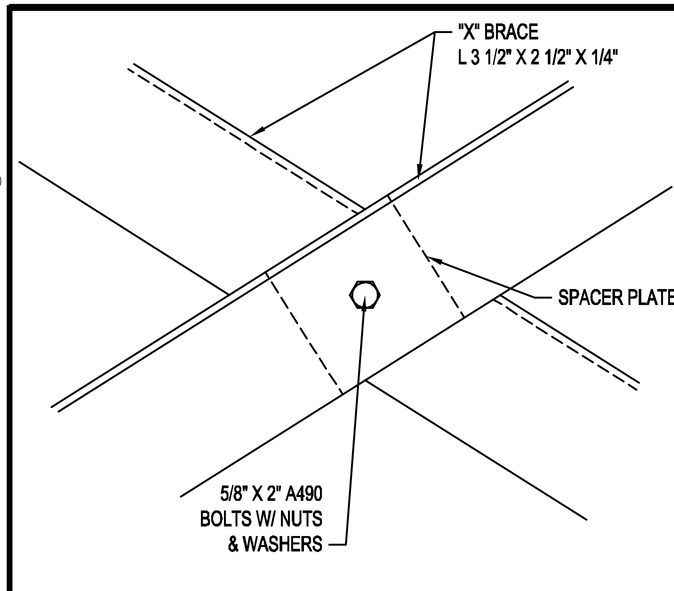
PAGE NAME: ELEVATION VIEW SHEET

SHEET M4 OF M11

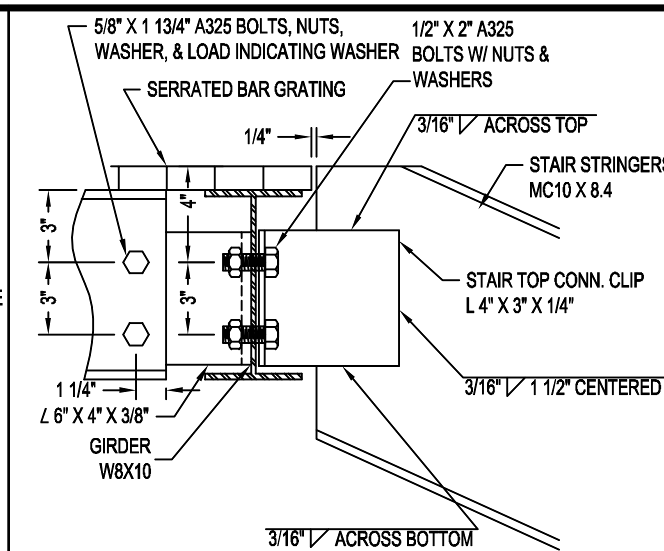
DEALER: FULLER ENTERPRISES CONSTRUCTION
JOB NAME: PACIFICORP WIND
LOCATION: 460 SIXTEEN MILE ROAD - DOUGLAS, WY 82633

PROPRIETARY INFORMATION

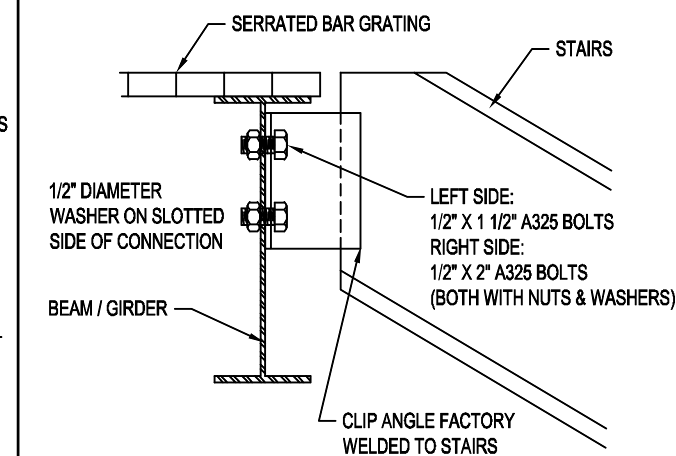
DRAWN BY: MO
DATE: 3-29-21
REVISED DATE:
SCALE: 3/16" = 1'-0"
ORDER NUMBER: PK34198-10614



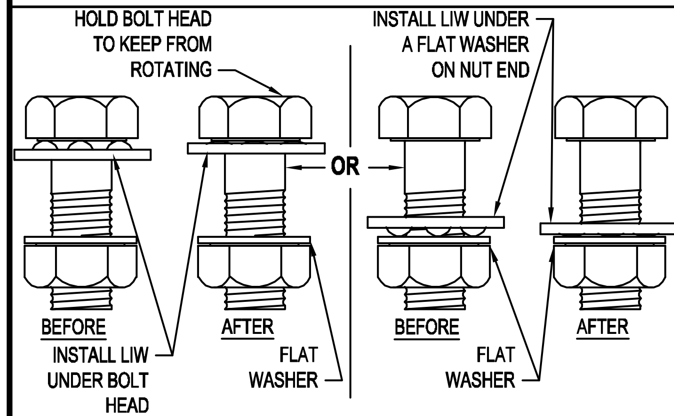
"X" BRACE ANGLE TO ANGLE CONNECTION
3" SCALE



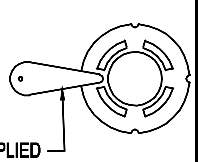
OUTSIDE STAIR TO BEAM CONNECTION
1 1/2" SCALE



STAIR TO BEAM CONNECTION
1 1/2" SCALE

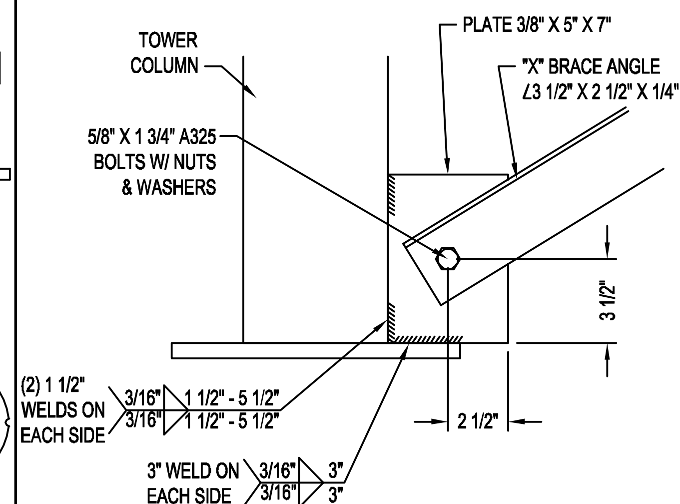


NOTE: TO ENSURE THAT THE WASHER IS PROPERLY COMPRESSED, AND THE BOLT TENSIONED, THE .015" FEELER GAGE MUST BE REFUSED IN 3 OF THE 4 SPACES BETWEEN THE BUMPS.

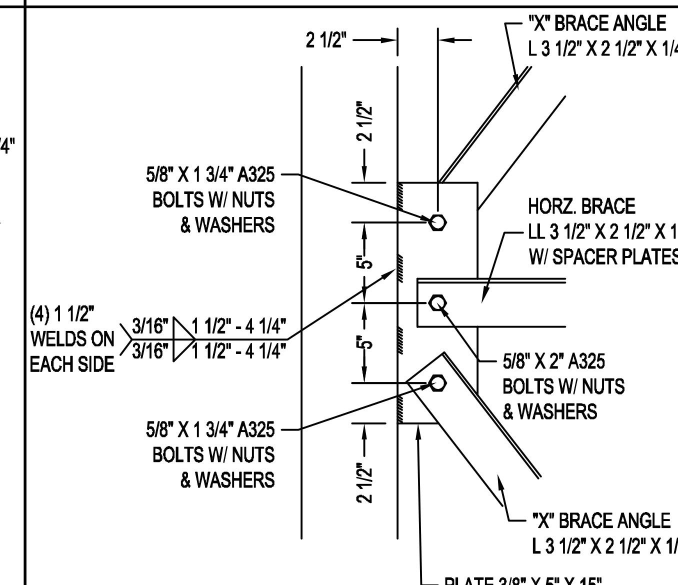


TURN NUT TO TIGHTEN BOLT

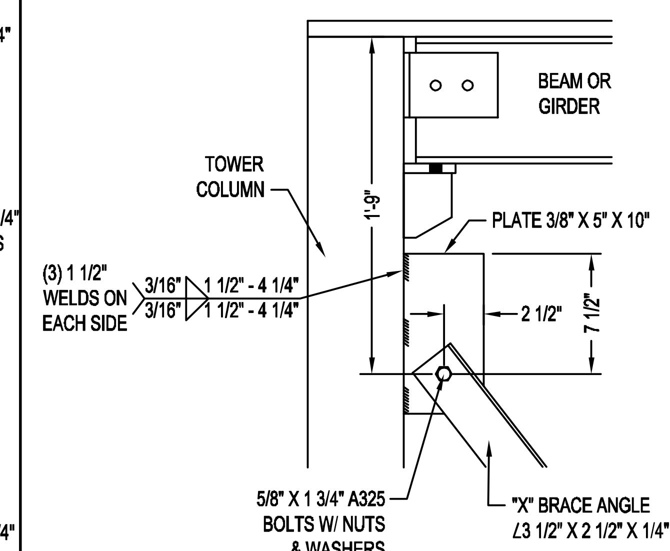
LOAD INDICATING WASHER (LIW) INSTALLATION DETAIL
6" SCALE



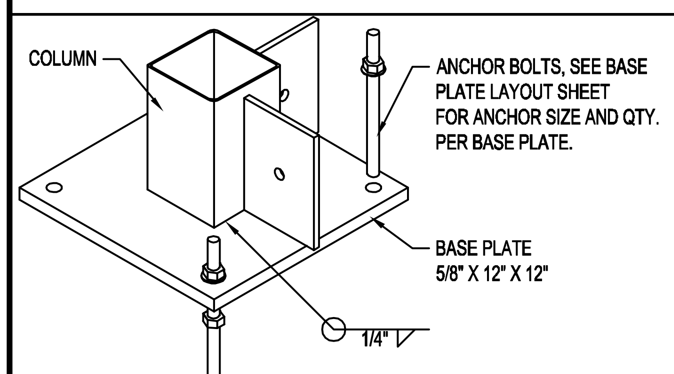
COLUMN BRACE CONNECTION AT BASE PLATE
1 1/2" SCALE



BRACE CONNECTION AT BEAM
1" SCALE



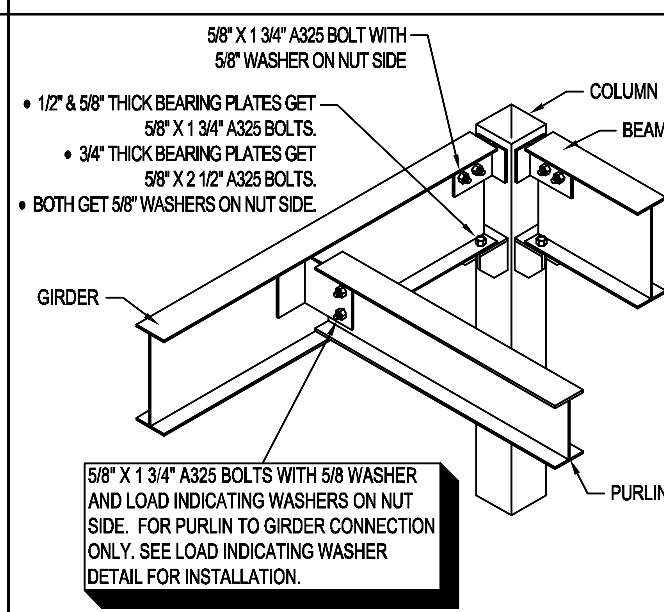
BRACE CONNECTION AT BEAM
1" SCALE



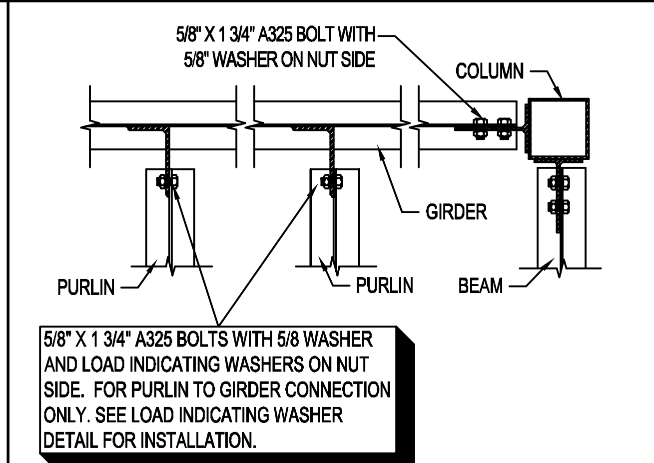
IMPORTANT NOTE:

1. BASEPLATES MUST BE IN FULL CONTACT WITH THE CONCRETE OR EXCESSIVE MOVEMENT IN THE TOWER WILL BE EXPERIENCED.
2. NUTS (SUPPLIED) TO BE INSTALLED UNDER BASE PLATES TO LEVEL AND PLUMB THE TOWER.
3. A MINIMUM OF 1" GROUT MUST BE INSTALLED UNDER EACH BASE PLATE.
4. HOLD BASE PLATES UP OFF THE CONCRETE WHILE ANCHORS ARE INSTALLED. USE 2"X4" DUNNAGE THAT CAME WITH SHIPMENT.

TYPICAL BASE PLATE ANCHORING DETAIL
1" SCALE

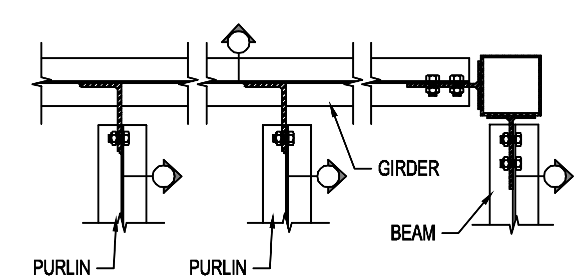


PARTIALLY RESTRAINED COLUMN / BEAM CONNECTION
1/2" SCALE



NOTE:
-INSTALL ALL BEAMS ON THE SAME SIDE OF THE CONNECTION CLIPS UNLESS OTHERWISE NOTED.

PARTIALLY RESTRAINED COLUMN / BEAM CONNECTION
3/4" SCALE



NOTE: THIS SYMBOL, " " MEANS THE BEAM NEEDS TO BE INSTALLED TO THE SIDE OF THE CONNECTION CLIPS THAT THE SYMBOL IS POINTING.

CRITICAL BEAM INSTALLATION DETAIL
3/4" SCALE

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PAGE NAME: ENLARGED DETAIL SHEET

PLAN NORTH
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SHEET M5 OF M11

DEALER: FULLER ENTERPRISES CONSTRUCTION

JOB NAME: PACIFICORP WIND

LOCATION: 460 SIXTEEN MILE ROAD - DOUGLAS, WY 82633

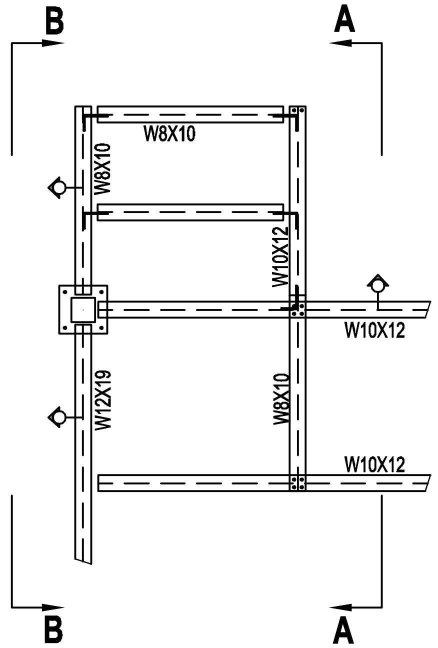
DRAWN BY: MO

DATE: 3-29-21

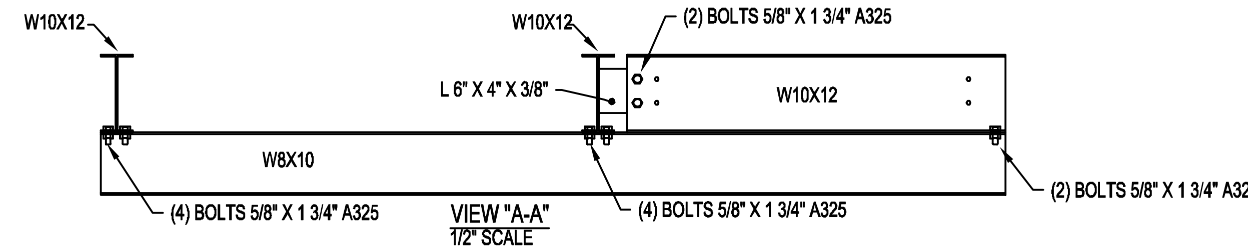
REVISED DATE:

SCALE: 3/16" = 1'-0"

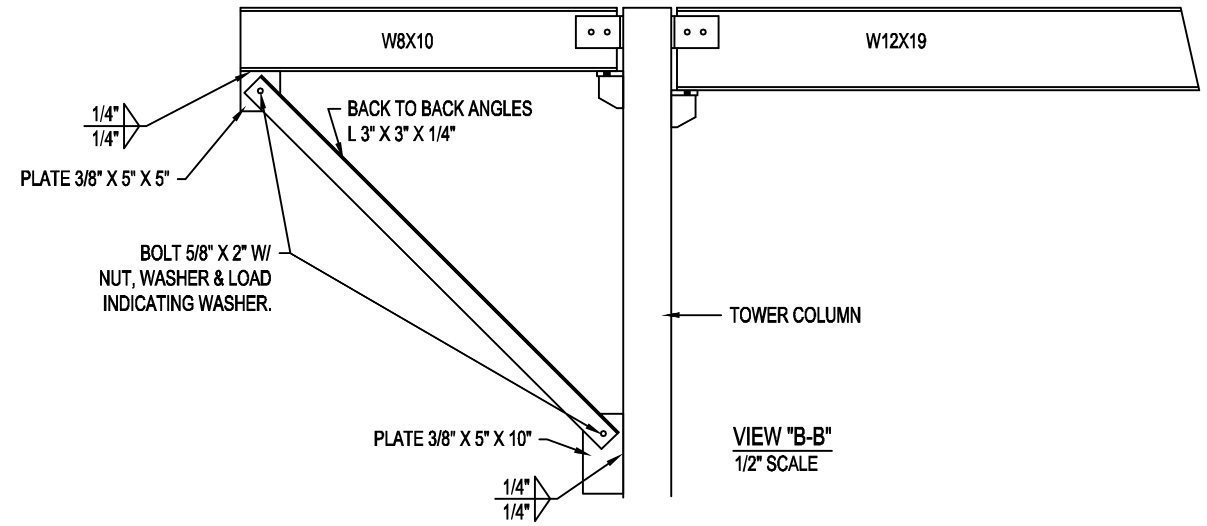
ORDER NUMBER: PK34198-10614



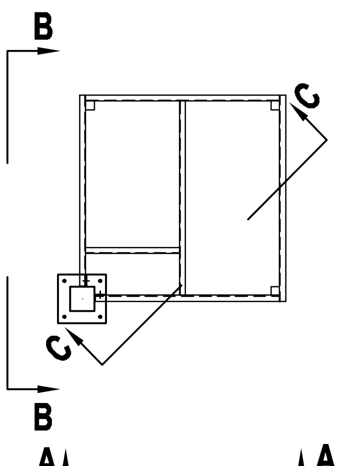
ENLARGED PLAN VIEW OF LANDING AT THE 360" ELEV.
1/4" SCALE



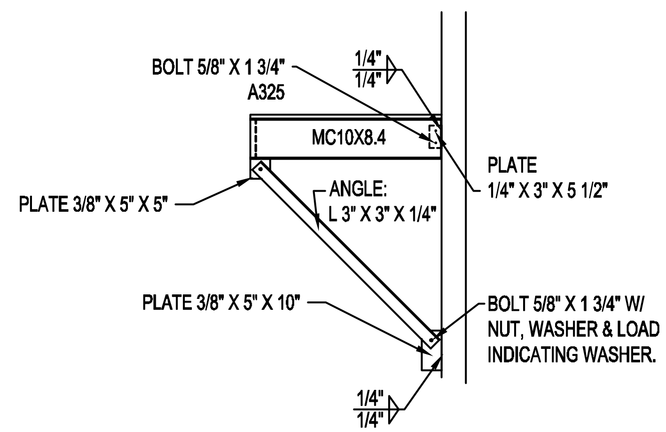
VIEW "A-A"
1/2" SCALE



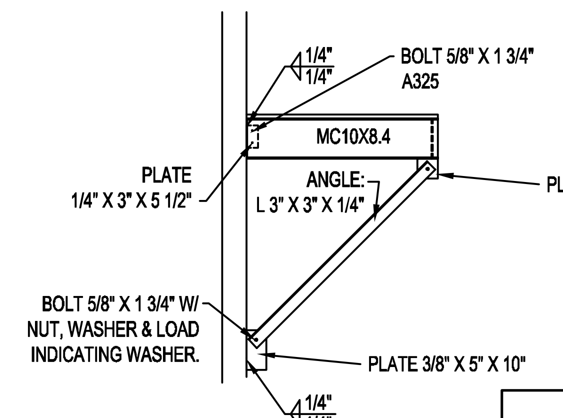
VIEW "B-B"
1/2" SCALE



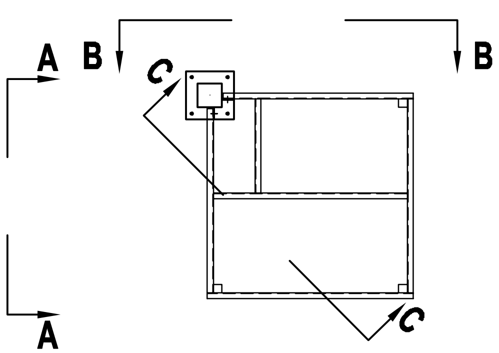
ENLARGED PLAN VIEW OF LANDING AT THE 255" ELEV.
1/4" SCALE



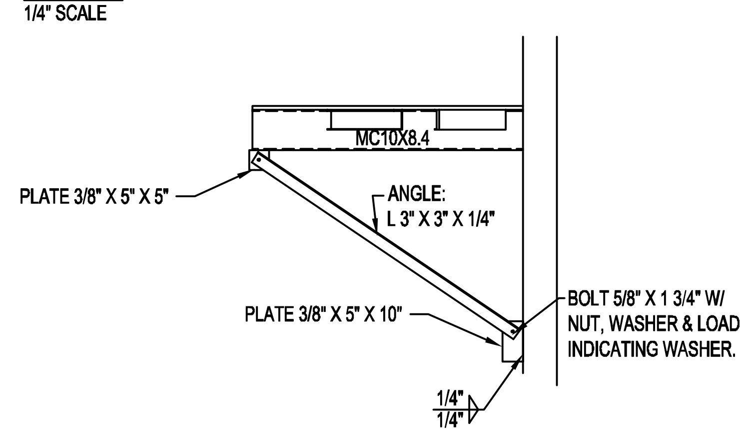
VIEW "A-A"
1/4" SCALE



VIEW "B-B"
1/4" SCALE



ENLARGED PLAN VIEW OF LANDING AT THE 115" ELEV.
1/4" SCALE



VIEW "C-C"
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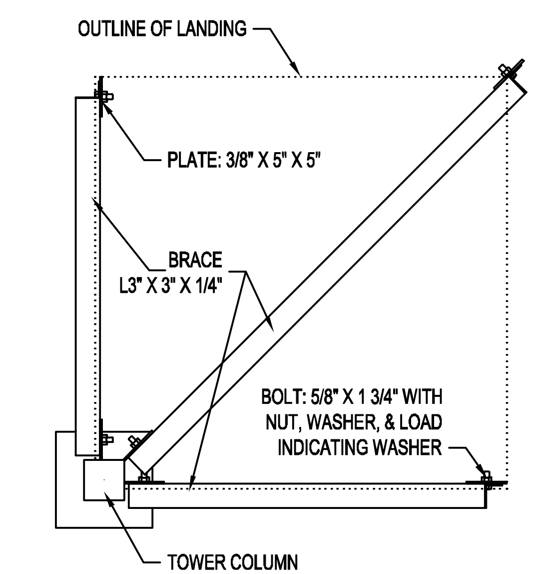

LANDING BRACING DETAIL
1/2" SCALE

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PAGE NAME: 115", 255", AND 360" LANDING ELEVATION DETAILS

SHEET M6 OF M11

DEALER: FULLER ENTERPRISES CONSTRUCTION
JOB NAME: PACIFICORP WIND
LOCATION: 460 SIXTEEN MILE ROAD - DOUGLAS, WY 82633

PROPRIETARY INFORMATION
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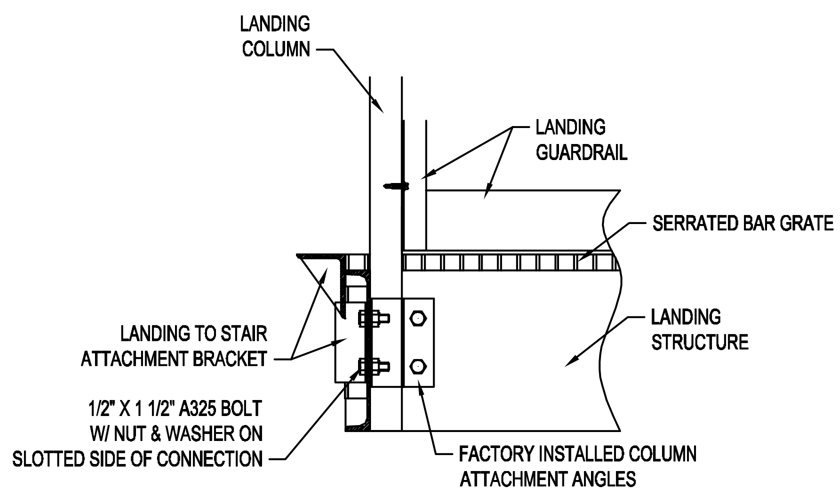
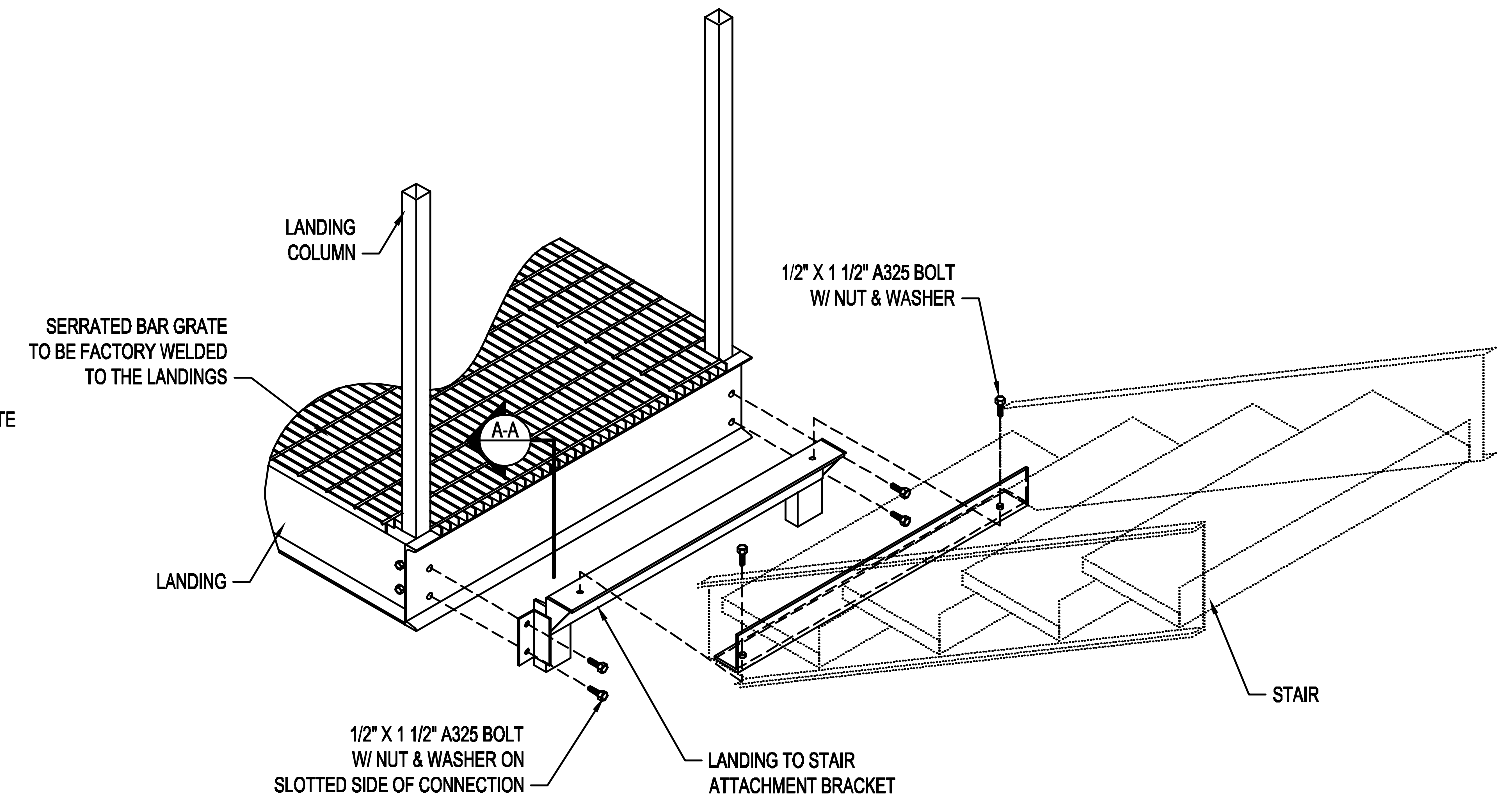
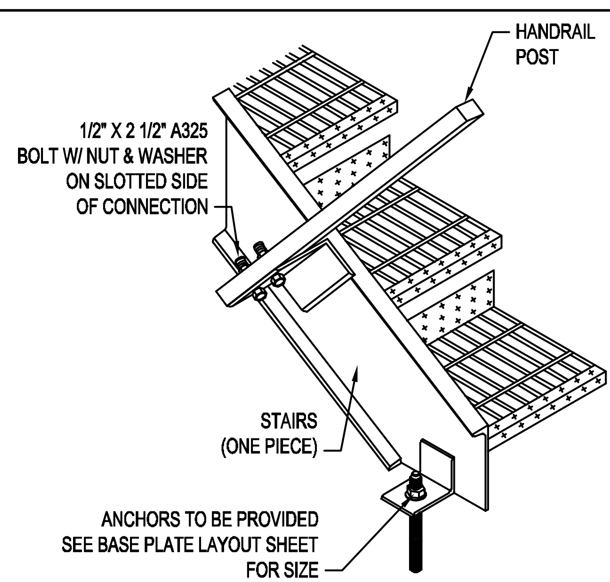
DRAWN BY: MO
DATE: 3-29-21
REVISED DATE:
SCALE: 3/16" = 1'-0"
ORDER NUMBER: PK34198-10614



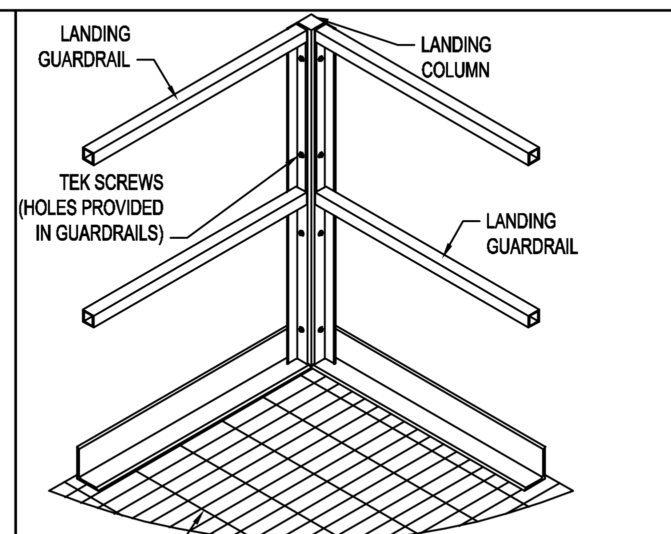
SECTION VIEW A-A
1" SCALE



TYPICAL PARTIAL LANDING ISOMETRIC
WITH LANDING TO STAIR ATTACHMENT BRACKET
1/2" SCALE

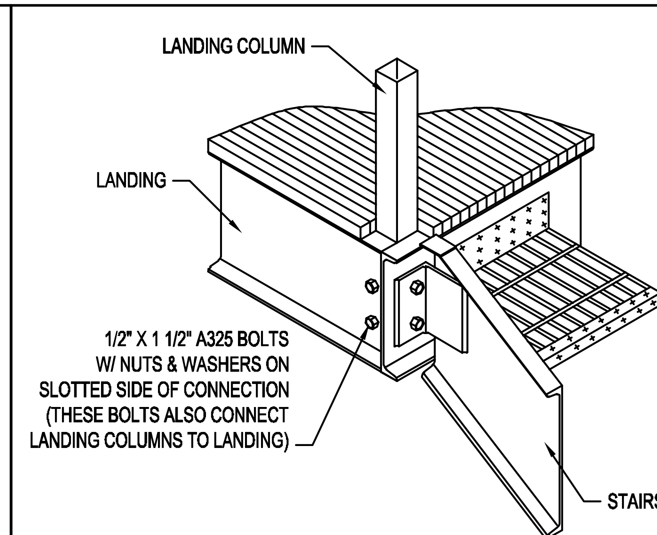


STAIR BASE & HANDRAIL CONNECTION
3/4" SCALE

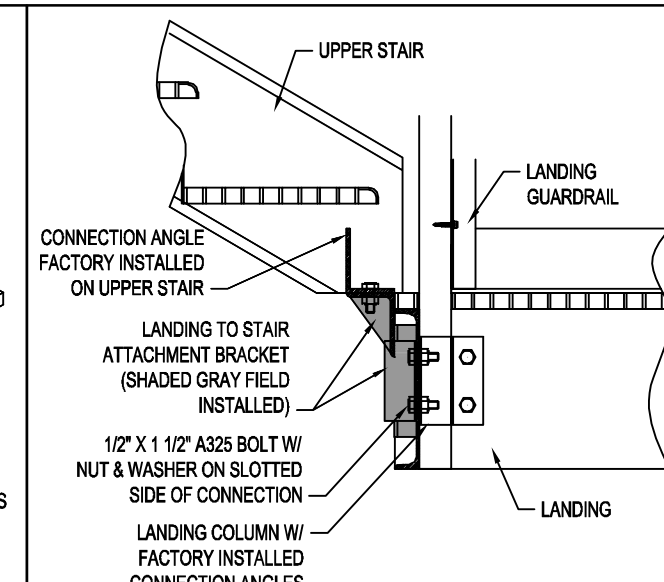


NOTE:
ALL RAILINGS TO BE TEK SCREWED TO LANDING COLUMNS

LANDING GUARDRAIL CONNECTION
1/2" SCALE



TYPICAL STAIR TO LANDING CONNECTION
3/4" SCALE



UPPER STAIR TO LOWER LANDING CONNECTION
1" SCALE

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PAGE NAME: STAIR AND LANDING DETAIL SHEET

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SHEET M7 OF M11

DEALER: FULLER ENTERPRISES CONSTRUCTION

JOB NAME: PACIFICORP WIND

LOCATION: 460 SIXTEEN MILE ROAD - DOUGLAS, WY 82633

PROPRIETARY INFORMATION

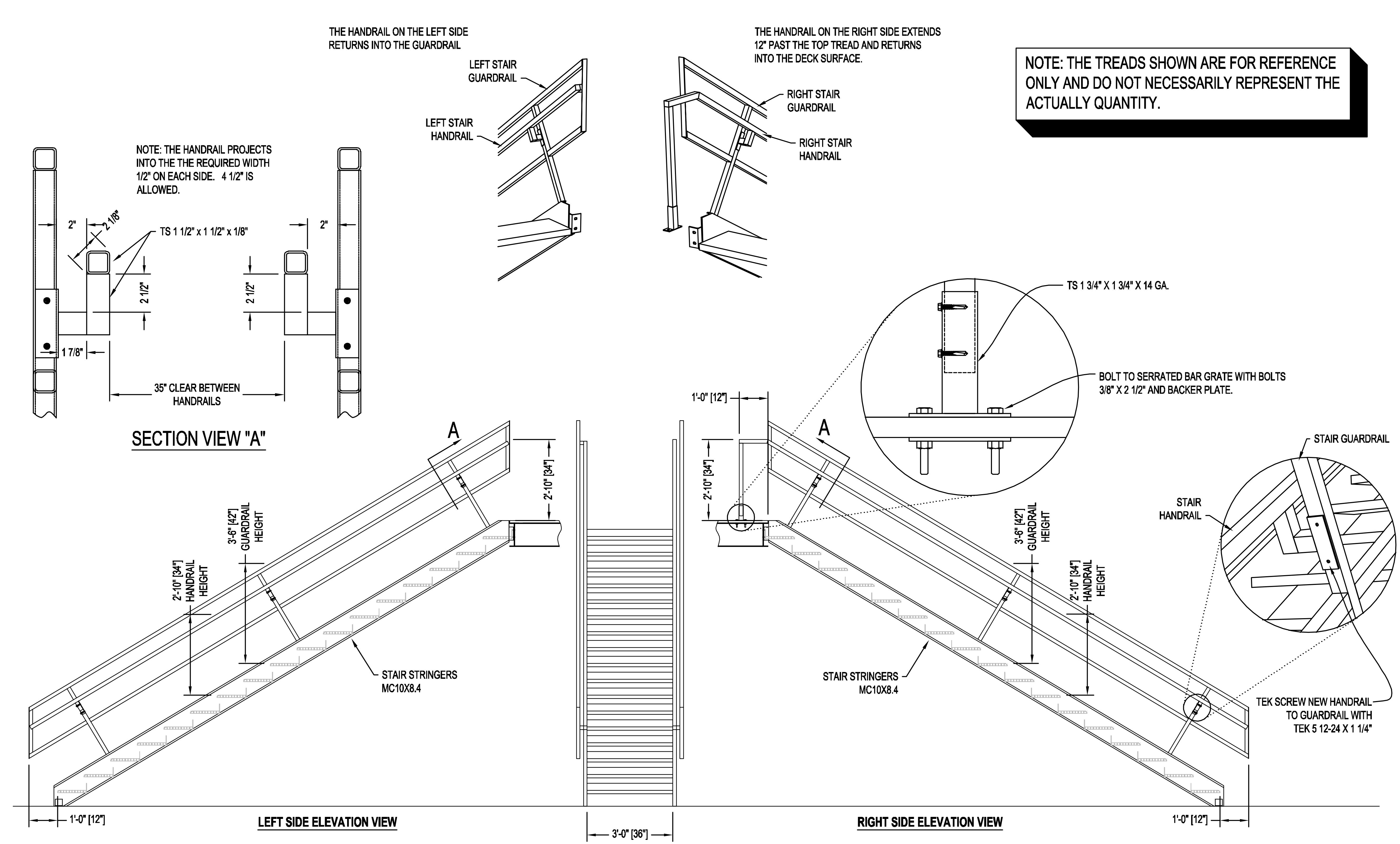
DRAWN BY: MO

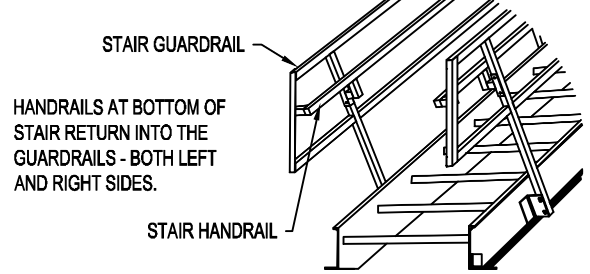
DATE: 3-29-21

REVISED DATE:

SCALE: 3/16" = 1'-0"

ORDER NUMBER: PK34198-10614





STAIR HANDRAIL DETAIL FOR STAIR FROM SLAB-ON-GRADE TO 115" LANDING LEVEL

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PAGE NAME: STAIR HANDRAIL DETAIL SHEET FROM SLAB-ON-GRADE TO 115" LANDING LEVEL

PLAN NORTH
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SHEET M8 OF M11

DEALER: FULLER ENTERPRISES CONSTRUCTION

JOB NAME: PACIFICORP WIND

LOCATION: 460 SIXTEEN MILE ROAD - DOUGLAS, WY 82633

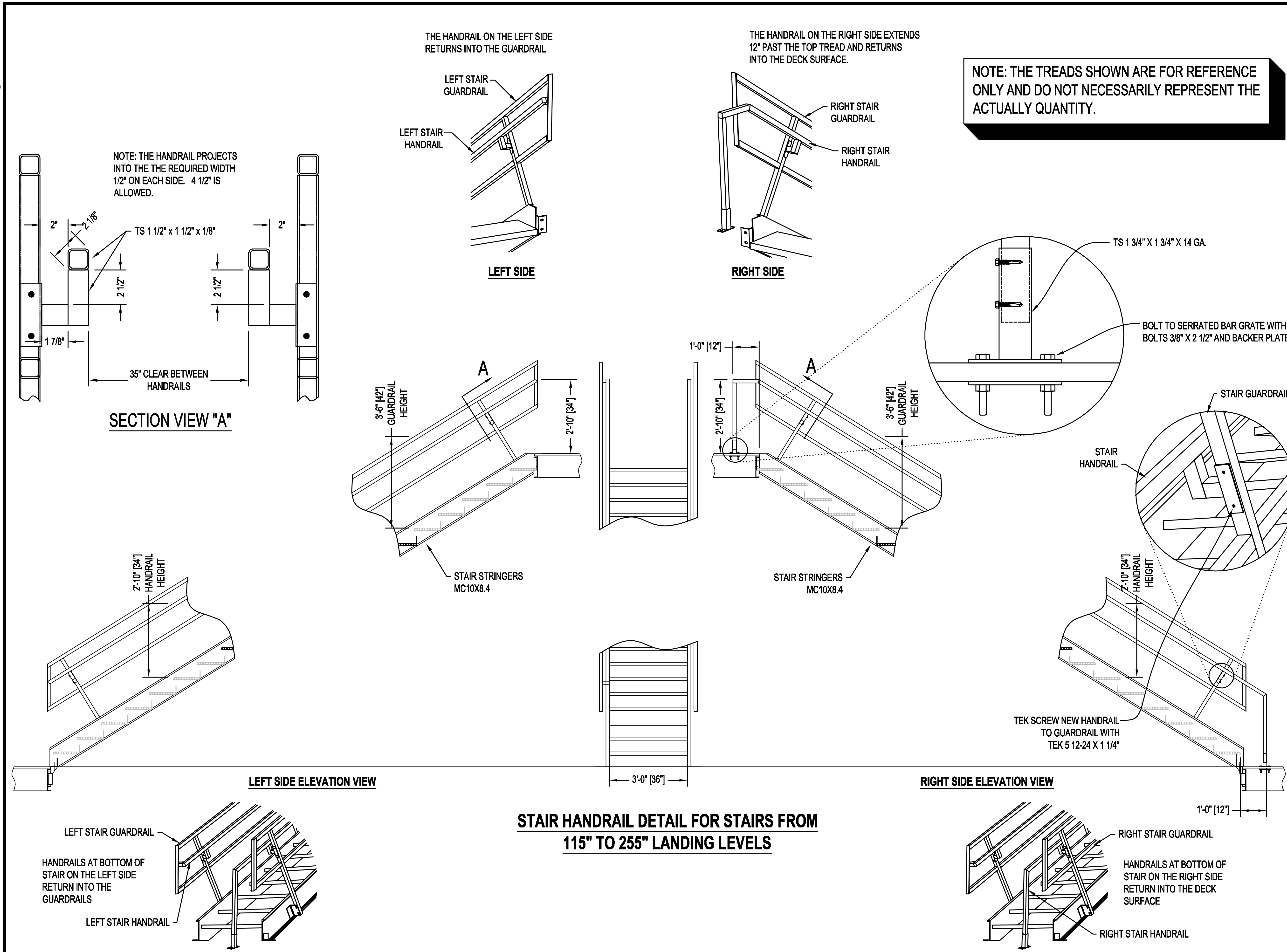
DRAWN BY: MO

DATE: 3-29-21

REVISED DATE:

SCALE: 3/16" = 1'-0"

ORDER NUMBER: PK34198-10614



STAIR HANDRAIL DETAIL FOR STAIRS FROM 115" TO 255" LANDING LEVELS

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PAGE NAME: STAIR HANDRAIL DETAIL SHEET FROM INTERMEDIATE TO INTERMEDIATE LANDING

SHEET M9 OF M11

DEALER: FULLER ENTERPRISES CONSTRUCTION

JOB NAME: PACIFICORP WIND

LOCATION: 460 SIXTEEN MILE ROAD - DOUGLAS, WY 82633

PROPRIETARY INFORMATION

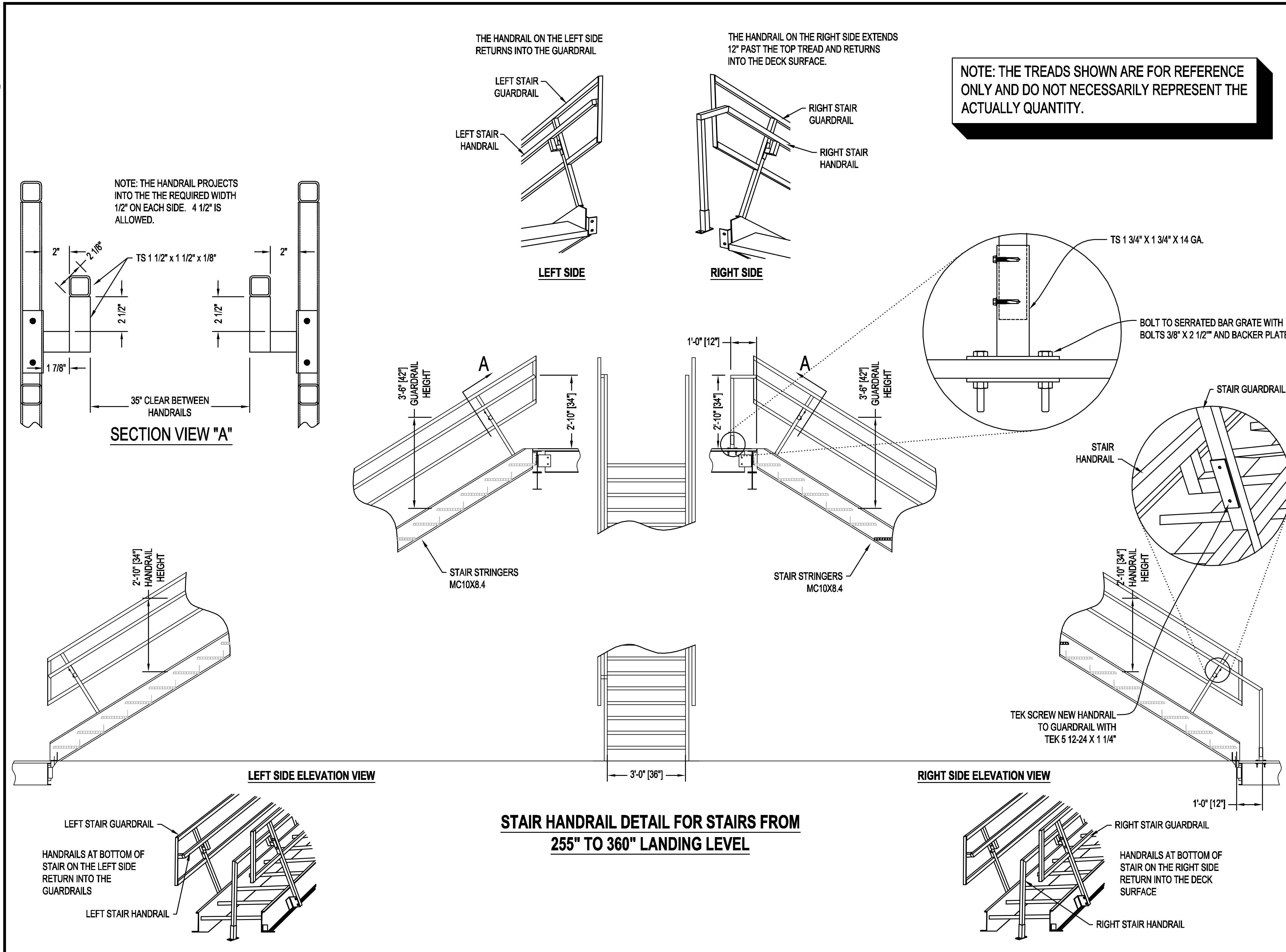
DRAWN BY: MO

DATE: 3-29-21

REVISED DATE:

SCALE: 3/16" = 1'-0"

ORDER NUMBER: PK34198-10614



STAIR HANDRAIL DETAIL FOR STAIRS FROM 255" TO 360" LANDING LEVEL

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PAGE NAME: STAIR HANDRAIL DETAIL SHEET FROM INTERMEDIATE LANDING TO TOP LANDING

SHEET M10 OF M11

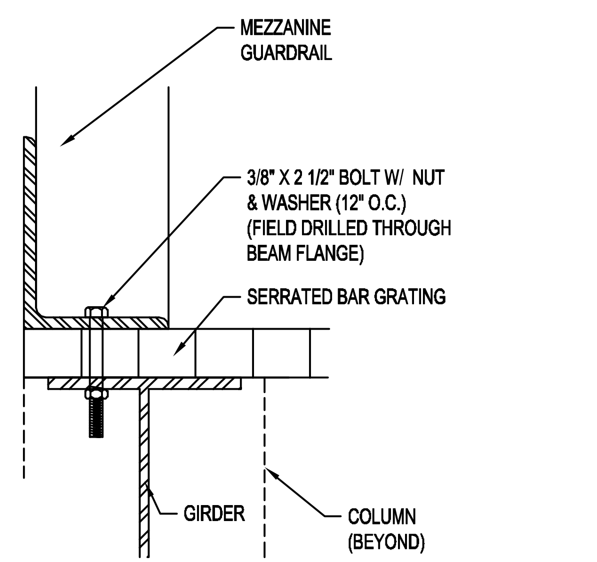
DEALER: FULLER ENTERPRISES CONSTRUCTION

JOB NAME: PACIFICORP WIND

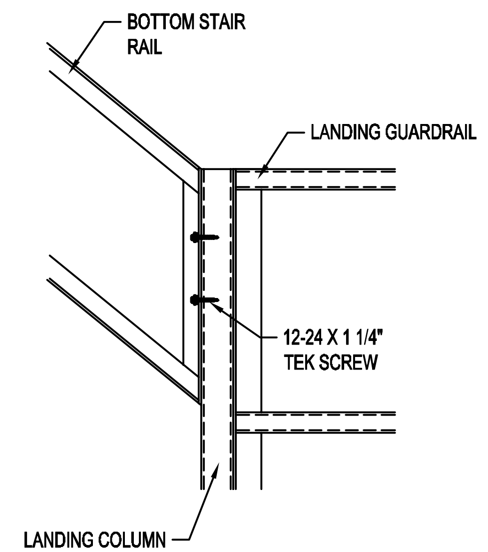
LOCATION: 460 SIXTEEN MILE ROAD - DOUGLAS, WY 82633

PROPRIETARY INFORMATION

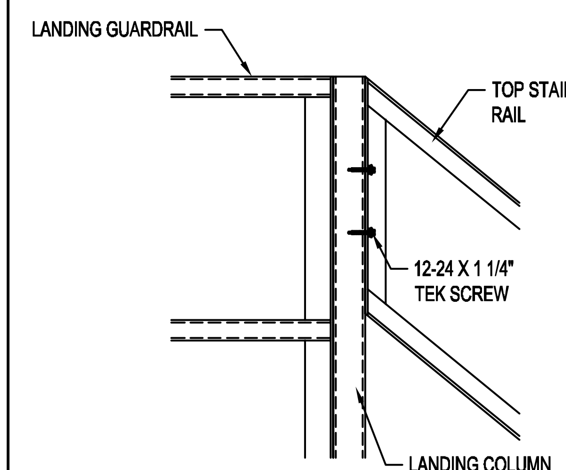
DRAWN BY: MO
DATE: 3-29-21
REVISED DATE:
SCALE: 3/16" = 1'-0"
ORDER NUMBER: PK34198-10614



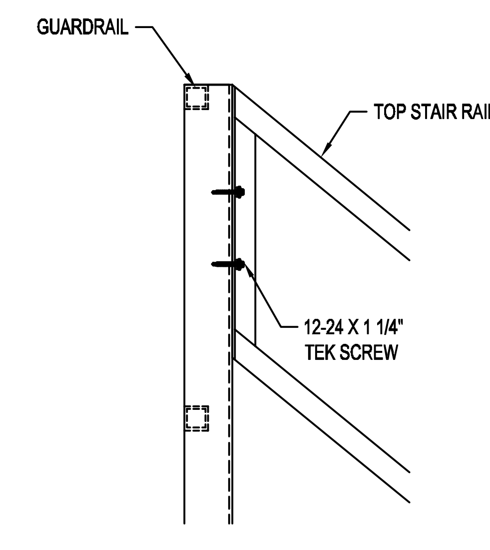
GUARDRAIL BASE SECTION AT DECKING SIDE VIEW
3" SCALE



BOTTOM STAIR RAIL TO LANDING COLUMN
1" SCALE

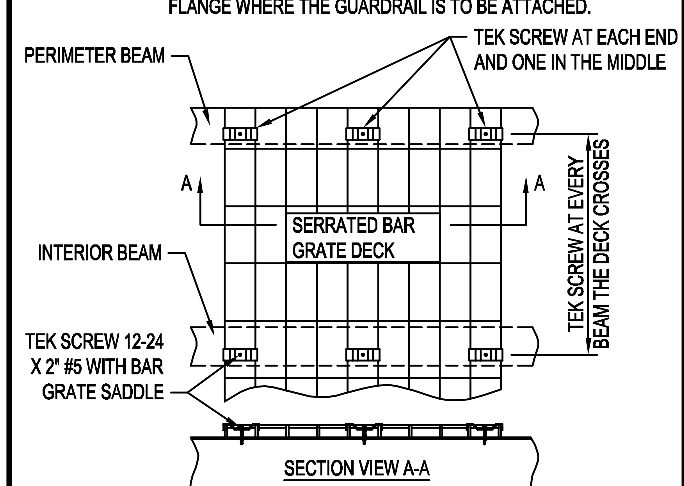


TOP STAIR RAIL TO LANDING COLUMN
1" SCALE



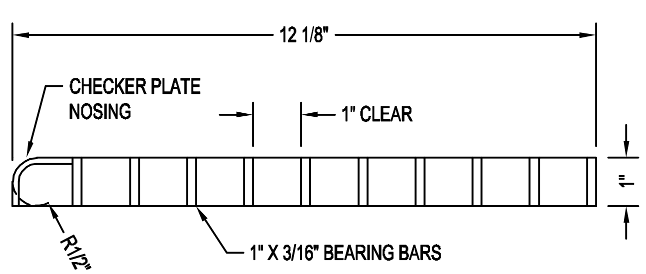
TOP STAIR RAIL TO GUARDRAIL
1" SCALE

NOTE: TO ACCOMMODATE GUARDRAIL ATTACHMENT MAKE SURE SADDLES ARE INSTALLED ON THE INSIDE FLANGE WHERE THE GUARDRAIL IS TO BE ATTACHED.



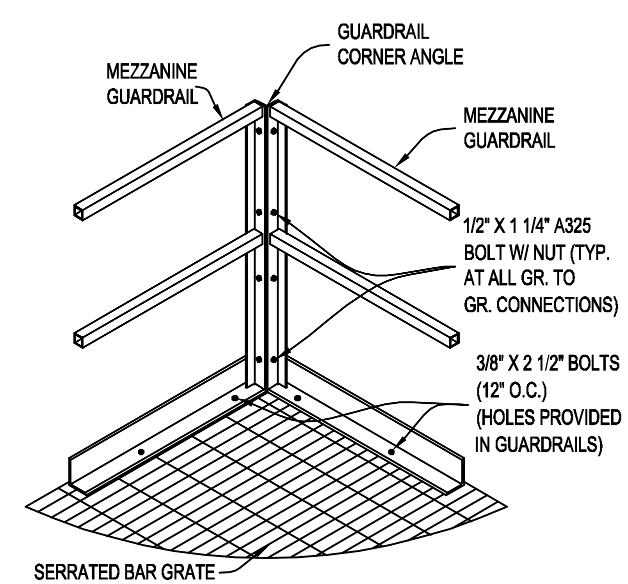
SEE DECK LAYOUT FOR ORIENTATION OF THE GRATING.

SERRATED BAR GRATE ATTACHMENT TO BEAMS
3/4" SCALE

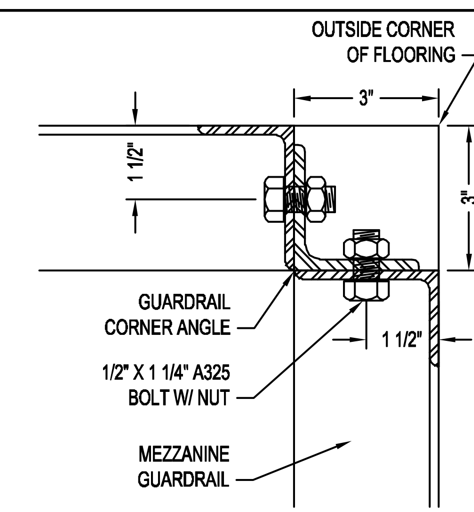


1" X 3/16" 19W4 SERRATED BAR GRATE TREADS WITH CHECKER PLATE NOSING. BEARING BARS ARE ON 1 3/16 CENTER, 1" CLEAR BETWEEN BEARING BARS.

SERRATED BAR GRATE TREAD DETAIL
3" SCALE



GUARDRAIL CORNER CONNECTION



GUARDRAIL CORNER CONNECTION
3" SCALE

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PAGE NAME: ENLARGED DETAIL SHEET

SHEET M11 OF M11

DEALER: FULLER ENTERPRISES CONSTRUCTION

JOB NAME: PACIFICORP WIND

LOCATION: 460 SIXTEEN MILE ROAD - DOUGLAS, WY 82633

DRAWN BY: MO

DATE: 3-29-21

REVISED DATE:

SCALE: 3/16" = 1'-0"

ORDER NUMBER: PK34198-10614

RFP Appendix A-1.4 - Solar

Solar Photovoltaic Renewable Resource Technical Specification 2021

RFP APPENDIX A-1.4 SOLAR
WORK SPECIFICATIONS (BTA)

TABLE OF CONTENTS

1.0 ACRONYMS AND ABBREVIATIONS

AC	alternating current
A	ampere
ASCE	American Society of Civil Engineers
ASTM	American Society for Testing and Materials
CPT	control power transformer
DC	direct current
EL	electroluminescence
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
kW	kilowatt
kWh	kilowatt hour
LPS	lightning protection system
MW	megawatt
MW_{AC}	megawatt alternating current
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
O&M	operation and maintenance
PCB	polychlorinated biphenyl
PCC	Point of Common Coupling
PV	photovoltaic
PVC	polyvinyl chloride
QA/QC	quality assurance/quality control
SCADA	supervisory control and data acquisition
SCCR	short-circuit current rating
SPD	surge protection devices
SWPPP	Storm Water Pollution Prevention Plan
TÜV	Technischer Überwachungsverein
UL	Underwriters Laboratories, Inc.
V	Volt

V_{AC}	volts alternating current
V_{DC}	volts direct current
VDE	association for electrical, electronic, and information technologies

2.0 LIST OF APPENDICES TO APPENDIX A

A-1	Not Used
A-2	Interconnection Agreement (Seller provided)
A-3	Permit-Matrix (Seller provided)
A-4	Not used
A-5	Project One-line Drawing and Layout (Seller provided)
A-6	Division of Responsibility (Owner provided)
A-7	Owner Standards and Specifications (Owner provided)
A-8	PVSYST Performance Summary Report (Seller provided)
A-9	Product Data Input Supply Forms (Seller provided)
A-10	Not Used

3.0 REFERENCE PACIFICORP STANDARDS

RFP Appendix A-7 contains the following Owner standards that apply to this specification:

(01) Attachment 1A Project Document Formatting and Requirements.

(02) Attachment 1B Project Document Deliverables.

(03) Computer Aided Design (PacifiCorp Energy) General AutoCAD/Drafting Standards (Specification DCAP876).

(04) Renewable Resources: Engineering Procedures/CAD Standards, Volume 8 Consultant Drafting Procedures and Standards (For Engineering Drawings)

(05) 04.1 Substation Equipment Power Transformers, ZS-001 and b) 04.2 Two-Winding Distribution Transformer, ZS-102.

(06) Material Specification ZS 061, Electrical Equipment-Insulating Oil.

(07) Material Specification ZS 065, Wind, Ice, and Seismic Withstand.

(08) Material Specification ZS 066, Contaminated-Environment Protection.

(09) Procedure SP-TRF-INST, Transformer Receiving, Installation and Testing.

(10) Asset Management Form 006F, Meter and Relay Equipment Memorandum.

(11) PacifiCorp Engineering Handbook, Part 6B.5 Fence Application and Construction.

(12) PacifiCorp Engineering Handbook, Part 6B.6 Substation Grounding.

(13) PacifiCorp Protective Relaying Standard, Document Number: GEN-ENG-RELAY-0001.

(14) PacifiCorp Protective Relaying Standard, Arc Flash Hazard Standard, Document: GEN-ENG-RELAY-0002.

(15) PacifiCorp Protective Relaying Standard, "Relay Current Transformer (CT) & Potential Transformer (PT) Insulation Integrity Test," Document: GEN-ENG-RELAY-0003.

(16) PacifiCorp Protective Relaying Standard, "Thermal Plant Protective Relay Maintenance and Testing-PRC-005," Document: GEN-ENG-RELAY-1003.

(17) PacifiCorp Protective Relaying Standard, "Relay Testing & Commissioning Checklist."

(18) PacifiCorp Protective Relaying Standard, "Relay Installation Procedure," Document: GPCP-EQPMNT-INST.

(19) PacifiCorp Protective Relaying Standard, "Current Transformer Installation Procedure (Relay)," Document: GPCP-CT-INST.

(20) PacifiCorp Protective Relaying Standard, "Current Transformer Installation Form (Relay)," Document: GPCP-CT-INST.

(21) PacifiCorp Substation High-Voltage Warning Signs, SG-001.

(22) Specification for Substation Equipment Installation Testing and Commissioning.

(23) SV002 Bird and Animal Protection-General Installation Instructions

(24) SV251 Bird and Animal Protection for Miscellaneous Equipment

(25) TD051 Danger Sign

OTHER RELEVANT DOCUMENTS

PacifiCorp "Open Access Transmission Tariff". FERC Electric Tariff

4.0 TECHNICAL SPECIFICATION

This is Appendix A - Solar "Solar Photovoltaic Renewable Resources 2020 – Technical Specification", which will subsequently become a contract document, as a supplement to the Build Transfer Agreement ("The Agreement"). Capitalized terms used and not defined herein have the meanings given in the Agreement unless the context requires otherwise.

4.1. Introduction and Seller Responsibilities

Seller shall provide all required services and materials for the successful completion of the Plant. Seller's responsibilities shall include environmental permitting, design, engineering, procurement of equipment, Site preparation work, foundations, installation of all equipment, bulk material and commodities supply, and Site finishing work. Seller also shall deliver project management, construction management, commissioning and startup, and testing of work, all as described in this document including all referenced appendices and standards which will subsequently become a contract document.

Seller shall construct all roads, foundations, electrical systems, control systems, monitoring systems, communications, ancillary structures, storage facilities, security systems, and fencing, and shall erect and commission and start-up the photovoltaic (PV) System in the locations and orientations set forth in the Site plan and Site layout drawings and in accordance with this document, and all related specifications that relate thereto.

Installation of the PV System shall be performed by a recognized, experienced Contractor in accordance with federal, state, local, and utility specifications and requirements and in accordance with the relevant state energy office. The electrical installation of the PV System shall be performed in accordance with the same requirements. The Work shall be performed by an electrical contractor licensed in the state where the project will be constructed. The work shall be performed by a licensed Contractor approved by the relevant State authority. Seller shall provide comprehensive onsite construction management for the Plant and shall commission and start-up the Plant. Seller shall manage, supervise, inspect, and furnish all labor, equipment, materials, temporary structures, temporary utilities, products, and services related to the foregoing, all on a turnkey basis.

These specifications are intended for use by Sellers providing a Solar PV Plant to be owned by PacifiCorp (Owner). The PV Plant shall be designed, built, commissioned, and started-up by the Seller based on these PV Specifications, and all other Owner requirements including its interconnections for connecting to the transmission or distribution system. Upon completion of the quality assurance/quality control (QA/QC) procedures and Plant Acceptance the PV Plant shall be turned over for care and custody by Owner. Seller shall perform the Work in accordance with the following:

(01) In a manner that is sufficient, complete, and adequate in all respects necessary for the Plant to successfully achieve Final Acceptance by the Guaranteed Final Acceptance Date.

(02) In conformance with the professional standards, skill, expertise, and diligence of design and construction of professionals regularly involved in utility-grade, utility-scale, grid-connected solar PV power projects in the United States.

(03) In compliance with the terms of the contract documents, the operating guidelines, the Utility's interconnection requirements (**RFP Appendix A-2 – Interconnection Agreement**), and all applicable laws, standards, and permits including PacifiCorp's "Access Transmission Tariff", FERC Electric Tariff.

(04) Approved as to form, use, and content by all government authorities and private entities authorized to administer or enforce any building, electrical, or construction code or standard whose approval of the final design of the Plant, or any portion thereof, is necessary for the construction, operation, or interconnection of the Plant.

4.2. Performance Characterization

The predicted PV system performance estimate must be provided in **RFP Appendix A-8** and is based on the performance characterization data in **RFP Appendix C-2 and C-3**. The predicted PV system performance information that is to be provided shall include the PVSyst report, the 12X24 output in an Excel format, and an hourly profile 8760 output in an Excel format.

4.3. Permitting

Seller shall apply for and obtain all permits and authorizations necessary for construction and to support operations of the Plant, as per the attached permitting matrix (**RFP Appendix A-3**). Copies of all applicable permits will be provided to Owner within 5 business days after they are obtained or completed.

4.4. Construction and Installation

Prior to beginning construction, Seller shall provide a comprehensive onsite construction management plan for the construction of the Plant in accordance with all applicable laws and policies and Health, Safety, and Environmental Plans of the Seller and if work is performed on Owner property, meet all safety program requirements of Owner including Appendix A Contractor Health Safety and Environmental Requirements, Appendix A Contractor Safety Plan Requirements, and all changes to applicable law and Owner policies. No later than 15 days prior to initial Site mobilization, Seller shall prepare and submit such Plans to Owner. Seller shall also provide Owner with an evaluation and appropriate documentation of the safety record for any licensed Subcontractor that will be performing work on the Plant.

Seller shall assemble, construct, and install with its own labor forces and/or with Subcontractors labor, tools, and equipment necessary to complete the Plant, including the following Works:

(01) Site preparation, including but not limited to drainage required by the civil engineering plan, and remove excess debris

(02) Coordination with Owner when trenching is performed

(03) Direct current (DC) cabling and combiner and junction boxes

(04) Alternating current (AC) trenching and cabling

(05) Inverters, switchgear, and transformers and accompanying supports and/or concrete pads

(06) All equipment from the DC solar array up to and including the point of interconnection with the electric utility system

(07) Perimeter security fencing, access gates, and security systems (described in section A-3.9 Security)

(08) Security lighting

(09) Installation of the monitoring system, meteorological station(s), and revenue grade metering.

Installation of all required Customer Owner interconnection structures of equipment – e.g. Substation or disconnects, meter and GOAB poles.

Seller shall provide all utilities necessary during construction, including but not limited to electricity, water, toilets, fuel and communications. Seller shall be responsible for all costs associated with construction power. The following sections and associated appendices describe the scope of work and technical specification for the Plant.

4.5. Site and Plant Description

Seller shall, at its own cost and expense, design, engineer, procure, construct, test, permit, and start up a utility scale PV solar system with a design output as stated in its proposal.

Except as otherwise expressly provided in the Agreement, Owner is not responsible for providing any material, labor, or services of any kind during Seller's execution of the Work. Seller is fully responsible for all development, permitting, engineering, procurement, construction, interconnection coordination, and startup and testing activities, and shall deliver a complete, operational, and reliable turnkey Plant to Owner. Seller shall provide civil, electrical and structural engineered drawings stamped by an engineer certified in the state where the project will be constructed, materials and equipment, installation of PV modules, installation of electrical systems including inverters, electrical connection to the existing electrical infrastructure, and construction of mounting structures on which the PV modules are installed. Seller shall provide comprehensive onsite construction management for the Plant and shall commission the Plant. Seller shall manage, supervise, inspect, and furnish all labor, equipment, materials, temporary structures, temporary utilities, products, and services related to the foregoing, all on a turnkey basis.

4.6. Design and Engineering

Seller shall design and engineer the Plant in accordance with prudent utility practices, with the professional standards, skill, expertise, and diligence of design and construction of professionals regularly involved in utility-grade, utility-scale, grid-connected solar PV power projects for public utilities in the United States. The design must conform to the requirements and conditions of all applicable permits, codes and standards, and laws, and it must be in compliance with the operating guidelines and meet the Owner specifications.

Seller is responsible for all engineering for the Plant. All design drawings, specifications, and calculations shall be signed by a professional engineer-of-record in the state where the project will be constructed. The Agreement provides for submission to Owner of complete design drawings, data, and documents for review and comment. These engineered design drawings, data, and documents must be submitted to Owner for review and comment before construction is to begin.

Seller is responsible for ensuring that all components are installed min 1 foot above the 100-year flood plain (e.g., inverter stations, substation, supervisory control and data acquisition [SCADA] system, Security System, control building, PV modules, tracker motors, switchgear, transformers, combiner boxes, etc.). The Seller is responsible for ensuring that all PV modules and combiner boxes are installed above the maximum snow height.

Any third-party study or independent engineering reviews including, but not limited to, the geotechnical study and the corrosion study shall be provided to Owner.

4.7. Engineering Design Package

Based on the review of the Plant Site and infrastructure, Seller shall design (or have designed by consulting engineers) a Plant (including all layout, civil, electrical, and structural components) that will produce the required electricity and that is capable of being operated in a safe, normal, reliable, and continuous manner as required by the contract documents at all operating conditions and modes specified below. The system design shall comply with all applicable laws and regulations and applicable permits. Owner may utilize a third-party or independent engineering consultant to perform technical reviews. Studies prepared by the Seller's third-party consultants shall be provided to the Owner for review.

The Engineering Design Package shall include but not be limited to all items required in **Appendix A-7.2 Attachment 1B – Project Document Deliverables**:

(01) Studies related to the project, such as the geotechnical engineering report and the lightning protection study

(02) Schematic and preliminary designs

(03) Design calculations

(04) All drawings including mechanical, electrical, structural, civil, and construction drawings (Site plans, schematic single lines, wiring diagrams and detail drawings). Drawings shall follow **Appendix A-7.03**.

(05) Project schedule

(06) Product description information

(07) Bill of Materials

(08) Equipment details, descriptions, and specifications

(09) Commissioning and start-up plan

(10) Full power test plan (capacity test)

(11) Layout of equipment

(12) GIS Shapefiles of all project equipment (transformers, junction boxes, overhead line poles, access roads, etc.)

The Engineering Design Package shall be provided prior to commencement of construction.

4.8. Site Layout, Maps, Line Drawings

Prior to beginning construction or procuring equipment, Seller shall submit to Owner Site layout design drawings, data, and documents for review. The design shall include a vehicle access road to provide maintenance, cleaning, and public safety access with a 30-year service life (assuming regular maintenance) that shall comply with state and local county surface requirements.

The Seller shall plan and execute construction of earthwork methods and culverts (or other water control devices) to control surface drainage from cuts and fills and prevent erosion and sedimentation in compliance with the Storm Water Pollution Prevention Plan (SWPPP).

4.9. Structural Engineering

Seller shall supply or design the PV arrays' mounting systems, foundations, and piers, as well as any equipment pads and buildings on the Site. The designs of these components shall be based on the requirements of applicable codes, standards, and permits, and the information/specifications provided by the module, inverter, transformer, switchgear, racking/tracking structures, and all other vendors.

Concrete designs shall conform to the requirements listed in the latest applicable editions of ACI 318 Building Code Requirements for Structural Concrete (ACI 318) and ACI 336.1-01 Specification for the Construction of Drilled Piers, if applicable. At a minimum, compressive strength of concrete shall not be less than 4000 psi (28 MPa).

Steel designs shall conform to the requirements listed in the latest applicable edition of AISC Manual of Steel Construction. Seller shall be responsible for full design of all structural components including connections. Load combinations used in design shall be defined as according to the latest edition of ASCE 7 or local applicable codes, whichever is most restrictive. The designer shall consider various wind load configurations to ensure that the most critical loading conditions are captured.

Welding shall be performed in accordance with AWS D1.1 Structural Welding – Steel (AWS) by AWS certified welders. The Seller shall ensure that installation tolerances and structural deflection are followed.

4.9.1. Geotechnical Analysis

Geotechnical analysis shall be provided by Seller and performed by a qualified geotechnical engineering firm employing a licensed Professional Engineer. The results of the analysis shall be used when designing the foundations for the structures on the Site.

At a minimum, the following should be included in the analysis:

(01) Review publicly available geotechnical information and reports. This may include soils and geologic maps and literature, photographs, hydrogeology reports, groundwater reports, and water well data.

(02) Coordination and mobilization of the geotechnical services team for subsurface exploration of the Site. This should include working with the local utilities to mark any existing underground utilities (such as cables, gas lines, piping, etc.) in advance of mobilization.

(03) Study the Site to determine the presence of faults, ground fissures, slope instability on the Site or adjacent lands, and other potential geologic hazards that could affect the structural design, construction, and long-term operation of the Plant.

(04) Drilling or digging of exploratory borings and pits. The amount and depth shall be determined by the Seller's geotechnical engineering firm.

(05) Performance of cone penetration tests. The amount and depth shall be determined by the Seller's geotechnical engineering firm.

(06) Laboratory testing of collected soil samples from the borings and test pits. An evaluation of the in-place moisture content and dry density, gradation, plasticity, consolidation characteristics, collapse potential, expansivity, shear strength, soil resistivity for the purposes of determining cable ampacity, chloride content, sodium sulfate content, and solubility potential (total salts) should be conducted.

(07) Analyze the corrosivity of the soil. Include a recommendation for the type of cement to be used in any concrete foundations. Also include recommendations for corrosion protection for underground steel, including rigid metal conduit (such as the need for polyvinyl chloride [PVC] coatings).

Provide design criteria that can be used as required for performing L-Pile calculation – structural soil layers, K values, etc.

A detailed geotechnical report shall be provided outlining the tasks performed and the results of the testing. Included in the report should be any recommendations for the foundation designs, structural support designs, corrosion protection for both underground steel and concrete, pile drive frequency, minimum pile size, and any geologic conditions that may prevent the development of the project. Specifically, an opinion on the viability of driven piles as the PV racking supports should be provided.

4.9.2. Environmental Loads

All structures on the Site shall to be designed using environmental loads as specified in the American Society of Civil Engineers (ASCE) 7-16 (year 2016) code book *Minimum Design Loads for Buildings and Other Structures.* These include wind loads (Chapter 6), snow loads (Chapter 7), rain loads (Chapter 8), ice loads (Chapter 10), and earthquake loads (Chapter 11). Each structure on Site shall be grouped in Occupancy Category II as defined in Table 1-1 of ASCE 7 - 2016. The corresponding importance factor shall be used for each load calculation.

4.9.3. Racking/Tracking Foundations and Supports

All foundations and supports must be designed using the calculated environmental loads discussed above and soil properties provided in the geotechnical report. Foundations and supports shall meet the recommendations found in the geotechnical report. Foundations and supports shall be designed for a minimum 30-year lifetime, including all environmental factors and corrosion. Foundations and supports should be designed to withstand the impacts and contact pressure from the installation method (such as a vibratory hammer). Any damage to corrosion protection coatings during installation should be repaired. Foundations and supports, including any field-applied modifications (e.g., holes drilled), shall meet the requirements in Corrosion Protection. The pile calculations shall account for the top 12 inches of soil to not have any load bearing capacity due to long term erosion and other effects over the course of the structure life. Pre-drilled or other special foundation types will be evaluated on a case by case basis.

4.9.4. Equipment Pads

All equipment pads shall be located such that adequate personnel access is provided to such equipment. A minimum of 4 feet (or 1.5 meters) horizontal clearance from obstructions that would otherwise limit access to the equipment on the pad shall be provided around all equipment pads. The pads shall be sized sufficiently to allow safety and adequate working space around the equipment. The inverter stations, switchgear, substation (if applicable), and other buildings shall be elevated minimum 1 foot above the Federal Emergency Management Agency 100-year flood plain. The slope of the earthwork around the inverter stations and other equipment shall allow safe and ergonomic access to the equipment.

4.9.5. Corrosion Protection

Corrosion protection shall be utilized on the structures of the Plant. The type and amount shall depend on the selected materials of construction and conditions at the Site. A study of these conditions along with recommendations from the geotechnical report shall be used to design the corrosion protection.

The corrosion protection study shall be performed by a qualified corrosion expert and documented with references and calculations showing that the foundations, supports, racking, fasteners, and conduit shall meet a 30-year design life in aboveground and belowground conditions. If galvanized materials are used, field-applied zinc coatings shall meet American Society for Testing and Materials (ASTM) A780, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings. This standard contains minimum requirements for the material, surface preparation, and application process. For example, repairs to damage due to vibratory pile driving shall conform to ASTM A780.

It is preferred that all holes in structural members requiring galvanization shall have the holes drilled before the galvanization is applied. Should holes be drilled in the field, galvanizing shall be applied to the exposed steel as specified in ASTM A780. All field welds shall have a field-applied galvanization as specified in ASTM A780. For example, if torque tubes with a 3-mil (0.003-inch) hot-dip galvanization are to be welded in the field, a field-applied coating, such as hot stick repair, shall meet or exceed the original 3-mil coating thickness of the torque tube per ASTM A780 requirements.

Only steel bolts with pre-applied corrosion inhibitors or stainless-steel bolts and fasteners shall be allowed in the entire mounting structure.

4.9.6. Single Axis Tracking Structures

In the event a tracking system is utilized, the system shall be designed using the environmental loads and the Occupancy Category as discussed in Environmental Loads. The torque tubes, attachments, module mounting brackets, fastening hardware, foundations, and supports shall have a 30-year design life. Equipment shall have corrosion protection coatings as discussed in section Corrosion Protection.

A common feature of many trackers is the “stow” option during high winds. This feature will change the tracker’s tilt to a more favorable angle to decrease the wind loads on the racking, supports, and foundations during high wind conditions. If a “stow” is required to meet design wind loads, a backup energy source (e.g., a backup emergency battery system) shall be installed on the Site to ensure that the tracker shall be able to move into the stow position if the power from the grid is interrupted during high wind conditions in excess of the vendor’s design limit or the foundation design limit.

4.10. Civil Engineering

Seller shall design all systems in accordance with applicable codes and standards. Seller shall design necessary road improvements to meet state and local transportation codes, standards, conditional use permit stipulations and conditions, and requirements presented by construction equipment, delivery vehicles, and operation and maintenance traffic. Seller shall perform required Site preparation, to include earthworks, SWPPP, and erosion control. Seller shall attempt to minimize earthwork and vegetation disruption for the installation of the Plant to the extent it is compliant with the use permits; however, site grading and surfacing shall be designed to control vegetation to minimize fire danger and provide the ability to operate and maintain the Plant. Any land contours that may affect PV electrical generation should be included in the PV system performance estimate. If required, Seller shall import engineered fill to slope the Site and prevent accumulation of standing water. Any direct burial cabling shall be protected with adequate bedding materials to ensure long-term cable integrity. Dust control shall be maintained in accordance with state and county requirements until Final Acceptance is achieved. Seller shall provide other Site maintenance as needed during construction. Seller shall coordinate interaction between Owner and any permitting authorities regarding the Work.

4.10.1. Human Access

Seller shall make access to all equipment safe and reasonably ergonomic for maintenance staff. For example, if an inverter pad is elevated, the earthwork surrounding the concrete pad shall have a safe approach slope.

4.10.2. Erosion Control

Seller shall submit a location-specific erosion control plan for state and/or local jurisdiction approval prior to construction.

All areas of temporary soil disturbance are to be graded, if necessary, and re-vegetated in a timely manner to limit erosion as required by the local jurisdiction. A weed management plan for site reclamation shall be developed and submitted to Owner for review prior to construction.

All storm water and erosion control measure details to include installation, operation, and maintenance requirements.

The civil design shall include specifying applicable seeding notes and details for temporary and final/permanent site stabilization. Seed mix specifications shall be outlined on the civil plans. Seed mixes to be low lying, native mixes.

Protection of sensitive features during construction as established by environmental, biological, and/or historic studies.

The Seller shall provide an Erosion and Sediment Control Plan document that includes, and not limited to, at least the following sections:

(01) Initial Land Disturbance

(02) Construction Period Disturbance

(03) Stabilization Plan

(04) Post Construction Stabilization Plan

(05) Long Term Maintenance Plan

4.10.3. Grading and Drainage

The grading and drainage plan shall be designed and installed in accordance with state and/or local code and permit requirements. All structures required for the drainage plan, if any, shall comply with state standard specifications for drainage facilities.

The Seller shall design the site in a manner which properly manages storm water and/or groundwater such that minimal pooling/ponding of water occurs in any of the array or access road areas. Efforts shall be made to minimize earthwork and balance total cut/fill on site for a zero off-haul/import condition. Efforts shall be made to balance different areas on site to limit the earthwork haul lengths as most practical.

Efforts shall be made to maintain the pre-construction drainage patterns and peak flow rates at the outlet locations, for the post-construction condition.

Grading and associated earthwork shall be considered for site optimization and racking selection. Grading shall be conducted to allow installation of racking system per any mechanical and other installation tolerances.

Earthwork quantities shall be tabulated on the civil plans.

The Base Flood Elevation shall be determined based on the higher elevation and worst effect scenario between the Official Floodplain limits published by the authorities or the site-specific study to determine the flood height. The site-specific study shall take into consideration a 100-year Design Event (statistically computed) and/or local Historical Storm data. 100-yr Design Event (statistically computed) and/or check with local Historical Storm.

The site shall be designed such that all critical electrical equipment (combiner boxes, inverters and transformers) have a minimum freeboard height of 1 foot above the Water Surface Elevation or applicable Base Flood Elevation (BFE) as determined in the site Hydrological and Drainage Study Report. All PV modules have a minimum freeboard of 1 foot above the WSE or applicable BFE. Additionally, the site design shall meet any governing agency requirements. If requirements conflict, the more stringent requirement shall govern.

Grading, Storm Drainage and Erosion Control Plan. Contracted civil engineer (contracted by Seller) will prepare a grading and erosion control plan in accordance with state and/or local municipality requirements. Plan will depict federal, state and locally regulated waters and required buffers, as appropriate. Contracted engineer will prepare permit application forms and drawings. Seller will coordinate with Owner to obtain required signatures prior to submitting and will deliver the land disturbing permit to Owner upon receipt. This plan shall include:

(01) Project Description (Topography, Watercourses, Soils, Regulatory Floodplain, etc.)

a. Pre-Construction Conditions

b. During Construction Conditions

c. Post-Construction Conditions

(02) Applicable Construction Notes

a. Construction Methods and Standard Details

b. Confirmation of applicable Codes and Standards

(03) Results

a. Pre, During and Post Construction flows, water depths, velocities, etc.

b. Sizing details (ditches, swales, culverts, basins, etc.)

Seller shall design the solar PV array is such a manner that all arrays and above ground PV system equipment and electrical equipment are outside of any pooling/ponding of water due to 100-year storm event. If the Seller has no alternatives but to build portions of the array within areas of water pooling/ponding based on a 100-year storm event, the Contract shall specifically request an approval from the Owner to do so. In that scenario, the Seller shall prepare a hydrology study to assess peak flows and flood risk across the project site for a 100 -year storm event. The Civil, Electrical and Structural design takes into account the results of the Hydrology Study and the design specifications. Seller shall implement the findings of the Hydrology Study such that water sensitive equipment and structures will be elevated above or sited outside the areas identified in the Hydrology Study within the 100-yr flood limits. The contract shall implement a design to effectively de-water any areas water pooling/ponding after a 100-year storm event. No areas within the facility shall have water pooling/ponding for longer than 72 hours after a 100-year rain event intensity. Lesser rain intensities shall not result in water ponding/pooling anywhere within the solar PV facility.

4.10.4. Dust Control
Seller shall apply dust control materials to minimize raising dust from construction operations and traffic, including haul routes, using only dust control mixtures approved by the state and/or local jurisdictions.

4.10.5. Fire Prevention and Protection
As part of its Safety Plan, the Seller shall include a fire prevention and response plan.

The Seller shall perform all work in a fire-safe manner.

The Seller shall comply with all state, federal, and local fire prevention regulations.

4.10.6. Construction Access
Seller shall abide by all load limits established by the applicable Department of Transportation (DOT) for the relevant state where the Plant is built.

Seller shall be responsible for providing, operating, and maintaining equipment, services, and personnel with traffic control and protective devices, meeting the requirements of the *Manual of Uniform Traffic Code Devices* as required, to allow traffic flow on haul routes and onsite access roads in a safe manner. Seller shall be responsible for any costs to comply.

Seller is responsible for construction of temporary access around areas of excavation and other construction activity, if necessary and as required. Seller is responsible to obtain state and/or local jurisdiction permits for developing temporary or permanent access from public road rights-of-way.

4.10.7. Site Access Roads
The Site access road, if not currently in place, shall be designed and installed by the Seller. If the Site access road does exist, then it is to be improved by the Seller to a 20-foot gravel road. This design shall be based on sufficient soils and subsurface investigation by a qualified professional to ensure that the constructed road will meet its intended purpose. The design life of the access road shall be 30

years, assuming minimal maintenance without full re-surfacing. The Site access road shall be a gravel road sufficient to satisfy the loading requirements of the equipment vendors and to provide all-weather access for operation and maintenance of the Plant. Site access roadway design shall comply with state and/or local permit requirements.

Temporary construction roads and staging areas not connected to permanent roads (if any) shall be restored by Seller in accordance with permit requirements and post construction stabilization plan.

Seller shall provide a minimum setback of 20 feet between the perimeter fence line and any equipment or as directed by local authorities if more distance is required. This setback space may be used as a perimeter road.

For interior service roads as necessary, Seller shall allow a minimum road width of 16 feet with 20 feet min clear access. Pathways between rows of modules and circuit blocks may be narrower but designed with consideration of procedures required for accessing all modules and array equipment for maintenance and repairs. Interior roads (as needed) shall be 16 feet wide. Pathways between rows of modules and circuit blocks may be less. Road surfacing shall meet local fire and emergency vehicle access requirements

Seller shall follow the Geotechnical Engineer's recommendations for subgrade preparation, prior to construction of the access roads, as well as for any aggregate base material selection, placement, and compaction.

Drainage patterns shall not be interrupted due to the placement of the roadway or water conveyance shall be provided on the side the roads. Where needed properly sized culverts or low water crossing shall be provided. It is the Seller's responsibility to ensure that all road designs adhere to the approved storm water runoff plans. Where road wash-out is a concern, hydrological effects shall be considered in the road design – max overtopping depth at low road locations, velocity at max depth, estimated shear stress vs permissible.

Roads shall have a minimum 30-foot inside radius, unless otherwise instructed by state or local requirements. A smaller turning radius may be approved with written approval from the Owner.

Earthwork

4.10.8. General

Earthwork includes, but is not limited to, the following:

(01) Trench excavation (including rock excavation) and backfill for underground utilities

(02) Excavation and backfill (including rock excavation) for foundations

(03) Installation of granular fill and surfacing around concrete structures, drainage facilities, towers, and related Site structures, and within roadways

(04) Finish grading around all concrete pads (e.g., an inverter pad) shall have a safe approach slope leading to the top of the pad or to a small step up not to exceed 8 inches in height

Seller shall make its own estimate of the types and extent of the various materials to be encountered or required to accomplish the Work.

Seller shall utilize sustainable practices where practical, such as recycling shipping containers, pallets, etc. All materials that are not practically recyclable shall be disposed of in an approved landfill. Seller shall clean up any spill or contamination that may occur on Site in accordance with approved standard procedures.

4.10.9. Excavation

Seller shall be responsible for making all excavations in a safe manner and consistent with the requirements of the Occupational Safety and Health Administration (OSHA).

Seller shall provide adequate measures to retain excavation side slopes to ensure that structures, equipment, and persons working in or near the excavation are protected.

Seller shall protect all above grade and below grade utilities.

4.10.10. Construction Signage

Seller shall provide temporary signage for local traffic control in accordance with state DOT or local county requirements and in accordance with the Agreement.

4.10.11. Fencing

Seller shall utilize temporary fencing whenever an existing fence is removed and as necessary to maintain security and prevent the movement of livestock and other natural wildlife. Seller shall provide a minimum setback of 20 feet between the perimeter fence line and the solar panels and project substation. Additional setback may be required by other standards. Fencing shall meet PacifiCorp design standards of **Appendix A-7.10.**

4.10.12. Site Finish Grade

Seller shall leave the Site in a clean condition upon completion of the work. Efforts shall be made to restore area to a clean condition as soon as practical. Seller shall remove all trash, debris, and stockpiles. The Site access roads shall be returned to a condition that meets the original specification by repairing road damage such as ruts, gouges, and weather damage that may have occurred during construction.

The Site finish grade within the equipment footprint and in areas required for operation and maintenance of the Plant shall be fully stabilized in a manner that meets or exceeds local county requirements.

Provisions of the SWPPP for final storm water drainage shall be implemented.

Seller shall seed and mulch all areas of the Plant Site that have been disturbed beyond the permanent portion of the Site and access road, per the SWPPP. Seller shall follow the post construction stabilization plan for restoration guidance. It is preferred that the Seller use low water, low maintenance plans for re-seeding. Plant Design and State Requirements

Any technical requirements under any applicable state incentive program shall be met by the Seller. For example, any technical requirements under the state energy office incentive structure shall be met by the Seller for the state where the Plant is built.

4.11. Electrical Engineering

Seller shall provide all electrical engineering design services, meeting applicable codes and standards and the requirements of Pac Trans.

The engineering and design shall include the appropriate sizing and cabling (above and below ground) that will connect all applicable equipment to the point of interconnection. The Plant electrical system shall be designed for electrical system losses on the DC wiring system to be no more than 2 percent average within an inverter block and losses on the AC wiring system no more than 2 percent within a single distribution circuit. All DC disconnects at the inverter (s) and combiner boxes shall include a visible gap when in the open position or integral voltage and current detection such that no special PPE is required to ensure the circuit is deenergized.

The overall sequence of power flow for the photovoltaic plant shall be DC power generated by individual modules arranged in strings and the strings wired to a central point among them to be combined into larger groups of strings. These combiners are connected to the inverter DC bus input. The inverter outputs AC power at low voltage, is stepped up immediately, and is fed into the medium voltage collector system. The collector system is comprised of several AC circuit limited in size by the max ampacity of a 1250 kcmil per phase conductor between the substation and the first inverter in the circuit. The total size of the project will be optimally distributed across the required circuits and fed into the transmission system at the project substation through the point of interconnect.

All protection equipment used throughout the system shall be sized, specified, and coordinated to reduce damage to surrounding components in the event of a fault.

The above ground portion of the electrical systems shall be neatly routed to facilitate access, troubleshooting, maintenance, etc.

Trench depth for electrical wires shall be as follows:

(01) Bottom of trench ~ 3.5 feet typical for DC trench
(02) Bottom of trench ~ 4 feet below finish grade for AC trench (28 kV)
(03) Bottom of trench ~ 5 feet below finish grade if both DC and AC (28 kV) in same space

The electrical design shall include the design of equipment grounding and lightning and surge protection for the entire Plant Site. Seller shall provide a comprehensive surge protection system and provide a lightning risk assessment. The results of the lightning risk assessment and consultation with Owner will be the basis for determining the extent of the lightning protection system (LPS) that is required.

An arc flash study shall be performed per **Appendix A-7.13**. Incident energy values based on the protection coordination shall be used for arc flash labeling and as the basis for the PacifiCorp arc flash safety procedures.

Seller shall design and specify all communications hardware and software required for system protection and remote monitoring and control. All monitoring and communication supplemental equipment and cabling shall be designed and specified by Seller, subject to Owner review.

The power delivered to the grid must at all times meet the interconnect requirements for power factor. A one-line drawing is required illustrating the power factor control strategy.

4.11.1. Communication System

Seller shall procure and install a SCADA system as required in the Interconnection Agreement.

Seller shall install communications systems as required by the Interconnection Agreement.

Seller shall install communications systems as required in Security.

Seller shall supply all equipment necessary to connect to Transmission Provider’s fiberoptic cable for each of the communications described in this section.

4.11.2. Communications System Testing and Warranty

Seller shall test the installed communication system to demonstrate its ability to meet the requirements of its intended use. Testing shall be performed when the final system interconnections have been made.

4.11.3. Security

Seller shall provide a security system for the Plant. The security system around the perimeter shall include a 7-foot-high chain link fence with 1-foot top guard (total 8-foot high) of three strands of nine-gage barbed wire. The perimeter fence shall include three locked gates: two with a width of 20 feet for vehicles and one pedestrian entrance with a width of 4 feet. Fencing shall meet guidelines in section A-3.6.4 Fencing. Seller shall utilize temporary fencing whenever an existing fence is removed and as necessary to maintain security and prevent the movement of livestock and local wildlife.

Perimeter signage shall be provided by Owner and installed by Seller in accordance with Owner standards. Signage shall be installed every 65 feet along the perimeter fence and on all gates. Signage shall be installed five feet above ground level.

Signage that will be provided by the Owner will include the following:

Warning! Hazardous Voltage Inside Keep Out

English SI# 7999852

Spanish SI# 7999854

No Trespassing

SI# 8252306

Mounting Hardware

SI# 7999092

The Seller shall be responsible for security during construction.

Seller shall contract with AVTEC SYSTEMS INTEGRATOR, A DIVISION OF CACHE VALLEY ELECTRIC, (Security Sub-Seller), to provide and install the necessary security equipment. Contact:

Avtec – System Integrator
Michael Petric
(801) 908-4191
michael.petric@cve.com

This equipment may include, but is not limited to:

(01) LED Spot or LED flood lights.

(02) Security cameras located such that they are capable of adequate identification of intruders covering the perimeter of the Site. Cameras shall be placed at a height that permits line-of-sight access to the property and minimizes shading onto the PV array.

(03) Cameras with a control and detection system that assists in the detection and identification of intruders.

(04) Network - Digital Video Recorders used to record video that could be used for evidence in the event of theft or vandalism.

(05) Seller shall negotiate with the Security Sub-Seller to identify the scope of work that will be performed by the Security Sub-Seller, to ensure that a complete and operational security system as described by the Security Sub-Seller is provided. The Security Sub-Seller shall provide to the Seller the security system design, which will indicate the location of cameras, DVRs, security lighting and any security communications equipment, based on the Seller's overall System design. The work that may be provided by the Security Sub-Seller may include the furnishing and installation of wiring, cabling, labor, tools, equipment, and ancillary materials required for a complete and operational security system. At minimum, it is expected the Security Sub-Seller will provide the following equipment: cameras, network DVRs, and any specialized security communications equipment.

(06) Seller shall be responsible for the furnishing and installation of all necessary conduit, 120 Volt alternating current (V_{ac}) power extensions for all Security related equipment. Seller to allocate a minimum /of (3) three each – 1" conduits from each Inverter Pad.

(07) Seller shall provide a free-standing weather proof enclosure with adequate space required for Security Control Equipment as specified by the Security Sub-Seller. Seller may also install the solar facility SCADA equipment, in accordance with Section A-4.12, within the same enclosure.

(08) Installation of telephone lines, and/or cellular modem(s), and/or local area network for the interconnectivity of all related Security System Equipment.

(09) Seller shall provide fiber optic cable for Security System Communications. Fiber optic cable shall consist of a minimum of (4) four fiber strands between each inverter pad. Security fiber strands provided can be included in the fiber optic cabling that is provided as part of the SCADA Communications System.

(10) The system shall be complete, tested, and fully operational. Prior to construction, Seller shall provide the following:

(11) Descriptive statement and single-line block diagram to show how all related equipment will interface and operate as a complete system.

(12) Product data: manufacturer's technical data sheets on each product to be used.

(13) Drawings, including plans, elevations, equipment mounting heights, and dimensions required to show devices' locations and demonstrate accessibility compliance in accordance with referenced documents.

(14) Detailed schematic wiring diagrams for all system devices; wiring information shall include cable type, conductor routings, quantities, and connection details at devices.

(15) Manufacturer's user's manuals for operations, administration, installation, and maintenance.

Security System Installation

All system components and appurtenances shall be installed in accordance with the manufacturer's specifications, referenced practices, guidelines, and applicable codes. All necessary interconnections, services, and adjustments shall be furnished as required for a complete and operable system as specified. Control signal, communications, and data transmission line grounding shall be installed as necessary to preclude ground loops, noise, and surges from adversely affecting system operation.

All security system wiring shall be installed in dedicated conduit throughout. Cable shall not be pulled into conduits or placed in raceways, compartments, outlet boxes, junction boxes, or similar fittings with other wiring. All low-voltage wiring outside the control console, cabinets, boxes, and similar enclosures shall be plenum rated where required by code.

All wiring conductors connected to terminal strips shall be individually numbered and each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with the name and number of the device as identified and shown on the drawings.

4.11.4. Cybersecurity Requirements

General Security Criteria

1. Please confirm you have and maintain security controls to protect the Company's networks, systems, software, Confidential Information, and Data no less rigorous than those set forth in the latest published version of ISO/IEC 27001 – Information Security Management Systems– Requirements and ISO/IEC 27002 – Code of Practice for International Security Management.

2. If providing a web portal or web service, please confirm that web services use HTTPS/TLS version 1.2 or later for all content.

3. Please confirm you encrypt all Company data while at rest as well as when in transit over the network.

4. Please confirm that all Company-related file transfers are encrypted while at rest as well as when in transit over the network.

5. For responses above, please confirm all encryption uses NIST-approved algorithms and key lengths.

6. Please confirm you support federated single-sign-on (SSO) authentication for any Company accounts, whether via web interface or mobile application. You must have the ability to support Azure Active Directory.

7. If you do not support federated single-sign-on (SSO) authentication, please confirm that Accounts provided by you support multi-factor authentication compliant with NIST SP 800 63-3 Authentication Assurance Level 2. Provide documentation that supports compliance and describe supported authentication mechanisms.

8. Please confirm, by provision of supporting documentation, that email sent while under the Contract to the Company by you or by any service: Originates from a domain(s) with a published Domain-based Message Authentication, Reporting and Conformance (DMARC) policy of "reject" and with a published Sender Policy Framework (SPF) policy consisting of valid senders and a "fail" directive (-all). If the optional DMARC "pct" directive is used, "pct" must be set to "100".

9. Please confirm, by provision of supporting documentation, that email sent while under the Contract to the Company by you or by any service passes a Domain-based Message Authentication, Reporting and Conformance (DMARC) authentication check.

10. Please confirm, by provision of supporting documentation, that email sent while under the Contract to the Company by you or by any service is signed by a DomainKeys Identified Mail (DKIM) 2048 bit key.

11. Please confirm, by provision of supporting documentation, that email sent while under the Contract to the Company by you or by any service supports Transport Layer Security (TLS).

12. Please describe your process to disclose known vulnerabilities to the Company related to products or services provided as they pertain to the proposed service.

13. Please describe methods supplied to the Company to verify software integrity and authenticity for any software or patches provided by you as they pertain to the proposed service.

14. Please describe your process for security event monitoring and notification/alert/response plans, including response to security incidents affecting the Company.

15. Please confirm you will notify the Company of a security incident as soon as practicable, but no later than 48 hours after discovery.

16. Please confirm you will coordinate responses to security incidents with the Company that pose a security risk to the Company.

17. Please confirm that all rights to any data provided by the Company shall remain exclusive property of the Company.

18. Please confirm you will not share data with third parties for unrelated commercial purposes, such as advertising or advertising-related purposes.

19. If remote access of any type will be required as part of the service, please fully describe your requirements for remote access.

20. If remote access of any type will be required as part of the service, confirm your ability to conform to Company requirements for intermediate host methods for remote access, such as Citrix or Virtual Desktop,

21. If remote access of any type will be required as part of the service, and if a virtual private network is required, please confirm your ability to terminate in a demilitarized zone network (DMZ). Note that direct virtual private network connectivity to Company corporate networks is always prohibited.

22. If remote access of any type will be required as part of the service, confirm that you will notify the Company when remote or on-site access is no longer needed by your representatives, where applicable.

23. Please list facilities proposed in bid located outside the continental United States.

24. Please list any support staff used during the term of this contract located outside the continental United States.

25. Please confirm you will disclose third parties upon which you depend to deliver the Company offering (such as third-party software, implementation, hosting, for example).

26. Please describe your methods to securely ship and deliver products to the Company as they pertain to the proposed service.

For Hosted or Cloud Services:

27. If your service is comprised in whole or in part of a cloud-based or hosted services solution, please confirm you currently undergo, or are willing to undergo, annual Statement on Standards for Attestation Engagements (SSAE) Service Organization Control (SOC) 2 Type 2 audits ("Audit") for your enterprise or covering the scope of services for the term of the contract with the Company, as appropriate. Note that a datacenter audit alone will not be sufficient. You may include an audit for datacenter/colocation provider for informational purposes.

28. If your service is comprised in whole or in part of a cloud-based or hosted services solution, please confirm that your administrative access complies with NIST SP 800 63-3 Digital Identity at Authentication Assurance Level 2 or higher, where compromise of one factor does not contribute to compromise of the other factor. Provide compliance documentation and describe supported authentication mechanisms.

5.0 EQUIPMENT

5.1. Equipment Supply

As described in detail throughout this document, Seller shall purchase and furnish to the Site all material required to complete the Plant, including the following material:

(01) Miscellaneous steel
(02) Support steel posts
(03) Components (nuts, bolts, clamps, etc.)
(04) PV modules
(05) Fixed tilt racking or single axis tracker equipment (as applicable) and components
(06) DC cabling and combiner boxes
(07) DC junction boxes
(08) AC cabling
(09) Power centers, including inverters
(10) Electrical switchgear
(11) Transformers
(12) Meteorological station
(13) Snow Monitoring System
(14) Remotely accessible data acquisition system
(15) All materials related to drainage required by the civil engineering plan
(16) All electrical conduit and junction boxes
(17) Concrete equipment pads
(18) Fencing, gates, lighting, security cameras, and security camera recording equipment
(19) Communications structure (if required)

Each item of equipment to be supplied by Seller shall be subject to inspection and testing during and upon completion of its fabrication and installation as per PacifiCorp Facility Connection (Interconnection) Requirements for Distribution Systems (34.5 kilovolts and below).

Seller shall provide the manufacturer's flash test data for all modules to Owner upon procurement of modules.

Prior to the arrival of equipment and materials at the Site, the Seller shall install a fenced, secured area and provide security for the storage of such equipment and materials. Seller shall notify Owner of the location and layout of intended staging areas, parking areas, storage areas, office areas, workshops, and other temporary facilities. Temporary construction roads and staging areas not converted to permanent roads (if any) shall be restored in accordance with all permit requirements.

Seller shall be responsible for receiving and storing all freight at the Site in a secure manner.

Installed equipment and materials shall be new, of good quality and suitable grade for the intended purpose, and not a lower grade or quality than specified in the design and engineering plans or in manufacturers' recommendations. Where applicable, utility-grade equipment shall be used. Commercial- or residential-grade equipment shall not be acceptable. No equipment shall utilize polychlorinated biphenyls (PCBs).

If Seller proposes to use equipment that is non-utility grade, it is the responsibility of Seller to identify the equipment and report it to Owner for approval. It is the responsibility of Seller to identify any equipment using SF_6 gas. It is the responsibility of Seller to identify any proposed batteries and provide quantities and associated data sheets. It is the responsibility of Seller to provide data sheets and quantities on any proposed chemicals used on the Plant. Seller shall provide a list of all major equipment to be purchased, constructed, and installed as part of the Plant. The list shall identify both the items and quantities.

5.2. Signage and Labeling

Permanent naming placards should be placed on all equipment, including inverters, combiner boxes, transformers, and others according to the NEC and Owner specifications. Naming on placards and/or tags shall match drawing naming convention. Security signage shall be in accordance with A-3.9 Security. All signage must meet current industry standards. Placards and signs shall have a life span of 20 years.

All cables shall be labelled to meet applicable codes and standards. All cables shall have a label affixed to the outer jacket with a Brady or equivalent cable marker at each termination of a type accepted by Owner before installation. Labelling will match the point to point drawings. A method for ensuring labeling is complete must be included in the Seller's QC Inspection Point Program.

5.3. Grounding and Bonding

Seller shall provide detailed information (such as ground-grid drawings and calculations) for all proposed Plant grounding. Seller is responsible for designing and providing the Plant system grounding and equipment grounding. The Plant grounding design shall be done in accordance with Institute of Electrical and Electronics Engineers (IEEE) standards for generating stations. Substation grounding shall be done in accordance with IEEE standards for substation grounding. All grounding designs shall be reviewed by Owner prior to Seller commencing work.

All ground conductors shall be stranded copper and may be bare if exposed. Ground conductors in conduits shall be green-insulated. Ground lugs shall be mechanical and rated aluminum to copper. All below grade connections shall be exothermic welds. Step-up transformers and inverters and the Plant switchgear shall be bonded to the ground ring at opposing corners of the equipment. Mounting structures shall be grounded in a manner that is sized for maximum available short-circuit current and lightning current (if required).

Seller shall submit to Owner grounding and lightning calculations for assurance of safe step and touch potentials on the Site, in accordance with Owner's standards. Seller shall conduct a ground resistivity test, as prescribed by Owner prior to testing, with opportunity for witness as provided in the Agreement, to verify that the grounding system meets minimum requirements for the overall grounding scheme. Interior fencing (including without limitation internal fences around interconnection equipment and inverters) shall be installed and grounded and substation grounding shall be done in accordance with PacifiCorp Engineering Handbook Parts 6B.5 and 6B.6. Fencing around the perimeter of the overall Plant Site shall not need to meet the aforementioned Handbook standards but shall be grounded in accordance with local codes. Perimeter fences shall not be shared with the substation fence and shall be at least 30 feet from the fence around the interconnection equipment. A ground grid meeting the requirements of IEEE 80 shall be installed in the area of the interconnection equipment.

5.4. Bird and Animal Protection

Bird and animal protection at the Project Substation shall be provided following Owners Standards referenced in Appendix “A-7”.

5.5. Surge and Lightning Protection

Seller shall provide a lightning risk assessment performed to industry standards by a certified lightning protection professional, as outlined in section A-4.4.2 External Lightning Protection System (LPS). The results of this assessment, in consultation with Owner, shall be the basis for determining the requirements and extent of the facility LPS and a surge protection system that provides protection of the PV panels, DC power circuit, inverters, measurement control and communications systems, and other major electrical equipment.

5.6. Surge Protection

A staged, comprehensive surge protection system, inclusive of Type 1, 2, and 3 surge protective devices (SPDs), shall be incorporated as determined by the lightning risk assessment (A-3.7.1 Electrical Engineering) or as required by the photovoltaic and inverter manufacturers in all relevant pieces of electrical equipment. Protection shall be provided within the inverter on both the DC and AC sides as required by inverter manufacturer. Additionally, surge protection shall be provided in combiner boxes, trackers, and measurement control and communication systems as determined by the lightning risk assessment study. Type 3 surge protection installed within that equipment shall be mounted on DIN rails and must have finger safe replaceable modules that can be exchanged without the use of tools. SPDs shall be applied on all power circuits (AC and DC) and all communications and control circuits in a coordinated, staged manner. The operating status of the power SPDs shall include visual indication and shall be able to be remotely monitored by a set of integral contacts.

In addition to the performance requirements indicated above, all SPDs shall be compliant to the respective domestic or international standards, including, but not limited to, the following standards and guidelines:

Underwriters Laboratories, Inc. (UL) Standard 1449 3rd edition.

IEEE Guideline C62.41.1-2002

IEEE Guideline C62.41.2-2002

IEEE Standard C62.42.0 -2016

IEEE Standard C62.45-2002

IEEE Standard 1100-2005

5.7. SPDs for PV DC Power Circuits

SPDs applied on PV DC power circuits shall meet all the requirements listed above in this general section and shall be specifically designed for and labeled to UL 1449 3rd edition and UL's Certification Requirement Decision for PV DC application. DC PV SPDs shall be rated for a short-circuit withstand capacity (I_{SCWPV}) of not less than 1,000 amperes (A). The SPDs must be specifically designed to be able to disconnect themselves from an energized DC circuit by means of an internal integral fused circuit and do so without damage caused by faulting arcs. SPDs must be selected for the voltage system that they are to be applied (such as 600; 1,000; 1,200; or 1,500 V_{DC}). SPDs shall be from an equipment manufacturer regarded as a Tier 1 Supplier. Surge Suppression, Inc. of Destin, Florida is the preferred manufacturer of any required SPDs.

5.8. SPDs Applied on AC Power Circuits

SPDs applied on AC systems must meet all the requirements listed above in this general section and must be specifically designed for and compliant to UL 1449 3rd edition. SPDs must be selected for the system voltage where they are to be applied. SPDs are to have a short-circuit current rating (SCCR) higher than the short circuit availability where they are installed, therefore not requiring external fusing. SCCR of 200,000 A is ideal. SPDs shall be from an equipment manufacturer regarded as a Tier 1 Supplier. Surge Suppression, Inc. of Destin, Florida is the preferred manufacturer of any required SPDs.

5.9. SPDs for Measurement, Control, Instrumentation and Communications Circuits

All critical non-power circuits are to be protected with appropriate DIN rail-mounted pluggable surge protection for the system they are applied. Surge protection bases are to permit signal continuity even if the SPD module is removed from the base. SPDs shall be from an equipment manufacturer regarded as a Tier 1 Supplier. Surge Suppression, Inc. of Destin, Florida is the preferred manufacturer of any required SPDs.

5.10. External Lightning Protection System (LPS)

Based on the findings of the lightning risk assessment and/or the discretion of the Owner, an external LPS may be required to be installed. If so, Seller shall provide an LPS to protect the overall plant from direct lightning strikes to any portion of it, including, but not limited to, solar panels, inverters, outside cabinets, and buildings housing electrical equipment. The LPS shall consist of air terminals of proper height and spacing (using the rolling sphere method), properly rated and properly designed and placed down-conductors to assure safety of personnel during discharges, and a properly designed and installed ground system.

The systems shall be designed in accordance with the latest globally recognized standards for such designs, which are either International Electrotechnical Commission (IEC) 62305-1 and IEC 62305-3, or NFPA 780.

Grounding systems shall be in compliance with IEEE Standard 142-1982, IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems.

Designs are to be provided by a recognized expert LPS design firm, supplier, or professional engineering firm, and are to be submitted to the Owner.

All components of the LPS shall be in compliance with the selected system design standard chosen.

Careful consideration must be given to the design and placement of all air terminals to have no shadowing effect on PV panels.

5.11. Photovoltaic Modules

The PV modules shall:

(01) Meet IEC 61215 (crystalline silicon PV modules) or IEC 61646 (thin film PV modules).

(02) Meet IEC 61730: Photovoltaic Module Safety Qualification.

(03) Meet IEC 61701: Salt Mist Corrosion Testing of Photovoltaic Modules; Severity 6.

(04) Be listed to UL standard 1703 for the voltage specified.

(05) Include all known and future duties, tariffs, export tariffs, customs, demurrage, and shipping costs.

(06) Be from an equipment manufacturer regarded as a Tier 1 Supplier.

(07) Module supplier should provide a bankability report from an independent engineer.

(08) Manufacturer should provide an established track record of installed systems throughout the United States.

(09) Demonstrate workmanship quality through a third-party factory audit or testing score such as VDE Quality Tested certificate, or Solar buyer’s Independent Quality Assessment overall rating of “Good” or better with zero critical findings.

(10) Demonstrate a 25-year rated lifetime via long-term outdoor testing and/or accelerated lifetime laboratory testing. Testing such as Thresher testing, DNV-GL’s “PV Module Reliability Scorecard,” Atlas 25+ PV Module Durability Testing (Desert Climate Classification preferred), or Technischer Überwachungsverein (TÜV) long-term sequential testing of the specific model of the PV module selected is an acceptable demonstration of a 25-year module expected life.

(11) Demonstrate that damp heat testing is performed at proposed design voltage (e.g., 1,500 V_{DC}).

(12) Demonstrate proposed module is Potential Induced Degradation (PID) free.

(13) Be only factory "firsts" meeting all QA/QC requirements. No "seconds," or modules not meeting all quality control requirements shall be allowed.

(14) Demonstrate manufacturing quality by electroluminescence (EL) testing of every module for defects.

(15) Preferred PV module vendors are:

a) Canadian Solar
b) First Solar
c) Hanwha Q CELLS
d) JA Solar
e) Jinko Solar
f) Kyocera
g) LG
h) LONGi Solar
i) Mission Solar
j) Panasonic
k) Phono Solar
l) REC Solar
m) Renesola
n) Sanyo
o) Solar Frontier
p) SolarOne
q) SolarWorld
r) SunPower
s) Trina

Demonstrate batch consistency by documenting that the batch of modules proposed for this project meets performance requirements. A minimum of five modules shall be tested to ensure performance and reliability under accelerated lifetime tests. Documentation shall include flash test results and EL images before and after the tests shown in Figure 1. Costs of the modules, shipping, testing, and

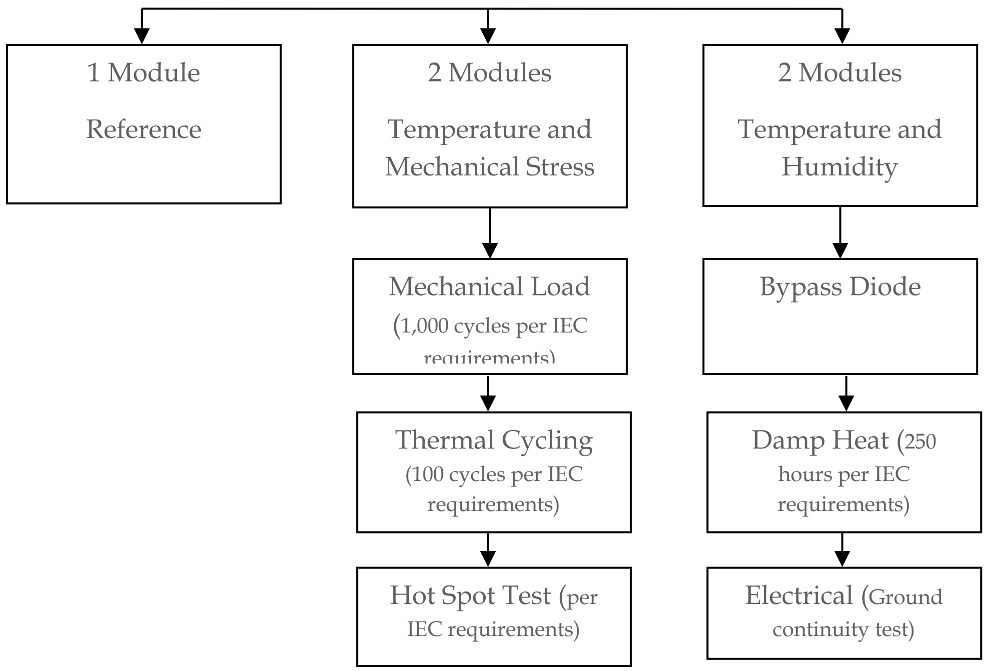

Figure 1: Module Manufacturing and Batch Quality Assurance

summary report are the responsibility of the Seller. The documentation of the batch, module sampling, EL imaging, flash testing, and summary report shall be provided to the Owner.

Note that the Owner, at its sole discretion, may randomly select up to 20 PV modules shipped to the Plant for delivery to a third party for quality verification testing. The costs of such verification testing will be the responsibility of Owner. Owner reserves the right to refuse the Bidder's proposed module if the independent tests indicate performance, workmanship, batch quality, or reliability issues.

PV module manufacturer shall:

(01) Be ISO 9001 certified (alternatively, ISO 62941)

(02) Be ISO 14001 certified

(03) Have a minimum of 5 years' experience manufacturing PV modules

5.12. Padmount Transformers

Transformers shall meet transformer efficiency standards set forth in the most recent version of the U.S. Department of Energy "Energy Conservation Program for Commercial Equipment: Distribution Transformers Energy Conservation Standards; Final Rule." Transformers shall be rated for inverter source operation and the environment in which they will operate. The transformer shall be supplied with a no-load tap changer with 5 high-voltage taps capable of operating at +5, +2.5, -2.5, and -5 percent above and below nominal collector system voltage at full rating. The transformer shall be supplied with a fused disconnect switch on the transformer high-voltage side to isolate the transformer in case of an internal fault. The switch/transformer configuration shall be designed for loop feed. Transformers shall be either dry-type, biodegradable fluid, or less-flammable oil insulating fluid. Enclosure finish shall be a top powder coat that is designed for a 25-year service life. Seller shall provide and install pad mount transformers as provided in the Agreement. Owner shall reserve the right to attend factory witness testing of padmount transformers.

Seller that interconnects to the PacifiCorp system shall provide equipment and perform the work in compliance with the requirements of the **RFP Appendix A-2 - Interconnection Agreement, RFP Appendix A-7.04**, and other applicable standards and specifications listed in **Appendix A-7 – Owner Standards and Specifications**.

5.13. Inverters

The inverter units shall be utilized for inverting the DC input from the Plant to AC output. Seller may use large-scale, central inverter or string inverter design strategies. However, either design shall be capable of operating under all required federal, state, and local standards and codes, and be capable of providing all the required grid support.

Inverters shall be calibrated and set so that the AC output, after inverter clipping and losses between the inverter to the meter, shall not exceed the Plant AC capacity at the meter. Seller shall supply and install inverters, transformer pads, and wiring/cabling to this equipment in accordance with National Electrical Code (NEC) and any other applicable standards. Seller will tie into the existing medium-voltage distribution system, connecting the system to the new generation facilities via medium-voltage transformers.

Inverters selected for this project shall:

(01) Be UL listed to 1741 (Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources).

(02) Comply with IEEE 1547-2018, including testing to IEEE 1547.1 and IEEE C62.45. Regulatory standards compliance shall also include IEEE C62.41.2 and CSA107.1-01.1. Inverters shall have voltage and frequency ride-through functionalities, as well as be capable of actively regulating voltage levels by providing adjustable active and reactive power. The inverters/plant controllers shall have the capability of reducing their active power during certain pre-determined conditions, as specified in the Interconnection Agreement. The inverter shall have the capability to meet the following:

Ride-through region for voltage and voltage trip settings

Voltage at Point of Common Coupling (% Nominal Voltage)	Ride-Through Until (s)	Operating Mode	Maximum Trip Time (s)
>120			0.16
110- 120	12	Momentary Cessation	13
88 - 110	Continuous Operation	Continuous Operation	Continuous Operation
70 - 88	20	Mandatory Operation	21
50 - 70	10	Mandatory Operation	11

0 -50	1	Momentary Cessation	1.5

Default Interconnection System Response to Abnormal Frequencies

System Frequency Default Settings	Range of Adjustability (Hz)	Default Clearing Time (s)	Range of Adjustability (s)	Ride Through until (s)	Ride Through Operational Mode
f > 62	62 - 64	0.16	0 - 300	No Ride through	Not Applicable
60.5 - 62	60 - 62	300	0 - 300	299	Mandatory Operation
58.5 - 60.5	indefinite				
57.0 - 58.5	57 - 60	300	0 - 600	299	Mandatory Operation
< 57.0	53 - 57	0.16	0 - 5	No Ride through	Not Applicable

Notwithstanding the above, the inverter and associated system shall meet all requirements specified in the Interconnection Agreement. Seller shall notify Owner at least two weeks prior to factory acceptance tests that will be performed to demonstrate these capabilities. Owner, or its representative, shall have the opportunity to witness factory acceptance tests.

The inverter and associated equipment shall meet all standards for operating on the transmission or distribution systems including all aspects of dynamic grid support noted in A-4.7 b. above and the additional requirement for providing Primary Frequency Response as dictated by FERC and included in the PacifiCorp interconnection standards for Small and Large Generators.

Inverter shall be capable of providing voltage droop control.

(01) Carry a minimum 5-year standard warranty with options for at least a 20-year extended warranty.

(02) Be designed for a 30-year lifetime, assuming regular maintenance (including replacement of inverter components).

(03) Have a maximum harmonic distortion less than 3 percent of total harmonic distortion at rated power output.

(04) Have an efficiency greater than 98 percent not including medium-voltage padmount transformer according to the California Energy Commission (CEC) test procedures for peak efficiency.

(05) Be capable of rated output at 50º C or higher.

(06) Incorporate a no-load, two-pole, lockable disconnect switch or fusible disconnect for main DC power disconnect for maintenance personnel safety with visible gap between contactors when in the open condition. DC load break switches should be installed at the combiner boxes and at the inverters (located as close to the array as possible). Be equipped with lightning protection.

Skid-mounted package units containing all equipment including DC switches, master fuse boxes, inverters, step-up transformers, and other power conditioning system equipment are preferred. Skid-mounted package units with integrated steps, side rails, and other safety features are preferred. The inverter manufacturer must approve all structures that contain inverters, especially as it relates to ventilation and temperature.

Inverters located outdoors shall be enclosed in lockable enclosures with a minimum rating of National Electrical Manufacturers Association (NEMA) 3R and with coatings in accordance with section A-3.3.5 Corrosion Protection. Any sensitive electronic equipment associated with, or part of, the inverter shall be installed in a NEMA 4 rated enclosure.

To the extent practicable, inverters should be mounted/oriented in such a way to avoid the effects of the sun (for example, facing the LCD display north to reduce sun exposure). If an LCD screen will be exposed to direct sunlight, a shade canopy shall be installed to provide shading for the screen.

Enclosure must have a door interlock system to prohibit the door(s) from being opened while energized.

Inverter output shall be protected by a circuit breaker with short- and long-time adjustable over-current protection. This circuit breaker shall be externally operated, or the vendor shall furnish an external on/off (start/stop) switch.

Inverters shall employ a maximum power point tracking scheme to optimize inverter efficiency over the entire range of PV panel output for the given Site design conditions.

Inverters shall be equipped with all hardware for data collection and communication to the central SCADA server.

Inverter shall be equipped for direct external communication and control to Owner. If communications to Transmission Provider’s SCADA system is required by the Interconnection Agreement, then inverter communications and all available inverter controls shall be provided to the Transmission Provider over Transmission Provider’s telecommunication network (see **RFP Appendix A-2**).

Inverter shall include a fused, and disconnectable control power transformer (CPT).

Plant design for inverters rated to 1,500 or 1,000 V_{DC} shall comply with NEC Articles 690 and 490, and all other requirements applicable to installations rated over 600 volts (V).

Buildings, storage facilities, and enclosures shall be provided to the extent that protection is needed; the environment needs to be maintained for the long-term reliability, availability, and operation of the equipment; or that it is required by law or the Interconnection Agreement.

Inverter manufacturer shall:

(01) Be certified to ISO 9001 and ISO 14001 standards.

(02) Be regarded as a Tier 1 Supplier.

(03) Shall have supplied a minimum of 100 MW capacity in utility-scale projects located in North America.

Preferred inverter vendors include the following firms:

a) Huawei
b) Sungrow

c) SMA
d) TMEIC
e) ABB
f) Power Electronics
g) SolarEdge
h) Yaskawa-Solectria Solar
i) Ingeteam
j) Kaco New Energy
k) Enphase

5.14. Medium Voltage Cable and Equipment
MEDIUM VOLTAGE AC WIRING

(01) Governing Standards

a) NEC

b) UL 1072

c) ANSI/ICEA S-94-649

d) AEIC CS-8

e) RUS-1

f) One or more of the following ASTM specifications: B3, B8, B230, B231, B609

(02) Wiring Material

a) Medium voltage AC conductors shall be, single-phase, EPR or TRXLPE insulated cables, 100% or 133% insulation voltage rating as per design requirements, MV -90 rated, and shall have a concentric neutral.

b) Conductors may be made of either aluminum or copper.

c) Insulation rating shall meet or exceed the highest expected continuous circuit voltage. The outer jacket may be PVC or XLPE, however shall bare the UL marking and list of conductor size and ratings.

d) iv. In general, bare copper concentric neutral under jacket shall be 100% (full) for cable smaller than 500 KCMIL, 1/3 for 500 KCMIL, and 1/6 for 750 KCMIL and larger, unless short circuit calculations indicate larger neutral is required. Engineer shall coordinate with Owner on protection tripping maximum clearing time to use in the calculation. For any neutral size less than 1/6 the Owner must approve. v. Note: 133% insulation shall be required for delta connected circuits, if the circuit is not effectively grounded at the point of interconnection or substation breaker. vi. MV cables shall be of the UL type specified and have been designed, manufactured, and/or tested according to the following standards: UL 1072, ICEA S-94-649 (NEMA WC 74).

5.15. Overcurrent Protection Devices
DC AND LOW VOLTAGE AC OVERCURRENT PROTECTION DEVICES

(01) Governing Standards

a) NEC Article 240

b) UL 248-1

c) UL 1066

d) UL 489

e) IEEE Std C37, all applicable sections

(02) Application

a) Seller shall provide overcurrent protection devices for all conductors, busses and electrical equipment that may be damaged due excessive current on the circuit.

b) Seller shall provide overcurrent protection devices for all other equipment that may be damaged due to a fault or overcurrent event within the facility's circuits.

c) All overcurrent devices shall be selectively coordinated such that the branch level circuits are deenergized first, leaving as many feeder and main level circuits in operation as possible during a faulting event.

MEDIUM AND HIGH VOLTAGE OVERCURRENT PROTECTION DEVICES

(01) Governing Standards

a) NEC Article 240

b) IEEE Std C37

(02) Application

a) Seller shall provide overcurrent protection devices for all conductors, busses and electrical equipment that may be damaged due excessive current on the circuit.

b) Seller shall provide overcurrent protection devices for all other equipment that may be damaged due to a fault or overcurrent event within the facility's circuits

c) All overcurrent devices shall be selectively coordinated such that the branch level circuits are deenergized first, leaving as many feeder and main level circuits in operation as possible during a faulting event.

d) HV protection shall be coordinated and agreed with the utility, as required.

5.16. Surge Arresters

(01) Governing Standards

a) IEEE C62

b) IEEE SA – 1672

c) IEEE 1299

d) NESC

(02) Application

a) All AC circuits and equipment shall be protected from transient over voltage events with the use of surge arresters.

b) Medium Voltage surge arresters shall be metal oxide varistor type, and shall be rated for the anticipated maximum continuous over voltage (MCOV) level for the circuit.

5.17. Switches

(01) Governing Standards

a) IEEE C37

b) IEEE 1247

c) UL 98

d) UL 363

e) UL 489

f) NEC

(02) Application

a) Switches shall be installed in the electrical circuits where indicated on the engineering plans.

b) Switch voltage and current ratings shall be suitable for the application.

c) All switches intended to be used for load break applications shall be marked as such, otherwise Seller shall label the device as non-load break rated.

(03) Types of switches

a) Pad Mount

    a. SF-6

    b. Vacuum

a) Gang Operated Air Break (GOAB)

b) Knife Blade Disconnect

c) Rotary

d) AC or DC Contactor

5.18. Relays

(01) Governing Standards

a) IEEE C37

b) NESC

(02) Application

a) Protective relays shall be used for the automatic protection of circuits that cannot be protected by the sole use of fuses or stand-alone circuit breakers. This includes but is not limited to all medium voltage feeder and main circuits, substation transformers, and medium and high voltage buses.

b) Relays must be microprocessor controlled.

c) Relays may be single or multi-function devices, as long as the appropriate protective functions and setting levels can be achieved.

d) Schweitzer Engineering Laboratory (SEL) is the preferred manufacturer, however the Seller may select alternative vendors upon approval from the owner.

5.19. Instrument Transformers

(01) Governing Standards

a) IEEE C57.13

b) UL 506

(02) Application

a) Instrument transformers shall be used for converting primary line voltage or current to a level that may be read by an instrument such as a relay or meter.

(03) Ratings

a) Instrument transformer current and voltage ratings shall be determined by the EPC Seller, based on their application. ii. All instrument transformers used for metering shall be of metering class, relay class transformers are not acceptable. For operational metering, 0.5 class accuracy is acceptable, with 0.2 class required for revenue meeting.

b) Relay or metering accuracy class instrument transformers may be used for protective relay applications, as long as the accuracy meets the requirements of that application.

c) All Instrument current transformers shall be of accuracy class 0.15B0.5 with full output at two (2) times base rating.

d) All Instrument potential transformers shall be of accuracy class 0.3%.

5.20. Battery & Battery Chargers

(01) Governing Standards

a) IEEE 450-2010

b) IEEE 36-1928

c) IEEE 485

d) IEEE 937

e) UL 1236

f) UL 1642

g) UL 1989

(02) Application

a) Batteries shall be used to provide uninterrupted power supply to electronics throughout the project.

(03) Types of Batteries

a) Lead Acid

b) Nickle-Cadmium

c) Lithium Ion

5.21. Fiber Optic Cable and Data Conductors

FIBER OPTIC CABLE

(01) Governing Standards

a) ANSI/ICEA S-87-640

b) ANSI/EIA/TIA 455

c) ANSI/EIA/TIA 568

d) NEC Article 770

(02) Cable Specification and Construction

a) All fiber optic cables shall be single mode, 24-strand, all-dielectric, indoor and outdoor rated, as applicable for the intended use, rated for installation in direct burial, in conduit, or aerial applications.

b) Fiber optic cables shall be rated temperature conditions between -40°C and 70°C.

(03) CAT5 AND CAT6/ETHERNET CABLES

a) ANSI/EIA/TIA 568

b) NEC Article 800 and 840

(04) Cable Specifications and Construction

a) All CAT5, CAT5e, CAT6 and other non-optical cables shall be constructed with shielded twisted pairs, cabled within a polyolefin insulated sheath, with an abrasion-resistant PVC or polyethylene outer jacket.

5.22. Raceways, Conduit Bodies & Boxes

(01) Governing Standards

a) NEC

b) NESC

(02) Materials Specification

a) All conduits and raceways inside buildings/interior locations shall be EMT.

b) All EMT fittings shall be compression type, not set screw type.

c) All raceway fittings in outdoor locations shall be rain-tight compression type, unless otherwise noted.

d) Schedule 40 PVC shall be used for buried conduits (not under roads) or for conduits encased in concrete unless otherwise noted on the drawings.

e) Raceways in exposed exterior locations or under roads shall be schedule 80 PVC.

f) PVC installed in exposed exterior locations shall be marked as UV resistant.

g) "L" and "T" conduit bodies shall not be used. Mogul-type conduit bodies shall be considered by Owner upon request.

h) HDPE couplings with other types of conduit shall be listed for those conduit types, or approved by Owner

i) Use Meyers (or approved equal) hub listed to provide moisture protection for conduit entrances in all applicable locations unless conduit enters from the bottom side of enclosure.

j) All vertical mv conduit sweeps shall have minimum 36-inch radius. Horizontal mv conduit sweeps shall have minimum 60-inch radius.

5.23. Fixed Tilt Racking Structure

The fixed tilt racking system (if applicable) shall include the racking structure and all module mounting hardware. The racking vendor may supply the supports if desired, or the supports may be provided by a third party. The rack's azimuth and tilt angle shall be specified on the engineering drawings.

The racking system shall be designed using the environmental loads and the Occupancy Category as discussed above in section A-3.3.2 Environmental Loads. The racking structures, support attachments, module mounting brackets, fastening hardware, and supports (if applicable) shall have a 30-year design lifetime. Equipment shall have corrosion protection coatings as discussed in Corrosion Protection.

If the racking structure is a component of the solar array grounding and bonding strategy, the racking system shall meet UL 2703. Manufacturers' directions pertaining to grounding and bonding shall be followed.

Fixed tilt racking vendors under consideration shall have installed a minimum of 500 megawatts (MW) capacity in utility-scale projects.

5.24. Single Axis Tracking Structure

The single axis tracking system (if applicable) shall include the racking structure, mounting hardware, drive motor(s), and controller system. Additionally, any equipment required for the safe operation and wind stow (if applicable) should be included in the bid. The vendor may supply the supports if desired, or the supports may be provided by a third party. The trackers shall be oriented on a north-south axis and shall automatically track the path of the sun each day. All control equipment enclosures shall be rated NEMA 4.

Flexible cords or cables, where connected to moving parts of PV tracking arrays shall follow National Electrical Code 690.31 (E) pertaining to the number of strands required in flexible cabling, keeping in mind that this is a minimum standard and the number of strands may be significantly higher than Table 690.31 (E).

If the tracking structure is a component of the solar array grounding and bonding strategy, the tracking system shall meet UL 2703. Manufacturers' directions pertaining to grounding and bonding shall be followed.

Self-powered tracking systems shall be UL 3703 listed.

The tracking system shall be designed using the environmental loads and the Occupancy Category as discussed in section A-3.3.2 Environmental Loads of this specification. The torque tubes, support attachments, module mounting brackets, all fastening hardware, and supports (if applicable) shall have a 30-year design lifetime. Equipment shall have corrosion protection coatings as discussed in section A-3.3.5 Corrosion Protection. PV modules may be either 60-cell or 72-cell modules. Modules shall be oriented as modeled in Seller PVsyst or other modeling tool used by the Seller for System design.

As discussed in section A-3.3.6 Single Axis Tracking Structures, many trackers feature a “stow” option. If this feature is required for the racking, supports, and foundations to satisfy the design wind loads, a backup energy source shall be installed on the Site to ensure the tracker will be able to move into stow position during winds in excess of the supplier’s design wind speed if the power from the grid is interrupted. Owner does not require the backup energy source if the stow feature is not needed. Seller shall design the PV arrays’ mounting systems, foundations, and piers as provided in the Agreement. The design shall be based upon standard industry practice, including the requirements of applicable codes, standards, and permits, as well as the information and specifications provided by the module, inverter, transformer, switchgear, racking, and all other vendors.

Single axis tracking vendors under consideration shall have installed a minimum of 500 MW of capacity in utility-scale projects.

5.25. Direct Current Fused Combiner Boxes

Combiner boxes shall be rated for maximum system voltage and maximum system continuous and short-circuit currents.

Design should follow combiner box manufacturer instructions pertaining to temperature rating of output conductor in order to use 90^{o} F conductor rating, combiner box manufacturer must certify box assembly as 90^{o} F rated.

Enclosures shall be rated NEMA 4 and shall have integral key lock or provisions for padlocking.

DC inputs shall be fused with finger safe fuse holders for all hot conductors

Fuses shall have blown fuse indication.

Combiner box output shall have a means to be externally disconnected.

If the combiner box has a lightning protection device, the device should include a visual trip indicator.

5.26. Meteorological Stations

Seller shall provide complete solar meteorological weather stations for the Plant per the requirements of IEC 61724 -1 “Photovoltaic System Performance – Part 1: Monitoring” for Class A monitoring. The quality and quantity of stations will be as per Class A.

The required minimum measurements shall be as follows to meet Class A:

(01) Global horizontal irradiance (measured by two instruments)
(02) Plane of array irradiance (in the plane of the tracker if used)
(03) Ambient air temperature and relative humidity
(04) Cell temperature on a single solar module in the array
(05) Wind speed and direction (measured at 2 and 10 meters)
(06) Precipitation (rainfall)
(07) PV module soiling and back of module temperature sensor

Below is a list of the general features the monitoring station shall include and other provisions the design shall accommodate:

(01) Equipment calibration certificates
(02) Summary of common calibration recertification timelines
(03) Functional specifications for the measurement devices

(04) Electrical schematic and mechanical installation drawings, proposed commissioning plan (flow chart) and site troubleshooting and problem resolution protocol (flow chart) for the monitoring systems

(05) O&M manual that includes an overall description of the monitoring system, the routine O&M plan and schedule of maintenance events and procedures

(06) Equipment and installation warranties

5.27. Supervisory Control and Data Acquisition

Seller shall supply and install an Owner-approved monitoring hardware and software package, including interconnection communications. The monitoring system must be selected to provide its 5-year Commercial Solar Monitoring Equipment and Service Package for the Plant. SCADA pricing shall include hardware and software (including all software subscriptions) for a minimum of 5 years. The monitoring system shall provide energy generation data, historical data, solar insolation attributes, and meteorological data. The system shall be configured to sample data at a rate of once per second, with 1-to-10-minute average intervals and shall be configured to update the server at least once every 15 minutes. The system shall be configured to sample and store the 1-to-10-minute averaged interval data for a period of 24 months.

The Seller shall supply a meteorological station that will provide current weather data as noted in section A-4.11 Meteorological Stations.

The monitoring system shall be capable of issuing alarms and notices to instantly alert the system manager and operation and maintenance (O&M) Seller to potential system problems and outages. The metering and monitoring system shall comply with the accuracy requirements and general standards set forth in IEC 61724.

The metering scheme shall be capable of reading the net electrical energy to the grid during daylight hours and the nighttime auxiliary loads when the Plant is in standby mode. The metering and monitoring system shall be compliant with Western Renewable Energy Generation Information System certification requirements for Renewable Energy Credit sales or trading per section A-4.13 Revenue Meter.

Data from the monitoring system can be accessed through the system's dashboard, which allows for public and administrator panel views. All electronics shall be enclosed in a NEMA 4 enclosure. This system may be housed in the same enclosure as the security equipment (see Section A-3.9). The data shall be collected at hardwired locations and transmitted wirelessly via a cellular modem to be provided and installed by Seller. Seller shall test the installed communications system to demonstrate its ability to meet the requirements of its intended use. Testing shall be done when the final system interconnections have been made.

Seller shall furnish and install all materials and equipment necessary to complete the SCADA installation. The monitoring system shall be configured for automatic reporting of generation statistics required by Owner. The data shall be collected at the hardware locations and transmitted wirelessly via a wireless SCADA system to be provided and installed by Seller. Points to be monitored by the SCADA system shall include, at a minimum:

(01) Meteorological station
  a) Monitor and record all items in section A-4.11 Meteorological Stations

(02) Inverters
  a) AC voltage
  b) DC voltage
  c) AC current

d) DC current
e) Kilowatts (kW)
f) Kilowatt hours (kWh)

(03) Metering
a) Monitor and store date from the Plant meter on an interval between 5 and 20 seconds

(04) Transformers

(05) Tracker control system integration, remote monitoring, and control

(06) Any buildings or shelters

(07) Plant switchgear

The following shall make up the SCADA calculated values list:

(01) Model versus actual performance in kW and kWh
(02) Day's energy in kWh
(03) Month's energy in kWh
(04) Year to date energy in kWh
(05) Total lifetime energy in kWh
(06) Plant performance ratio, current value
(07) Plant performance ratio, day's average
(08) Plant performance ratio, month's average
(09) Plant performance ratio, year to date average
(10) Plant performance ratio, since commissioning

All monitored plant electrical generation equipment (e.g., inverters, transformers, switchgear) shall be monitored to capture real time AC and DC electrical characteristics, including:

(01) Voltage
(02) Current
(03) Power
(04) Frequency
(05) Power factor

All monitored plant electrical generation equipment (e.g., inverters, transformers, switchgear) shall be monitored to capture all diagnostic information, including:

(01) Temperatures
(02) Alarms
(03) Status indicators
(04) Fault states

5.28. Revenue Meter

A bi-directional revenue grade meter shall be installed to measure the total Plant output at the switchgear for accurately metering energy (kWh) generated by the Plant. The revenue grade meter shall be American National Standards Institute C12.20 0.2% Class UL listed, ISO9001 certified, which is accepted by all authorities requiring revenue grade. The meter must have a display for easy reading of current power generation and lifetime generation and shall be compliant with Western Renewable Energy Generation Information System certification requirements for Renewable Energy Credit sales or trading.

This revenue meter will be supplied by the Transmission Provider. Seller shall coordinate with the Transmission Provider for the installation of same.

5.29. Security Cameras and Related Equipment

The material furnished shall be in accordance with, but not limited to, the following codes and standards:

(01) NFPA 70 - National Electrical Code

(02) NFPA 101 - Life Safety Code

(03) UL 294 - Access Control Systems (if applicable)

(04) UL 1076 - Proprietary Burglar Alarm Units and Systems

(05) American with Disabilities Act - Public Law 101.336

(06) State Building Code

5.29.1. General Requirements

All security system components shall be UL labeled.

5.29.2. Security System Components

Security system components may consist of LED spot or LED flood lights, cameras, alarms, network video recorders, communication lines, and all wiring required for all the components. The security system shall be sufficient to monitor and deter any theft or vandalism onsite. The security component supplier shall provide detailed specifications of each component.

The Security Sub-Seller and Seller shall coordinate with the SCADA design/instrumentation and control engineer to ensure sufficient bandwidth is available on the network to accommodate the proposed security system. Owner may elect to reduce the equipment needs based on the location of the Site and subsequent security requirements.

Surveillance cameras and pan/tilt/zoom (P/T/Z) drives shall meet the following minimum requirements. Surveillance cameras and P/T/Z drives shall be provided by the Security Sub-Seller. Alternative solutions providing higher upgradeability and compatibility with future products are acceptable at no additional cost, subject to Owner’s approval.

(01) The P/T/Z unit shall meet the following design and performance specifications:

- a) The unit shall be microprocessor controlled with network / IP based programming via standard WEB based interface.
- b) Each pan/tilt drive unit shall operate as an independent unit with exclusive programming and setup data contained on each unit’s nonvolatile memory.
- c) The unit shall be capable of 360-degree continuous pan rotation with a vertical unobstructed tilt of +36 to -85 degrees.
  - a. Manual Control Speeds of: 0.1 degree to 40 degree per second (Pan), and 0.1 degree to 30 degree per second (Tilt)
  - b. Preset Speeds of: 100 degree per second (Pan) and 30 degree per second (Tilt)
- d) The unit shall pan and tilt under manual control.
- e) The unit shall be capable of 16 learned tours and 256 configurable preset locations for Alarm Call-up configuration.

(02) The camera shall meet the following specifications:

a) The sensor type shall be 1/2-.8-inch Type Exmor CMOS Sensor.

b) The camera shall provide a minimum of 1080p (1920x1080) resolution, at 30 Images per second (ips).

c) Camera shall provide a minimum of 2 simultaneous video streams: Dual H.264 or H.264 and Scalable MJPEG.

d) Camera shall allow for control and monitoring of video via IPv4 and IPv6 Networks.

(03) The motorized lens shall meet the following design and performance specifications:

a) The camera shall provide 16:9 Aspect Ratio and shall provide a 30X optical zoom and 12X Digital Zoom.

b) The lens shall provide horizontal angle of view of 59.5 degrees (wide) to 2.1 degrees (telephoto).

c) The lens shall feature an automatic focus with manual override.

d) A step-down power transformer shall be provided for each camera. Transformers shall be rated 120/24 V_{AC} and shall have an adequate Volt-ampere rating for the load at 40 degrees C ambient air temperature. Individual Fuse Distribution shall be provided.

(04) The camera and lens housings shall be weatherproof and part of an Integrated Optics Cartridge (IOC). The IOC shall accommodate specified camera and lens combinations. IOC shall be dry nitrogen filled to 10 psig, to protect Camera Sensor / Lens optics from condensation and corrosion.

(05) Camera assembly shall be provided with integrated IR Illumination. IR Illumination Transmitters shall be integrated to the Pan / Tilt Assembly Housing to provide IR Illumination for areas being viewed by the camera.

a) IR Illumination shall be provided for distances up to and including 330 feet from each camera location.

5.29.3. Video Wiring System

(01) Description: 100-ohm, four-pair UTP, covered with a black PVC jacket.

a) Comply with ICEA S-90-661 for mechanical properties.
b) Comply with TIA/EIA-568-B.1 for performance specifications.
c) Comply with TIA/EIA-568-B.2, Category 6.
d) Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
    a. Communications, Direct Burial Rated: Type F/UTP, complying with NFPA 262.
    b. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher. All terminations shall use TIA/EIA 568B wire termination color coding.

(02) Power and/or Auxiliary Input/Output cable shall be multi-conductor twisted shielded cables selected for use with the specific equipment to be controlled for installation in concealed conduit system. Cables shall have outer jacket of PVC and shall be suitable for direct burial installation.

(03) All cables and conductors that serve as control, sensor, low voltage power, or data conductors shall have surge protection circuits installed at each end that meet the IEEE C37.90.1 surge withstand capability test. Fuses shall not be used for surge protection.

5.29.4. Network Video Recorder and Multiplexor

(01) The network video recorder (NVR) and multiplexer shall be provided as one integrated unit. The NVR shall be provided by the Security Sub-Seller.

(02) The NVR shall provide for live and playback viewing while the system continues to record new images. It shall be capable of time division, multiplexing multiple cameras and storing their digitized and compressed images on integral hard disk drives, and search and retrieval either locally at the unit or from a remote work station using a graphical user interface. It shall have Ethernet connectivity.

(03) The NVR shall record video on an internal hard disk drive(s). It shall support multiple internal and external hard disk drives of minimum 500 gigabytes, or large enough to store up to 1 month of the camera recordings.

(04) The NVR shall support archiving of images on an external archiving device. It shall support recording on portable / removable storage media.

(05) The NVR viewing software shall provide the following displays as a minimum in live and playback mode: full-screen, sequencing, quad, 9-way, or 12-way. It shall allow the user to rearrange cameras in any multi-screen display, in both live and playback modes. The display options shall include but not limited to:

a) Camera tilting

b) Title display, per monitor

c) Time and date, per monitor

5.29.5. Security Software

The Security Sub-Seller shall provide a minimum of two software and database management licenses. Seller shall provide two copies of the software on CDs for backup and a complete user manual. Software shall be Windows compatible. Seller shall provide free software upgrades during the warranty period of the system as a minimum.

5.30. Wires, Cable and Connectors

Seller shall provide information about proposed wire, cable, and connectors, including all underground facilities. Cable shall be designed and installed for a service life of 30 years. Cable for DC feeders and PV panel interconnect shall be 2-kilovolt 90°C (wet or dry) power cable type USE-2 or RHH/RHW-2 with XLPE jacket and UL 1581, VW-1 rating or approved equal for intended use capable of meeting DC collection system design current requirements. Externally installed cables shall be sunlight and ultraviolet resistant, suitable for direct burial, and conform to NEC 300.5 Underground Installation, Table 300.5 Minimum Cover Requirements, rated to the maximum DC voltage of the Plant.

PV panel interconnect connectors shall be: (i) latching, polarized, and non-interchangeable with receptacles in other systems, and (ii) tap branch connectors with multi-contact termination connectors. Grounding member shall be first to make and last to break contact with mating connector and shall be rated for interrupting current without hazard to operator.

Cables shall be listed and identified as PV wire as stated in NEC Article 690. If a cable tray is utilized, there shall be no self-tapping screws, only a clamping mechanism to secure the top. All underground cable shall be mapped and identified along its entire run with hazard tape and tracing, 18 inches above the cable elevation and 18 inches below finish-grade elevation.

Galvanized, rigid metal conduit where underground cable is exposed above ground or stubbed up to junctions or poles shall be used. Rigid metal conduit shall be included in the corrosion mitigation plan and shall be designed for a 30-year life in the Site soils and conditions. All 90-degree bends shall be in long sweeps installed in accordance with standard utility practices. Underground cable shall be direct-buried a minimum of 3 feet below finish-grade elevation. **No underground cable splicing shall be acceptable under any circumstance.** All cable splices shall be brought above ground and housed in a suitable enclosure or, if below grade, placed in a suitable vault that is clearly marked.

Cables shall be labeled in accordance with Section A-4.2 Signage and Labeling.

5.31. Plant Switchgear

Switchgear shall be located outdoors in a NEMA 4 lockable enclosure. Switchgear shall include an auxiliary compartment containing all instrument transformers associated with the protective relays and the 120/240-V CPT shown in the one-line diagram(s). The protective relay system shall be specified, designed, and installed in accordance with interconnecting utility's requirements. Switchgear monitoring and communication hardware shall be included to meet the requirements of sections A-4.12 Supervisory Control and Data Acquisition and A-4.13 Revenue Meter, and the metering requirements of Owner. Relay current transformers shall be C400 accuracy class.

The CPT shall be fused and disconnectable. The CPT shall be sized, and single-phase breakers shall be included to supply power to a 120-V convenience receptacle and an energy efficient light within the switchgear enclosure, switchgear heaters, and the 240/120-V_{AC} panelboard within the communications shelter (if applicable). The switchgear main breaker shall have vacuum fault interrupters and shall have provisions for bifurcation. Medium-voltage protective device selection and relaying should be based on the use of Schweitzer Electric Laboratories relays or approved other, as required and specified in the Interconnection Agreement.

In general, the interconnection design and components should meet the requirements of the interconnecting utility and the interconnection agreement (including the necessity of a grounding transformer if required).

5.32. Emergency Direct Current Battery System

The batteries and charger's location shall be specified in accordance with temperature and shading requirements, and the battery system shall meet the requirements set forth in the Interconnection Agreement. The battery system shall be sized: to provide DC power to trip, close, and recharge the switchyard 8 hours after a loss of power; recharge within 12 hours; and supply sufficient power to the SCADA and communications systems for 12 hours minimum. The battery sizing calculation shall be provided by Seller to Owner.

6.0 WARRANTIES

6.1. General Seller Warranty

Seller shall follow all material requirements of the warranties of the principal equipment suppliers using the procedures detailed in the manuals delivered upon completion of the Plant. All warranties shall be passed to Owner and shall be enforceable throughout the warranty period.

6.2. Solar Module Warranty

Provide the proposed module warranty duration, terms and conditions. At a minimum, solar module manufacturer shall provide a 25-year linear warranty on the solar modules with at least 80 percent of power output guaranteed at 25 years as more particularly described and provided in the module warranty to be provided by the Seller. The solar module manufacturer shall confirm that the warranty applies on an "as installed basis," i.e., it will confirm the panels were installed according to its requirements and specifications for installation.

Racking and Tracking System Warranty

Provide the proposed tracker warranty duration, terms and conditions. The tracking manufacturer, if applicable, shall supply a 5-year warranty for the installed structure and a 5-year warranty on the motor, and the racking design shall be certified by both the tracking manufacturer and the solar module manufacturer such that all warranties apply on an “as installed” basis. An extended warranty for parts only (motorized drives) shall be provided for a period of 10 years by Seller.
The racking manufacturer, if applicable, shall supply a 10-year warranty for the installed structure, and the racking design shall be certified by both the racking manufacturer and the solar module manufacturer such that all warranties apply on an “as installed” basis.

The racking and tracking manufacturer shall supply a minimum five (5) years full parts and labor replacement warranty, as more particularly described and provided by the Seller.

6.3. Inverter Warranty

Provide the proposed inverter warranty duration, terms and conditions. The inverter manufacturer shall provide a 5-year full parts and labor replacement warranty, as more particularly described and provided by the Seller. A six to 10-year warranty also may be offered by the inverter manufacturer. The inverter manufacturer shall confirm its warranty on an “as installed basis.”

6.4. Transformer Warranty

The transformer manufacturer shall provide a 5-year warranty for the transformers, as more particularly described and provided by the Seller.

6.5. SCADA Monitoring System and Security Equipment Warranty

Provide the proposed SCADA Monitoring System warranty duration, terms and conditions. Provide the proposed security system warranty duration, terms and conditions. The SCADA and security equipment system manufacturers shall provide a 5-year full parts and labor replacement and software upgrade warranty, as more particularly described and provided by the Seller.

6.6. Performance Warranty

This section not used.

7.0 APPLICABLE CODES AND STANDARDS

The Plant’s design, engineering, construction, interconnection, startup, and testing shall follow the applicable codes, standards, and publications that are in effect at the time of Plant initiation, and which are consistent with current utility industry standards. The codes and standards utilized shall be the latest editions in effect at the notice to proceed date.

Materials manufactured within the scope of Underwriters Laboratories shall conform to UL standards and have an applied UL listing mark. If no UL compliance is available, material and equipment shall be labeled or listed by a nationally recognized testing laboratory.

Where codes do not govern specific features of the equipment or system, Prudent Utility Practice, equipment manufacturer specifications, and standard industry standards shall apply. Where local codes or ordinances will have an impact on the design, Owner and Seller shall jointly address these with the local authorities having jurisdiction as provided in the Agreement.

8.0 DISTRIBUTION OR TRANSMISSION INTERCONNECTION

Seller is responsible for the cost of designing, procuring equipment for, and installing all interconnection and metering facilities required to deliver the Plant’s electrical output to the Point of Interconnection, in accordance with this Agreement and the Interconnection Agreement. Seller shall be aware of the relevant interconnection requirements for Small Generators, (less than 20 MW), and Larger Generators, (Greater than 20 MW) and design, install and operate the PV Plant accordingly.

Seller shall be fully responsible for working with and coordinating with the transmission provider to assure that the Plant is properly designed, constructed, and prepared to interconnect with the distribution system. Seller shall provide the interconnection equipment and structures to the Point of Interconnection as shown on the detailed design drawings and specified in the Interconnection Agreement. Seller shall coordinate its work on interconnection with the Owner and perform in accordance with any applicable requirements in the Interconnection Agreement. Seller shall provide Owner and the transmission provider with at least 15 days advance written notice of the first test that involves either backfeed or delivering energy to PacifiCorp and must be in compliance with the Interconnection Agreement.

9.0 OPERATIONS AND MAINTENANCE — MANUALS AND TRAINING

9.1. Documentation

Seller shall supply Owner with all manuals and/or handbooks (in printable electronic format) that provide, either in a single manual or handbook or collectively, complete operating and maintenance instructions (including inventories of spare parts and tools and parts lists with ordering instructions) for each major piece of equipment and system of the Plant. Each such manual and handbook shall comply with the requirements as set forth below and in **RFP Appendix A-7.2**.

9.2. Manuals

Seller shall provide Owner with six (6) paper copies and one editable electronic copy of all manuals.

Hard copy manuals shall be on standard 8-1/2" x 11" paper. Drawings and schedules which are to be bound into the manual shall also be 8-1/2" x 11" or 11" x 17" folded. Each manual shall be assembled and bound in heavy-duty post binders designed for rough usage. Light duty and ring binders are not acceptable. Binder capacity shall not exceed four inches, nor shall material included exceed the designed binder capacity. If the material to be furnished exceeds this capacity rating, multiple volumes shall be furnished. Binders shall be sized to the material to be contained, and capacity should not be more than approximately one-half inch greater than the thickness of material within the binder. All documents, illustrations, specifications, equipment data sheets, drawings, operating and maintenance instructions shall be in the English language. Use of the English system of units on documents is preferred; if the metric system of units is used, the drawing, data sheet, specification or illustration shall clearly indicate that the metric system of units is used. Each manual shall include a Table of Contents, front cover, side label and laminated index tabs and shall be of a consistent format.

The electronic copy of the manuals shall be organized in folders consistent with tabs in the paper manuals. Electronic copies of installation, operation and maintenance manuals shall be organized from the most general information in the top directory to the most specific information in the lowest level folder. The top-level folders shall include a document containing a directory of the subfolders describing the contents of each subfolder. Electronic copies of Installation, Operation and Maintenance manuals shall be organized by project, system, subsystem, equipment and components. Manufacturers' or vendors' electronic manuals shall be delivered as individual files. Seller shall not merge or combine manufacturer and vendor provided files containing manuals.

The manuals to be provided shall include:

<u>Design Manuals</u>

(01) Design manuals shall contain the following items:

(02) Drawing List, Drawing and Specification Identification System, Units of Measurement and Formats

(03) System List and Equipment Numbering System
(04) List of applicable drawings
(05) System design requirements
(06) System and equipment descriptions
(07) Equipment lists itemizing type, performance and technical requirements.
(08) Overall performance data

Start Up, Operation and Shutdown Manual for the Plant, including comprehensive and complete procedures for checkout, startup and testing of the Project and will include as a minimum the following items:

(01) Plant start-up and shutdown procedures
(02) Startup schedule
(03) Startup organization chart
(04) Administrative procedures
(05) Data sheets
(06) Test procedures for all tests required for Mechanical and Electrical Completion and Final Acceptance.
(07) Turnover sequences and procedures
(08) Safety clearance procedure
(09) Work responsibility matrix
(10) Installation, Operation, and Maintenance Manuals for the Equipment, including information typically supplied for equipment and/or systems such as the following items:
(11) System or equipment startup and shutdown procedures
(12) Description / design criteria of each item of equipment
(13) Nameplate information and shop order numbers for each item of equipment and components thereof
(14) Operating procedures and instructions for commissioning, startup, normal operation, shut down, standby and emergency conditions and special safety precautions for individual items of equipment or systems
(15) List of any start-up prerequisites
(16) Normal range of system variables
(17) Operating limits and hazards for all equipment and systems including alarm and trip set points for all devices
(18) Testing and checking requirements
(19) Effect of loss of normal power
(20) Tolerance of electrical supply frequency variation
(21) Final performance and design data sheets, specifications and performance curves for all equipment including test data and test curves
(22) Preventive maintenance schedule and maintenance instructions for equipment including standard and special safety precautions
(23) Lubrication schedule showing requirements and specifications for lubricants for equipment
(24) Dismantling and assembly procedures for equipment with associated tests and checks prior to returning equipment to service.

(25) Detailed assembly drawings to complement assembly procedures mentioned above including parts lists and numbers for replacement ordering.

(26) Setting and running clearances and tolerances

a) Cleaning procedures
b) Specifications for any gases, chemicals, solvents or lubricants
c) Drawing showing space provided for equipment maintenance for equipment and any fixed facilities for maintenance such as trolley beams, etc.
d) Methods for trouble-shooting
e) List of maintenance tools furnished with equipment
f) Installation instructions, drawings and details
g) Vendor drawings as appropriate
h) Installation, storage and handling requirements.

The above requirements are a minimum; however, requirements which are clearly not applicable to specific items or components may be deleted, however, any additional information which is necessary for proper operation and care of the equipment shall be included.

10.0 SPARE PARTS

No later than 90 days after the Effective Date the Seller shall provide to the Owner a recommended spare parts list, including quantities and prices if purchase with the contract, for the equipment and systems provided by the Seller. The recommended spare parts list shall include all expendable items that may be required during the operation of the Project. Each of the spare parts shall be fully identified by reference to the spares list, part number, cost, and manufacturer drawing number. Seller shall also identify spare parts that the Seller recommends should be stocked locally to ensure prompt repair due to any failure that can be reasonably expected, considering the length of time required to obtain replacement parts.

The Seller shall provide, receive, store locally, distribute and restock spare parts, materials, test equipment, instruments, tools, and consumables required for start-up and operation of the systems and equipment within its scope until **[Substantial Completion].**

If the Seller, his suppliers, or sub suppliers cease manufacture of any of the spare parts, or if for any reason any spare part will become unavailable at any time during the life of the facility, the Seller shall notify the Owner in writing at least 180 days prior to the unavailability of such spare parts. The Seller shall provide the Owner the opportunity to purchase sufficient stock of spare parts to support the system for its expected life.

11.0 TOOLS AND EQUIPMENT

Seller shall provide all special tools, test instruments and computer programs, as applicable for maintenance and operation which are not normally or readily available. The Seller shall submit a complete list of tools and equipment needed for erection/installation and maintenance and a list of special tools and equipment that will be provided, including prices. Special tools and equipment shall become the property of the Owner at the completion of the PV installation. The Owner reserves the right to purchase additional quantities of tools if desired.

12.0 FINAL PLANT COMPLETION

Following is the step-by-step procedure for orderly completion of the Plant:

(01) Mechanical and Electrical Completion

(02) Q/A Q/C testing

(03) Commissioning and Start-up procedures and tests

(04) Interim operating time

(05) Capacity Test

a) If Plant passes Capacity Test (Go to Final Acceptance and hand-over)

b) If failed Capacity Test – allowable period for corrective measures for re-testing of Capacity Test

(06) Substantial Completion

(07) Final Completion and hand-over to Owner

12.1. Step 1 Mechanical and Electrical Completion

Seller shall achieve Mechanical and Electrical Completion and assure that the Plant has been synchronized with the PacifiCorp Interconnection Facility (in accordance with PacifiCorp's requirements) before conducting the Capacity Test. Mechanical and Electrical Completion shall mean:

(01) Equipment for the Plant has been installed, including with the required connections and controls to produce electrical power.

(02) All equipment related to the solar tracking system (if applicable) has been installed and checked for alignment, lubrication, and rotation.

(03) All remaining electrical systems have been checked out and are ready for operation.

(04) All electrical continuity and ground fault tests and all mechanical tests and calibrations have been completed.

(05) All instrumentation is operational and has been calibrated in accordance with manufacturers' standards and guidelines and, where possible, loop checked.

12.2. Synchronization Procedures and Requirements

All testing shall be done in accordance with the Interconnection Agreement and all the requirements to achieve electrical and mechanical completion of the plant.

12.3. Step 2 Quality Assurance/Quality Control

Seller shall submit to Owner a copy of its QA/QC plan for review not later than 45 days after contract execution for Owner review and comment. The Plant shall be managed in accordance with the program.

The QA/QC program shall include, but is not limited to, such procedures and systems as the following:

(01) Road construction

(02) Rebar and conduit placement

(03) Concrete placement and testing

(04) All wire insulation testing—Megger testing or very low frequency testing

(05) Mechanical system—trackers, mounting structures, tracker controls

(06) Factory testing of inverters and transformers by the manufacturer

(07) PV source open-circuit measurements—V_{OC} at combiner boxes

(08) Fuse tests

(09) Termination pull testing

(10) All visual inspections

(11) Grounding continuity testing

(12) Earth-ground resistivity testing

(13) PV module inspection and manufacturer documentation of factory test per the manufacturer's existing program

(14) Metering and instrumentation calibration testing

(15) Step-up transformer testing

(16) Inverter phase rotation and matching with utility

(17) Relay settings at the point of interconnection to Owner

(18) Verification of security camera system operations, including device points, sequences, and communications

(19) Other Seller-prescribed procedures

All QA/QC testing procedures onsite shall be witnessed and documented by a qualified representative of Seller. Owner shall observe and witness QA/QC as necessary and at its discretion. A qualified engineer of Seller shall date and sign documentation indicating completion and acceptance of each onsite QA/QC test procedure.

12.4. Step 3 Commissioning and Startup

Seller shall provide the proposed commissioning and startup plan for the Plant at least 45 days prior to the proposed commissioning and startup dates. The plan shall follow procedures as dictated in IEC 62446-1.

Seller shall coordinate with Owner to develop an acceptable commissioning plan that includes a checkout and startup procedure. This work will assure: that systems are activated in a manner that is safe for personnel as well as for the equipment, that Seller work is complete and according to the contract documents, and that the systems perform as required by the contract documents and are ready to be turned over to Owner. As the construction and installation of the systems nears completion, Seller shall prepare punch lists and conduct system walk-downs, sub-system and system checkouts, startups, testing, and turnovers.

The final approved Acceptance Test and Commissioning Procedures shall follow IEC 62446-1, and at minimum, include the following:

(01) Safety plan during startup and commissioning

(02) Review of all QA/QC testing on the DC and AC sides of inverters

(03) Detailed procedure for Plant startup, including switching sequencing

(04) Confirm testing and energizing inverters in conformance with manufacturer's recommended procedures; note operating voltages; and confirm inverter is performing as expected

(05) Under full sun conditions, and after at least 15 minutes of operation, taking and recording Plant operating data—such as but not limited to megawatts direct current, megawatts alternating current (MW_{AC}), V_{DC}, V_{AC}, I_{DC}, I_{AC}, Solar Radiation, etc.

(06) Testing the system control and monitoring system to verify that it is performing correctly

(07) Testing the communication system for offsite monitoring

(08) Testing the Plant metering and protective relaying to verify they meet utility requirements

(09) Detailed procedure for interface and initialization with the grid

(10) Documentation of successful startup and commissioning procedure

(11) Written notification submitted by Seller to Owner that the completion of Acceptance Testing and Commissioning has occurred

Upon successful completion of energizing and startup, the Plant will be considered operable. The Plant will then move to the Interim Operating Period where Seller shall make the Plant ready for Capacity Testing.

12.5. Step 4 Interim Operating Period

Following successful completion of the startup and commissioning of the Plant, the Seller shall have a maximum of 45 days to resolve any operating issues. The Owner-designated operating and maintenance team shall receive training regarding the Plant during this period. After the successful execution of the Interim Operating Period, the Seller shall perform a Capacity Test Procedure to verify the rated output for the Plant. Seller is not required to use the maximum 45 days, rather it is an allowance of time.

12.6. Training

The Seller shall provide training for the PV system as specified below. The Seller shall determine the content and duration for each training session. The suggested class durations in this specification are meant to illustrate the level of training expected. Performance evaluation testing of all trainees (i.e. a written test) is required for all classes except the Orientation Training

12.7. Operator Training

The Seller shall provide the necessary training in proper operation of the PV system and related equipment. It is anticipated that this session will last 3-5 days. This session will be limited to a maximum of 20 people. Emphasis shall be placed on hands-on operating experience interspersed with the critical background as necessary, including switching procedures and emergency response training.

12.8. Maintenance Training

The Seller shall provide necessary training in maintenance of the PV system and related equipment, providing maintenance by the Owner option is chosen. The maintenance training shall be scheduled after successful completion of the availability guarantee period. It is anticipated that maintenance training will last 3-5 days. This session will be limited to a maximum of 20 people. The maintenance training shall include, but not be limited to:

(01) normal maintenance methods
(02) repairs and replacement
(03) diagnostic procedures
(04) equipment calibration
(05) re-energization

(06) special tests
(07) special tools
(08) safety and grounding procedures

12.9. Step 5 Capacity Test

Upon notification that the Plant is ready for field testing, the Seller, in the presence of Owner-designated engineers or a third-party independent engineer, shall complete the Capacity Test. The Test will be performed under field environmental conditions (in the field irradiance, temperature, and measured capacity in MW_{AC}) according to the procedures described in IEC TS 61724-2 "Photovoltaic System Performance Part 2: Capacity Evaluation Method". The metering and monitoring procedure for the Capacity Test shall conform to the IEC Standard "Photovoltaic Systems Performance – Part 1 Monitoring". For the basis of the Capacity Test, that the inverter stations will be producing AC power at a power factor of 1.0.

Seller shall submit its proposed plan to comply with the testing procedures 60 days prior to the date that Seller anticipates the commencement of the test. The Seller shall include in the testing procedure the proposed reference conditions for the testing which will be reviewed and approved by the Owner and its engineers. The objective of the Capacity Test is for Seller to demonstrate to Owner that the Plant has achieved the performance (in MW_{AC}) under the reference test conditions (irradiance, ambient temperature, wind, and other parameters used to define the capacity performance). Seller's Capacity Test procedure submittal shall, at a minimum, include a listing of test instrumentation, calibration procedures, test duration, type of data collected and collection frequency, test data collection procedures, and test reporting conforming to IEC 61724 Parts 1 and 2.

The objective of the testing shall be for the Seller to compare the actual measured capacity (MW_{ACTUAL}) to the contracted capacity ($MW_{CONTRACT}$) which are defined as follows:

MW_{ACTUAL} = The Plant capacity in MW_{AC} as measured resulting from the IEC 61724 capacity test at the reference test conditions.

$MW_{CONTRACT}$ = The Plant 'guaranteed contract capacity' by Seller in MW_{AC} at reference test conditions. (Seller bid)

Seller shall submit preliminary results of the Capacity Test within 24 hours of the conclusion of the test. Upon Independent certifier's acceptance of the preliminary test results, Seller shall submit to Owner a detailed test report within 10 business days of the completion of the Capacity Test. The test report shall consist of the following:

(01) Any agreed upon deviations to the test procedures
(02) Instrument calibration sheets/certificates
(03) Test data (manual and from the data acquisition system)
(04) Corrected test data
(05) Field notes
(06) Calculations
(07) Power factor at which test was taken
(08) Post-test uncertainty analysis
(09) Conclusion

If the rating falls below the guaranteed output, Seller shall take measures to bring the Plant up to the required rating.

If Seller chooses to take corrective measures to bring the power rating up to an acceptable level, then retesting may occur following notification to Owner in writing.

12.10. Step 6 Substantial Completion

After the startup and commissioning is successfully demonstrated to Owner's satisfaction in accordance with **RFP Asset Purchase and Sale Agreement**, the Plant will be considered Substantially Complete. To demonstrate substantial completion, the Seller shall:

(01) Commission the completed system in accordance with the tests to verify that:

a) The system is capable of being operated at all levels and operating modes in accordance with the operating guidelines, applicable laws, applicable standards, applicable permits, prudent utility practices, and requirements of the contract documents.

b) The Plant is functioning as expected within acceptable parameters and as designed at a nameplate capacity as per the final results of the Capacity Test.

(02) Facilitate completion or execution of any incentive- or rebate-related documents or other documents required for any warranty to become effective or to be assigned to Owner.

(03) Coordinate with PacifiCorp confirming that the facility has been installed per the Interconnection Agreement.

(04) Cause the Plant and all items of equipment and improvements at the Plant to be designed, manufactured, installed, calibrated, and tested where applicable in accordance with the published standards (as of the dates specified) listed in this Technical Specification; Seller shall notify Owner of any standards of such organizations that are inconsistent with each other and advise Owner of the manner in which it intends to resolve such inconsistency in accordance with the published standard.

(05) Acceptance testing of security system shall include verifying that each device point and sequence is operating correctly.

(06) Provide Owner a startup manual in conformance with section A-8.1.1 as part of the plant startup procedures.

(07) Provide Owner with all training and documentation as required to satisfy the requirements for Substantial Completion as listed in **Appendix A-7.2**.

(08) Within 45 days prior to Substantial Completion Seller shall complete training of Owner in the operation and recommended maintenance of the Plant.

12.11. Step 7 Final Completion

After Substantial Completion, Seller shall complete all punch-list items; demobilize; clean and clear the Site; submit all as-built drawings; O&M manuals, and spare parts lists; complete all training; deliver all spare parts onsite; and transfer all permits to Owner. Prior to submitting its request for a Final Acceptance Certificate, Seller shall perform the following tasks without limitation:

(01) Identify punch-list items and provide timeline for completion. Following the Final Acceptance Date, Seller shall complete the items on the punch-list in accordance with the standards described herein, and as quickly as reasonably practical. Seller shall coordinate with Owner regarding continued Site access.

(02) Conduct a final clean-up of the Site.

(03) Remove all its equipment from the Site (other than equipment, supplies, and materials necessary or useful to the operation or maintenance of the Plant, and equipment, supplies, and materials directed by Owner to remain at the Site until completion of the Plant).

(04) Tear down and remove all temporary structures on the Site built by Seller or its Subcontractors and restore such areas to a condition consistent with that of a newly constructed solar PV power plant, except as required by any provision of this Agreement.

(05) Remove all waste, rubbish, and hazardous material from and around the Site and disposed in accordance with all state, federal, and local regulations.

(06) Provide Owner with copies of all O&M manuals and warranties for the Plant.

(07) Provide final as-built documents upon completion.

(08) Complete all performance testing in accordance with the Capacity Test.

(09) Meet all requirements listed below.

12.12. Requirement for Final Completion

Final Completion of the Work shall be deemed to have occurred only if all the following have occurred:

(01) Seller has achieved Substantial Completion in accordance with Article 14;

(02) Owner has received final “as-built” drawings in accordance with the terms of this Contract;

(03) the Punchlist Items have been completed to the reasonable satisfaction of Owner;

(04) Seller has delivered the Final Release and Waiver of Liens and Claims in accordance with Section 7.6 and has delivered such other documents and certificates as Owner has reasonably requested to ensure compliance with all Applicable Laws;

(05) Seller has paid Owner all amounts due hereunder and not in dispute; and

(06) Seller has delivered to Owner a Notice of Final Completion stating that all the preceding conditions in this Section 15.4 have been satisfied.

12.13. Procedures for Final Completion

When Seller believes that it has achieved Final Completion, it shall deliver to Owner a Notice of Final Completion. Such Notice shall contain a report in a form reasonably acceptable to Owner, and with sufficient detail to enable Owner to determine that Seller has achieved Final Completion. Owner shall, within twenty (20) Days following receipt of such Notice, either: (a) approve Seller’s Notice of Final Completion, indicating Owner’s acceptance of the achievement of Final Completion; or (b) if reasonable cause exists for doing so, notify Seller in writing that Final Completion has not been achieved, stating in detail the reasons therefor. If Owner delivers the Notice under the preceding clause (b), Seller promptly shall take such actions, including the performance of additional Work, to achieve Final Completion, and upon completion of such actions, shall issue to Owner a revised Notice of Final Completion pursuant to this Section 15.5. Such procedure shall be repeated as necessary until Final Completion has been achieved. If Owner fails to respond to Seller’s submitted Notice of Final Completion within the time set forth above, Owner shall be deemed to have approved Seller’s Notice of Final Completion. For all purposes of this Agreement, the Final Completion Date shall be the date on which Seller delivers to Owner the Notice of Final Completion that Owner ultimately accepts or is deemed to have accepted (or pursuant to a later determination under the dispute resolution procedures, should have accepted). Any disputes regarding the existence or correction of any such alleged deficiencies shall be resolved pursuant to Article 35. Contract shall cause Final Completion to occur no later than sixty days following the Substantial Completion Date.

2022AS RFP
Appendix A-1.5
HV Work Specifications

High Voltage for Wind, Solar or BESS
Technical Specification

Draft

June 22, 2020

RFP APPENDIX A - HV
WORK SPECIFICATIONS (BTA)

TABLE OF CONTENTS

RFP APPENDIX A - HV
<u>WORK SPECIFICATIONS (BTA)</u>

1.0 EXHIBIT INFORMATION

1.1 Purpose

1.1.1 Without limiting the information summarized herein, the purpose of this document is to summarize the *minimum* performance specifications, quality standards, and other criteria required for the engineering, procurement, and construction of the High Voltage Systems for the Project.

1.2 Project Description

1.2.1 PacifiCorp (Owner) is soliciting proposals from qualified bidders (Sellers) for cost-effective renewable resources that are located in or can be delivered to PacifiCorp's west balancing authority area ("**PACW**"). Any High Voltage Systems for wind, solar or battery energy storage system projects to be owned and operated by Owner shall meet the Owner requirements set forth herein. The performance requirement is that the Project must be capable of producing safely, reliably and continuously at all ranges of rated power output and ambient conditions.

1.3 References

1.3.1 This exhibit shall be used in conjunction with RFP Appendixes related to Wind, Solar and Battery Energy Storage System Specifications which more fully describes the *minimum* scope of work and technical requirements for Seller.

1.3.2 In addition to anything summarized herein, <u>Appendix "A-7"</u> contains the following Owner standards that apply to this Technical Specification:

- RFP Appendix A-7.01: Attachment 1A Project Document Formatting and Requirements.
- RFP Appendix A-7.02: Attachment 1B – Project Document Deliverables
- RFP Appendix A-7.03: Computer Aided Design (PacifiCorp Energy) General AutoCAD/Drafting Standards (Specification DCAP876).
- RFP Appendix A-7.04.1: EBU PX-S01/S01A Substation Equipment—Power Transformer, All Ratings and Substation Equipment—Transformer-Specific Requirements
- RFP Appendix A-7.04.2: EBU PX-S02 Substation Equipment—Collector Substation Main Power Transformer
- RFP Appendix A-7.04.3: ZS-102 Two-Winding Distribution Transformer Inverter Step-Up Liquid-Immersed (Pad Mounted, Compartmental Type)
- RFP Appendix A-7.05: EBU SI-S04 Electrical Equipment—Insulating Oil
- RFP Appendix A-7.06: EBU SI-S02 Wind, Ice, and Seismic Withstand
- RFP Appendix A-7.07: EBU SI-S03 Contaminated Environment Protection
- RFP Appendix A-7.08: SP-TRF-INST Transformer, Oil-Filled Reactor and 3phase Regulator Installation Procedure

- RFP Appendix A-7.09: TD 051 Sign, Danger
- RFP Appendix A-7.10.1: 6B.5—Fence Application and Construction
- RFP Appendix A-7.10.2: Section 02810 Chain Link Fencing and Gates
- RFP Appendix A-7.10.3: Section 02815 Cantilever Slide Gate
- RFP Appendix A-7.11: 6B.6—Substation Grounding
- RFP Appendix A-7.12: GEN-ENG-RELAY-0001 Protective Relaying Standard
- RFP Appendix A-7.13: GEN-ENG-RELAY-0002 Arc Flash Hazard Standard
- RFP Appendix A-7.14: GEN-ENG-RELAY-0003 Relay Current Transformer (CT) and Potential Transformer (PT) Insulation Integrity Test
- RFP Appendix A-7.15: GEN-ENG-RELAY-1003 Thermal Plant Protective Relay Maintenance and Testing – PRC-005
- RFP Appendix A-7.16: Relay Testing and Commissioning Checklist
- RFP Appendix A-7.17: GPCP-EQPMNT-INST Generation Protection And Control Equipment Installation Procedure
- RFP Appendix A-7.18: GPCP-CT-INST Current Transformer Installation Procedure
- RFP Appendix A-7.19: PCF-CT-INST Current Transformer Installation Form
- RFP Appendix A-7.20: SG-001 Substation High-Voltage Warning Signs
- RFP Appendix A-7.21: EXHIBIT X Specification for Substation Equipment Installation, Testing and Commissioning
- RFP Appendix A-7.22.1: SV 251 Bird and Animal Protection for Miscellaneous Equipment
- RFP Appendix A-7.22.2: SV 001 Bird and Animal Protection – General Information
- RFP Appendix A-7.22.3: SV 002 Bird and Animal Protection – General Installation Instructions
- RFP Appendix A-7.23: Volume 8 Consultant Drafting Procedures and Standards (For Engineering Drawings)

1.4 Definitions

The following words shall have the respective meanings set forth below when used in this specification:

1.4.1 "**Access Roads**" means all of the complete, fully-functional roads to be constructed by Seller under the Agreement.

1.4.2 "**Agreement**" means the written agreement between Owner and Seller covering the furnishing of Work and other services in connection therewith. Other documents and deliverables are attached to the Agreement and made a part thereof as provided therein.

1.4.3 "**Applicable Standards**" has the meaning set forth in this specification.

1.4.4 "**As-Built Drawings**" means a complete set of drawings prepared by Seller or a SubSeller which accurately and completely represent the Work as constructed and installed.

1.4.5 “**BOP**” means balance-of-plant.

1.4.6 “**Collection System**” means the permanent electrical and communications infrastructure required to transmit energy and performance and operating data between each Wind Turbine and the Project Substation, or to the Turbine SCADA System control panel as appropriate.

1.4.7 “**Communications System**” means the supervisory, control, and data acquisition system for the Project Substation equipment (including all breakers, switches, transformers, relays, and meters) and permanent meteorological towers; all fiber optic cabling and supporting devices within the Collection System Circuits; and the Turbine SCADA System.

1.4.8 “**Seller**” means the person, firm, or corporation with whom Owner has entered into the Agreement.

1.4.9 “**Seller Deliverables**” means all drawings, plans, studies, reports, calculations, specifications, pictures, videos, test results, manuals, completion certificates, completion procedures, checklists, documents, and other similar items necessary for the successful completion of the Work.

1.4.10 “**Equipment**” means all of the parts, components, equipment, materials, apparatus, structures, tools, supplies, consumables, goods, and other items required or appropriate for a complete, fully-functional Project or that otherwise form or are intended to form part of the Work or the Project, including all equipment, materials, apparatus, structures, tools, supplies and other goods provided and used by Seller and the SubSellers for performance of the Work, but that are not incorporated into the Project, and excluding all Owner-Supplied Equipment.

1.4.11 “**Foundation**” means each Wind Turbine foundation.

1.4.12 “**Job Book**” means a manual to be prepared by Seller and approved by Owner, which will include all Seller engineering, design, purchasing, and other information relating to the Work.

1.4.13 “**Interconnection Line**” means the [TBD]-kV high-voltage transmission line connecting the Project Substation with the Point of Interconnection. “TBD” is a Project-specific voltage to be specified in the Proposal, but generally expected to be 115 kV or greater.

1.4.14 “**O&M Building**” means the operations and maintenance building for the Project.

1.4.15 “**Owner**” means PacifiCorp.

1.4.16 “**Point of Interconnection**” means the point where the Interconnection Line connects to the interconnection facilities constructed and owned by the interconnecting utility to which electrical power produced by the Project will be delivered.

1.4.17 “**Project**” means the generating facility described in the Proposal.

1.4.18 “**Project Schedule**” means the schedule of key dates, milestones, and other activities for timely completion of the Work, reflecting the project execution plan and anticipated sequence of site operations.

1.4.19 “**Project Site**” or “**Site**” means the location, or proposed location, of the Project.

1.4.20 "**Project Substation**" means the 34.5/[TBD]-kV substation to be located at the Project Site, with all necessary equipment to connect the Project to the interconnecting utility's grid. "TBD" is a Project-specific voltage to be specified in the Proposal, but generally expected to be 115 kV or greater.

1.4.21 "**Proposal**" means the formal offer of Seller together with all information submitted that pertains to this RFP.

1.4.22 "**Quality Plan**" means quality assurance and quality control plan to be prepared by Seller in compliance with the requirements in this specification.

1.4.23 "**Requirements**" means the Work Specifications, Prudent Wind Industry Practices, applicable laws, applicable permits, Applicable Standards, the Project Schedule, the Project's interconnection Agreement, the Project design documents, and the other requirements of the Agreement.

1.4.24 "**RFP**" means request for proposals.

1.4.25 "**Safety Plan**" means safety plan to be prepared by Seller in compliance with the requirements in this specification.

1.4.26 "**SCADA**" means supervisory control and data acquisition.

1.4.27 "**Security Plan**" means security plan to be prepared by Seller in compliance with the requirements in this specification.

1.4.28 "Seller" means qualified bidder under the PacifiCorp All Sources RFP.

1.4.29 "**Work**" means all actions, capital, contracts, labor, equipment, and materials necessary to construct the proposed Project and furnish wind energy and environmental attributes (including operating the Project) to Owner at the specified delivery point.

1.4.30 "**Work Specifications**" means the minimum performance specifications, quality standards, and other criteria required for the performance of the Work by Seller, each as described in more detail in this specification.

1.4.31 References to "**roads**" and "**roadways**" herein shall be understood to consist of all access roads, Wind Turbine Generator string and spur roads, substation roads, transmission line service roads, meteorological tower roads, maintenance building roads, and temporary construction roads to be constructed for the Project.

1.4.32 As used herein, "**raceway**" shall be understood to include conduit (rigid and flexible), underground duct, wireway, cabinets and boxes, and all materials and devices required to install, support, secure, and provide a complete system for support and protection of electrical conductors.

1.5 Interpretation

1.5.1 References herein to requirements to perform and/or provide work, services, equipment, or other similar items shall be understood to be the responsibility of Seller, unless explicitly noted as being a responsibility of Owner.

1.5.2 The headings of sections and subsections herein are for convenience only and shall be ignored in construing this exhibit.

2.0 STANDARDS OF PRACTICE

2.1 General Provisions

2.1.1 Seller shall be responsible for the interpretation of the data provided herein and validation of the proposed design.

2.1.2 Any proposed materials, structures, and/or assemblies shall be maintainable in the simplest and most cost-effective manner possible.

2.1.3 All materials shall be new, unused, of the highest quality, free of defects and irregularities, and consistent for use in wind generation facilities.

2.1.4 Equipment shall be installed, assembled, and tested in strict compliance with the manufacturer's drawings, code markings, and instructions.

2.1.5 The Seller shall ensure the final drawings, models, and associated documents meet the needs of the Project requirements and adhere to all applicable codes and standards. The Seller shall have the overall responsibility for the design and engineering provided by their Engineer of Record (EOR).

2.1.6 Physical and cyber security shall adhere to NERC Critical Infrastructure Protection (CIP) protocol. This compliance shall be demonstrated within the design and using additional reporting and documentation when necessary.

2.2 Supervision and Engineer of Record

2.2.1 All engineering shall be performed under the supervision of and stamped by the engineer(s) of record, who shall be a registered professional engineer with a current license in the Project jurisdiction. Such professional engineer(s) shall be registered in the applicable discipline for the drawings being signed and sealed.

2.2.2 Seller shall provide all engineering, technical expertise, management, and supervision, to design, engineer, specify and complete all aspects of the Project, including but not limited to: land use, access, interconnection, equipment, structures, devices, materials, construction, testing, and commissioning, (unless otherwise noted).

2.2.3 Seller shall be responsible for complying with all technical requirements contained in the Power Purchase Agreement and Generation Interconnection Agreement, including all Utility and ISO requirements.

2.2.4 Seller shall be aware of all local requirements and shall be incorporated into the design and construction of the Project. All Work concerning the geotechnical services shall be supervised and directed by a qualified, competent, practicing geotechnical engineer. A geotechnical engineer or engineering geologist shall observe, log borings, obtain soil samples, and record blow counts of the samples, drill rates, rock quality, depth to ground water, and other pertinent data under the direction of a licensed geotechnical engineer.

2.2.5 All Project submittals shall be subject to review and/or approval by Owner, as applicable, and shall meet the minimum requirements for submittals set forth in Section 3.1.

2.3 Applicable Standards

2.3.1 The Applicable Standards shall include (i) the minimum standards and industry codes and any other criteria required for the performance of the Work by Seller, (ii) each of the standards and industry codes listed below, and (iii) each of the relevant standards and codes issued by the organizations listed below (collectively, the "**Applicable Standards**").

(1) Aluminum Association ("AA")

(2) American Association of State Highway and Transportation Officials ("AASHTO")

(3) American Concrete Institute ("ACI")

(4) American Institute of Steel Construction ("AISC")

(5) Association of Iron and Steel Engineers ("AISE")

(6) American National Standards Institute ("ANSI")

(7) American Society of Civil Engineers ("ASCE")

(8) American Society of Heating, Refrigeration, and Air Conditioning Engineers ("ASHRAE")

(9) American Society of Mechanical Engineers ("ASME")

(10) American Society of Nondestructive Testing ("ASNT")

(11) American Society of Testing and Materials ("ASTM")

(12) American Water Works Association ("AWWA")

(13) American Welding Society ("AWS")

(14) Avian Power Line Interaction Committee ("APLIC")

(15) Code of Federal Regulations ("CFR")

(16) Concrete Reinforcing Steel Institute ("CRSI")

(17) Crane Manufacturer Association of America ("CMAA")

(18) United States Environmental Protection Agency ("EPA")

(19) Federal Aviation Agency, Department of Transportation ("FAA")

(20) Federal Energy Regulatory Commission ("FERC").

(21) Federal Highway Administration ("FHWA")

(22) IAPMO Uniform Plumbing Code

(23) Illuminating Engineering Society (“IES”)

(24) Institute of Electrical and Electronic Engineers (“IEEE”)

(25) Instrumentation Society of America (“ISA”)

(26) Insulated Cable Engineering Association (“ICEA”)

(27) International Building Code (“IBC”)

(28) International Code Council (“ICC”)

(29) International Electrotechnical Commission (“IEC”)

(30) Applicable state requirements, including State Department of Transportation and Environmental Protection

(31) National Electric Code (“NEC”)

(32) National Electrical Contractors Association (“NECA”)

(33) National Electric Safety Code (“NESC”)

(34) National Electrical Manufacturers Association (“NEMA”)

(35) National Electrical Testing Association (“NETA”)

(36) National Fire Protection Association (“NFPA”)

(37) National Safety Council (“NSC”)

(38) North American Electric Reliability Corporation (NERC)

(39) Occupational Safety and Health Administration (“OSHA”)

(40) Post-Tensioning Institute (“PTI”)

(41) Scientific Apparatus Makers Association (“SAMA”)

(42) Sheet Metal and Air Conditioning Contractors National Association (“SMACNA”)

(43) Society for Protective Coatings (“SPC”)

(44) Telecommunications Industry Association/Electronic Industries Association (“TIA/EIA”)

(45) Underwriter’s Laboratories (“UL”)

(46) Uniform Building Code (“UBC”)

(47) DNVGL-ST-C502, Offshore Concrete Structures.

2.3.2 Unless otherwise specified, all engineering, procurement, and construction associated with the Project shall comply with the latest revision of all applicable codes and standards including, but not limited to, those listed herein. Any departure from the referenced codes and standards must be fully explained in writing and submitted for Owner's review and approval prior to implementation.

2.3.3 All specific standards applicable to pieces of equipment, structures, and/or buildings may not be listed herein. Specifications may describe the specific standards that may apply.

2.3.4 Any general standard or organization listed above shall be understood to include all relevant codes, standards, and/or guidelines under that particular standard or organization. For example, ACI shall include ACI 301, ACI 305, ACI 306, ACI 318, etc.

2.3.5 Unless otherwise specified herein, in the case of conflict between any Applicable Standards, the more stringent requirement shall apply.

2.3.6 It is the Seller's responsibility to be knowledgeable to include designs and practices that incorporate the latest revisions of all applicable codes, standards and regulations.

2.4 Approved Suppliers

2.4.1 This Section 2.4 contains a list of approved materials, equipment suppliers, and subcontractors. In the event that Seller is considering the selection of a material, equipment supplier, or subcontractor that is not listed herein, Seller shall request approval from Owner prior to executing any contract for the procurement of such material or with such equipment supplier or subcontractor. Equipment catalog cut sheets shall be submitted for Owner review and approval prior to procurement.

2.4.2 Project Substation:

(1) Approved substation engineering contractors:

(a) Refer to Appendix C (*Approved Subcontractors*)

(2) Approved substation construction contractors:

(a) Refer to Appendix C (*Approved Subcontractors*)

(3) Approved main step-up power transformer suppliers:

(a) ABB

(b) Delta Star

(c) Efacec USA

(d) GE Prolec Transformers

(e) HICO

(f) Hitachi Power Systems Ltd

(g) Hyundai Heavy Industries (HHI)

(h) JSHP Transformer Corporation

(i) Mitsubishi Electric Power Products, Inc

(j) Pennsylvania Transformer (PTTI)

(k) Siemens Energy

(l) Smit Transformers

(m) Tebian Electric Apparatus Stock Company Ltd (TBEA)

(n) SPX Transormer Solutions (Waukesha)

(4) Approved station service transformer suppliers:

(a) ABB

(b) General Electric

(c) Cooper Power

(5) Approved high-voltage transformer suppliers:

(a) ABB (U.S. or Sweden)

(b) Alstom

(c) Trench N.A

(6) Approved 34.5-kV voltage transformer suppliers:

(a) ABB

(b) Alstom

(c) General Electric

(d) Ritz

(7) Approved high-voltage current transformer suppliers:

(a) ABB (U.S. or Sweden)

(b) Alstom

(c) Trench N.A

(8) Approved 34.5-kV current transformer suppliers:

(a) ABB

(b) Alstom

(c) General Electric

(d) Ritz

(9) Approved high-voltage circuit breaker suppliers:

(a) ABB (with spring/hydraulic mechanism)

(b) Siemens

(10) Approved 34.5-kV circuit breaker suppliers:

(a) Schneider Electric

(b) Siemens

(c) EMA

(11) Approved high-voltage surge arrestor suppliers:

(a) ABB

(b) Cooper Power

(c) General Electric

(d) Hubbell

(12) Approved 34.5-kV surge arrestor suppliers:

(a) ABB

(b) Cooper Power

(c) General Electric

(d) Hubbell

(13) Approved high voltage disconnect switch suppliers:

(a) Cleveland / Price

(b) Pascor Atlantic

(c) Southern States

(14) Approved 34.5-kV disconnect switch suppliers:

(a) Cleveland / Price

(b) Royal

(c) Southern States

(d) Hubbell

(e) USCO

(15) Approved battery charger suppliers:

(a) Alcad / Hindle

(b) Enersys (formerly Exide / Yuasa)

(c) LaMarche

(16) Approved battery suppliers:

(a) Enersys (formerly Exide / Yuasa); preferred.

(b) C&D

(17) Approved capacitor bank suppliers:

(a) ABB

(b) Cooper Power

(c) General Electric

(18) Approved control building suppliers:

(a) Trachte

(19) Approved panel suppliers:

(a) Gexpro

(b) Codale

(20) Approved relay suppliers:

(a) Schweitzer Engineering Laboratories (SEL)

(21) Approved grounding rod suppliers:

(a) Not used

(22) Approved compression connection suppliers:

(a) Burndy

(b) Hubbell

(c) Travis Pattern

(d) Alcoa

2.4.3 Interconnection Line:

(1) Approved Interconnection Line engineering contractors:

(a) Refer to Appendix C (*Approved Subcontractors*)

(2) Approved Interconnection Line construction contractors:

(a) Refer to Appendix C (*Approved Subcontractors*)

(3) Approved OPGW suppliers:

(a) Corning

(b) Fukijikura

(4) Approved grounding rod suppliers:

(a) Blackburn

(b) Weaver

3.0 GENERAL SPECIFICATIONS

3.1 General Provisions

3.1.1 All Work, including construction, materials storage, grading, landscaping, cut/fill, erosion control, and other similar or related activities, shall not extend beyond the designated disturbance areas. Unnecessary disturbance of the existing Project Site conditions shall be minimized, and under no circumstance may Seller perform any Work or cause any disturbance beyond these corridors without explicit written confirmation from Owner.

3.1.2 Existing access to the Project Site, including along public roads, shall remain open throughout construction.

3.1.3 All existing infrastructure, including communications towers, pipelines, telephone lines, and electrical lines, shall be maintained in their current condition throughout the construction of the Project.

3.1.4 Temporary power and utilities must be included by Seller including easements and access need for construction.

3.1.5 Seller shall maintain an office on or close to the site of the Project. These construction office trailers shall be delivered, set-up, furnished and ready to use including power, phone service, internet service, HVAC systems, sewer and restroom facilities and decking by Seller's mobilization date and shall be demobilized after substantial completion has been achieved.

3.1.6 Seller shall provide sufficient space and electrical service in the office complex area for one office trailer for the turbine supplier. Site grading shall include parking space for turbine supplier's personnel.

3.1.7 Seller shall maintain two-way radio communication till substantial completion. Each crew shall have a radio for communications, at all times, effective communication for compliance with the Seller's emergency action plan.

3.2 Submittal Requirements

3.2.1 This Section 3.1 sets forth the *minimum* requirements for all Seller-provided submittals, including Seller Deliverables.

3.2.2 General requirements:

(1) Seller is required to submit a Master Drawing List showing all drawings and documents estimated to be provided for the project within ten (10) Business Days after Notice to Proceed.

(2) Seller shall name and label all submittals using an Owner-approved naming convention. Such naming convention shall be used consistently for all submittals, and the only filename modification for revised submittals shall be a change in revision number. Unidentifiable submittals will be returned for proper identification.

(3) Submittals shall be accompanied by copies of native, electronic design files (e.g., AutoCAD .dwg file, PLS-CADD .bak file, etc.), including for interim design transmittals (e.g., 30%, 90%, etc. as applicable) and As-Built Drawings.

(4) All design submittals shall be provided in a common and consistent coordinate system. Such coordinate system shall be subject to Owner approval.

(5) All drawings shall be clearly marked with: Revision numbers, dates, clouds around any change and appropriate explanations for the design changes.

(6) Seller shall maintain current set of IFC drawings on-site at all times, updated to the latest revisions.

3.2.3 Quality requirements:

(1) Scanned submittals are not acceptable. All submittal text shall be electronically recognizable and searchable.

(2) Submittals to Owner shall be of suitable quality for legibility and reproduction purposes. Every line, character, and letter shall be clearly legible. Drawings shall be useable for further reproduction to yield legible hard copies.

(3) Documents submitted to Owner that do not conform to specified requirements shall be subject to rejection by Owner, and upon request, Seller shall resubmit conforming documents. If conforming submittals cannot be obtained, such documents shall be retraced, redrawn, or photographically restored as may be necessary to meet such requirements. Seller's (or its subSeller's) failure to initially satisfy the legibility quality requirements will not relieve Seller (or its subSellers) from meeting the required schedule for submittals.

3.2.4 Quantity requirements:

(1) Seller shall electronically transmit one (1) copy of all submittals to Owner, including modifications to submittals, except as otherwise specified elsewhere in the Agreement.

(2) Seller shall provide four (4) complete, full-size (size D), color sets *and* four (4) complete, 11-inch by 17-inch, color sets of As-Built Drawings in hard copy format, as well as one (1) complete, full-size (size D) set of As-Built Drawings in electronic format on external hard drive.

3.2.5 Languages and dimensions:

(1) All words shall be in the English language.

(2) All dimensional units shall be in English units. When both metric and English units of measurement are presented, English dimensional units shall prevail.

(3) All drawings and dimensions shall be to scale; not-to-scale ("**NTS**") dimensions will not be permitted on scalable drawings. A scale bar shall be included to permit use following photo-reduction.

3.2.6 Submittal completeness:

(1) Submittals shall be complete with respect to dimensions, design criteria, materials of construction, and other information specified to enable Owner to review the information effectively.

(2) Where standard drawings are furnished which cover a number of variations of the general class of equipment, each drawing shall be annotated to indicate exactly which parts of the drawing apply to the equipment being furnished. Use hatch marks to indicate variations which do not apply to the submittal. The use of "highlighting markers" will not be an acceptable means of annotating submittals. Such annotation shall also include proper identification of the submittal permanently attached to the drawing.

3.2.7 Transmittal of submittals:

(1) Submittals and Project documents shall be transmitted in (i) nonproprietary, native electronic format, incorporating any necessary reference files; and/or (ii) Adobe (*.pdf) files created directly from native electronic format.

(2) All electronic submittals shall be uploaded to Owner's web-based document management site. Selected submittals may also be required to be provided on CD, DVD, or flash drive.

(3) All electronic submittals shall be clearly named and versioned (e.g., revision number, date appended to file name).

(4) Each submittal shall be accompanied by a completed transmittal letter. Submittals that are not accompanied by a completed transmittal letter will not be accepted and will be returned to Seller. All Seller transmittal letters submitted to Owner shall contain the following information, at a minimum:

(a) Transmittal number.

(b) Date of transmittal.

(c) Seller's name.

(d) Project name.

(e) Owner's project number.

(f) Filename and revision number.

(g) Description of the information contained in the specific transmittal.

(h) Purpose of transmitting to Owner (i.e., issued for information, issued for review, etc.), including applicable Agreement references.

(5) Seller shall check and approve submittals of subSellers and manufacturers prior to transmitting them to Owner. Seller's submission shall constitute a representation to Owner that Seller approves such submittal(s) and has determined and verified all information contained therein, and Seller assumes full responsibility for doing so; and Seller has coordinated each submittal with requirements of the Work and the Agreement.

(6) Seller shall, at the time of each submission, call to the attention of Owner in the letter of transmittal any and all deviations from the Requirements.

3.2.8 Owner's review:

(1) Owner's review and approval of submittals will not relieve Seller of responsibility for any deviation from the Requirements unless Seller has in writing called Owner's attention to such deviation at the time of submission, and Owner has given written concurrence in and approval of the specific deviation. Approval by Owner shall not relieve Seller from responsibility for errors or omissions in submittals.

(2) Seller shall make all modifications noted or indicated by Owner and return the required number of revised submittals until approved. Direct specific attention in writing, or on revised submittals, to changes other than the modifications called for by Owner on previous submittals. After submittals have been approved, submit copies thereof for final distribution. Previously approved submittals transmitted for final distribution will not be further reviewed and are not to be revised. If errors are discovered during manufacture or fabrication, correct the submittal and resubmit for review.

(3) Seller shall not construct any portion of the Work until issued-for-construction drawings have been approved by Owner. Wind Turbine Generator Foundations shall not be constructed until the Wind Turbine Generator Foundation drawings and calculations have been approved by Owner, including its independent engineer.

(4) Seller shall submit equipment catalog cut sheets for Owner review and approval prior to procurement.

(5) Review of drawings by Owner does not relieve Seller of responsibility for errors, correctness of details or conformance with these specifications.

3.2.9 Design Submittals

(1) The Project Substation design documents shall include a general arrangement plan; physical layout diagrams; civil works drawings, including subgrade preparation, grading, drainage, and erosion control; protection and control system designs and philosophies; one-line diagrams; three-line diagrams; wiring diagrams, including A/C and D/C schematics; cable specifications and arrangements; conduit and cable schedules; panel scheduled; loop drawings; elevation drawings; connector and fitting details; foundation plans and details, including all structural calculations; ground grid plans; metering diagrams; conduit and trough plans; fencing details; control building drawings; the Project Electrical Studies, as defined in this specification; drawing index; bill of materials; construction sequencing; and inspection, testing, and quality control requirements, at a minimum.

(2) The Interconnection Line design documents shall include plan and profile drawings; structure details and drawings, including elevations, spacing, and hardware; civil works drawings, including subgrade preparation, grading, drainage, and erosion control; foundation design and embedment drawings; anchoring and guying details; structural calculations; PLS-CADD design files; grounding details; drawing index; bill of materials; construction sequencing; and inspection, testing, and quality control requirements, at a minimum. Interconnection Line electrical phasing shall be placed on the plan and profile drawings. Phasing should match the phasing at the Project Substation terminations with minimal rolls and phase swapping.

(3) The Communications System design documents shall include a plan view of the fiber optic cable layout; fiber optic loop diagram, including communication loop and connection details for all Wind Turbine Generators, permanent meteorological towers, and the O&M Building; communications block diagram, including all Communications System equipment, WTG/PV/BESS SCADA and utility equipment; logic descriptions; points lists; rack layout diagrams; HMI screen development; fiber termination diagrams; drawing index; bill of materials; construction sequencing; and inspection, testing, and quality control requirements, at a minimum.

(4) Issued-for-construction drawings shall not be changed or substantially deviated from without Owner approval.

(5) As-Built Drawings: As-Built Drawings shall be issued as the next sequential revision from previous releases. The revision block shall state “As Built”. All clouds, revision diamonds, and other interim control markings shall be removed, and all information listed as “later” or “hold” shall be completed. The As-Built Drawings shall include a final bill of materials. As-Built Drawings shall be created in the latest version of AutoCAD, or in the version of AutoCAD utilized by Owner, as applicable.

(6) All design submittals shall bear the Project name and the status of the submittal (e.g., Preliminary, Issued for Bid, Issued for Construction, As Built).

(7) Each drawing and submittal shall be sequentially numbered with a unique identifier.

(8) All materials shall be fully identified by Seller, and each engineering package shall include a bill of materials, including all equipment and materials to be procured. Every item in the bill of materials shall have a unique identifier (typically numerical). Each bill of materials shall list product name, manufacturer, unique product / part number, and quantity.

3.3 Project Schedule Requirements

3.3.1 This <u>Section 3.3</u> provides an outline for the *minimum* contents and requirements of the Project Schedule to be prepared by Seller. Seller shall provide Initial Level 3 Schedule, twenty-one (21) days after Notice to Proceed and at a level of engineering deliverable that supports construction detailed activity breakdowns for task duration and estimates of the work to be detailed/performed for the schedule. Final Level 3 Baseline Project Schedule to be provided within 1 week after approval of Initial Level 3 Schedule.

3.3.2 For purposes of only this Section 3.3, the following words shall have the respective meanings set forth below.

(1) "**Activity**" means a discrete part of a contract that can be identified for planning, scheduling, monitoring, and controlling the construction Work. Activities included in a construction schedule consume time and resources but shall not include planned work stoppages. Activities shall not normally reflect the Work of more than one trade.

(2) "**Baseline**" schedule means the initial Project Schedule, as approved by Owner.

(3) "**Critical path**" means the longest sequence of activities in a project plan which must be completed on time for that project to complete by the stated due date.

(4) "**Critical path method**" or "**CPM**" means a method of planning and scheduling a construction contract where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Agreement.

(5) "**Float**" means the measure of leeway in starting and completing an activity. Float time (including total float) is not for the exclusive use or benefit of either Owner or Seller, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Agreement completion date.

(6) "**Predecessor activity**" means an activity that precedes another activity in the network.

(7) "**Resource loading**" means the allocation of manpower, equipment, or material necessary for the completion of an activity as scheduled.

(8) "**Successor activity**" means an activity that follows another activity in the network.

(9) "**Total float**" is the measure of leeway in starting or completing an activity without adversely affecting an intermediate deadline or the planned Agreement completion date.

3.3.3 General requirements:

(1) Seller shall propose and submit for review and approval by owner a baseline schedule.

(2) Seller shall utilize Primavera Professional Project Management Software from Oracle for preparation of the Project Schedule. At a minimum, this shall be version Primavera P6.7 or newer.

(3) Activities in the Project Schedule shall be defined so that no single construction activity is longer than 20 calendar days and no single other activity is longer than 30 calendar days, respectively, unless specifically allowed by Owner.

(4) Each activity shall be assigned a number. Numbering shall be such that predecessor activity numbers are smaller numerically than successor activity numbers in the Baseline Project Schedule. Seller shall use even-numbered activities for base Agreement Work, and odd-numbered activities for change order work. No activity number shall change after approval of the Baseline Project Schedule.

(5) The Project Schedule shall include a clear and logical work breakdown structure, wherein all items are assigned a sensible activity number based upon the type of work being performed. Such work breakdown structure shall be subject to approval by Owner.

(6) Procurement process activities shall be included for all long-lead and major items (as defined by Owner) as separate activities in the Project Schedule. Procurement cycle activities shall include, but not be limited to, submittals, approvals, purchasing, fabrication, and delivery.

(7) The Project Schedule shall indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

(a) Preparation and processing of submittals

(b) Mobilization and demobilization

(c) Acquisition of key permits

(d) Completion of interconnection studies and interconnection agreement, respectively

(e) Purchase of major equipment

(f) Delivery

(g) Fabrication

(h) Utility interruptions

(i) Installation

(j) Work by Owner that may affect or be affected by Seller's activities

(k) Startup and initial operations

(l) Tests and inspections

(m) Training

(8) The Project Schedule shall include Milestones indicated in the Agreement, including, but not limited to, guaranteed Milestone completion dates and any critical milestones. All major milestones shall be presented at the top of the Project Schedule.

(9) The Project Schedule shall show the Work in Gantt chart format, on a sheet size of 11-inch by 17-inch, the scale and spacing shall allow room for notation and revisions, and the font shall be sized such that it is easily legible when printed.

(10) Each revised or updated Project Schedule shall show actual progress compared to the originally accepted Baseline schedule and any proposed changes in the schedule of remaining Work.

(11) The Project Schedule shall clearly identify all critical path activities. Scheduled start and completion dates shall be consistent with Agreement milestone dates.

(12) Seller shall not use artificial activity durations, preferential logic, or other devices for sequestering Float. Owner retains the right to reject any schedule submittal in which Seller has sequestered Float. Any activity with lag greater than two (2) days shall be identified in the activity description.

(13) Constraint dates shall be kept to a minimum, and all constraints shall be identified with descriptive text in the activity description.

(14) All activities shall have a predecessor activity and successor activity except for the first and last activities in the Project Schedule.

(15) Each Project Schedule shall meet the minimum requirements for submittals set forth in Section 3.1 (*General Provisions*

3.3.4 All Work, including construction, materials storage, grading, landscaping, cut/fill, erosion control, and other similar or related activities, shall not extend beyond the designated disturbance areas. Unnecessary disturbance of the existing Project Site conditions shall be minimized, and under no circumstance may Seller perform any Work or cause any disturbance beyond these corridors without explicit written confirmation from Owner.

3.3.5 Existing access to the Project Site, including along public roads, shall remain open throughout construction.

3.3.6 All existing infrastructure, including communications towers, pipelines, telephone lines, and electrical lines, shall be maintained in their current condition throughout the construction of the Project.

3.3.7 Temporary power and utilities must be included by Seller including easements and access need for construction.

3.3.8 Seller shall maintain an office on or close to the site of the Project. These construction office trailers shall be delivered, set-up, furnished and ready to use including power, phone service, internet service, HVAC systems, sewer and restroom facilities and decking by Seller's mobilization date and shall be demobilized after substantial completion has been achieved.

3.3.9 Seller shall provide sufficient space and electrical service in the office complex area for one office trailer for the turbine supplier. Site grading shall include parking space for turbine supplier's personnel.

3.3.10 Seller shall maintain two-way radio communication till substantial completion. Each crew shall have a radio for communications, at all times, effective communication for compliance with the Seller's emergency action plan.

(1) Submittal Requirements) herein.

(2) The Project Schedule shall include allowances for delays that may be encountered for reasonably expected weather conditions, non-working holidays, and other similar items.

(3) Recovery Schedule - A detailed breakdown of the detailed schedule may be requested by Owner as a mitigation plan for a Critical Milestone activity that becomes delayed.

3.3.11 Concurrent with each Project Schedule submittal, Seller shall submit the following reports:

(1) General: electronic copies of the complete Project Schedule file in P6 executable (*.xer) format (including the Project-specific *.plf layout filters) and Adobe (*.pdf) format, respectively.

(2) Critical path report: list of all activities on critical path, sorted in ascending order by activity number.

(3) Activity report: list of all activities sorted by activity number and then start date, or actual start date if known. Within each activity, Seller shall indicate estimated completion percentage in no greater than 10 percent (10%) increments.

(4) Logic report: list of preceding and succeeding activities for all activities, sorted in ascending order by activity number.

(5) Total float report: list of all activities sorted in ascending order by activity number and showing total float by activity.

(6) Three-week look ahead: list of all planned Work activities during the current week and the subsequent two-week interval, sorted in ascending order by activity number.

(7) Tabulated reports and/or schedule layouts showing the following:

(a) Identification of activities that have been added, deleted, or changed

(b) Changes in activity durations in workdays

(c) Changes in total float

(d) Detailed schedule layout showing start and finish date variances

(e) Critical path and near critical path (1 to 15 days float) layout with variances

(f) Major milestone report with variances

(g) Activity constraints, including type

(8) Format for each activity in all reports described above shall contain, at a minimum, activity number, activity description, resource loading, original duration, remaining duration, early finish date, late start date, late finish date (or actual start date and/or actual finish date, as applicable), and total float in calendar days.

3.4 Job Book Requirements

3.4.1 This Section **Error! Reference source not found.** sets forth an outline for the *minimum* contents of the Job Books to be prepared by Seller.

3.4.2 Job Book outline:

(1) **General:**

(a) Index:

1. Job Book index
2. Project Directory
3. Drawing index, including all categories listed under Section 3.4.2(2)(b) below

(b) Schedule:

1. Final Project Schedule
2. Actual delivery schedule of Owner-Supplied Equipment

(c) Seller plans:

1. Safety Plan
2. Security Plan
3. Environmental Plan
4. Project execution plan

(d) Health and safety statistics:

1. Project construction Work hours and statistical information
2. Incident reports, including accidents, thefts, injuries, and near misses

(e) Changes:

1. Project Change Orders
2. Seller correspondence concerning Change Orders

(f) Permits:

1. Owner permits
2. Seller permits
3. Certification of compliance to permit requirements

(g) Training:

1. Project construction training records

2. Copies of training manuals

(h) Reporting:

1. Plan of the day reports

2. Weekly progress reports

3. Monthly progress reports

(i) Contracting:

1. List of Subcontractors used on the Project

2. Summary of all work performed by Subcontractors

3. Copies of all subcontracts for construction services (non-priced)

4. Copies of purchase orders for major equipment

(2) **Drawings and manuals:**

(a) Design documentation:

1. Project Site plan

2. As-built Wind Turbine Generator coordinates

3. Design basis and Project Site data

4. Engineering calculations and design studies

5. Final geotechnical engineering report

(b) Issued for construction drawings:

1. Project Substation (including civil, structural, and electrical)

2. Interconnection Line

3. SCADA System

4. As-Built Drawings, including all items listed under Section 3.4.2(b) above

5. Project bill of materials

6. Correspondence between Owner and Seller, including RFIs

(c) Manufacturer model/serial with manuals and data sheets for all equipment within or a part of the following:

1. Project Substation

2. Interconnection Line

3. SCADA System

4. Project Balance of Plant

(d) Other equipment documentation:

1. Instruction manuals for building systems

2. Equipment factory acceptance test reports

3. Spare parts list

4. Warranty agreements (including contact information) for all Equipment

(e) Material safety data sheets

(3) **Quality assurance documentation:**

(a) Construction photographs:

1. Photographs of construction activities

2. Photographs of Project Site restoration

(b) Civil / structural works:

1. Road base aggregate proctor testing results

2. Road base density testing results

3. Access Road inspection documentation

4. Drainage structure inspection documentation

5. Soil testing results

6. Compaction testing results road subgrade and aggregate base

7. Moisture and density analysis

8. Drainage works (including culverts) inspection reports

9. Concrete mix design(s) and placement procedures

10. Grout mix design(s) and placement procedures, including specification sheets

11. Concrete and grout testing results / reports

12. Concrete batch tickets

13. Trial Batch Testing Report

14. Site Water Analysis Report

15. Batch Plant Scale Certification

16. Crane Pad compaction test results

17. Non-conformance and corrective action reports

(c) Project Substation:

1. Construction inspection documentation

2. Control building/switchgear inspection

3. Main Power transformer factory acceptance test

4. Control Building factory acceptance test

5. Main power transformer foundation installation inspection

6. Equipment foundation excavation, reinforcement, concrete placement, earthing installation, foundation backfilling inspection

7. Concrete cable trenches installation inspection

8. Fences and gates installation inspection

9. Substation yard earthing system installation inspection

10. Final grade level and backfilling inspection of substation yard

11. Relay functionality check

12. Energization and testing procedures

13. Electrical testing and commissioning results, including commissioning checklists

14. Communications validation and IT integration

15. Non-conformance and corrective action reports

16. Switching Procedures

(d) Interconnection Line:

1. Check of the delivered material

2. Check of pole coordinates and orientation

3. Pole drilling, reinforcement placement, concrete placement inspection

4. Pole, insulators and conductor's installation inspection

5. Construction inspection documentation

6. Energization and testing procedures

7. Electrical testing and commissioning results, including commissioning checklists

8. Non-conformance and corrective action reports

(e) <u>Agreement certificates (e.g., Certificate of Access Road Completion).</u>

(f) <u>Other certifications:</u>

1. Reinforcing steel mill certificates

2. Flange bolt certifications

3. Tooling calibration records and testing certificates

4. Rigging inspection reports

5. Welding certifications

6. Equipment receipt, inspection, and inventory reports

(4) **Handover Documents:**

(a) Substation Completion Certificate

(b) Interconnection Line Completion Certificate

(c) Project Substantial Completion Certificate

(d) Project Final Completion Certificate

(e) All the associated punch lists

(f) All certificates of insurance

(g) Any third-party inspection reports

(h) All approved permits and utility permissions

(i) Partial and Final Lien Release Certificates

(j) Set of Project Record drawings

3.5 Quality Plan Requirements

3.5.1 This Section 3.5 sets forth an outline for the *minimum* contents and requirements of the Quality Plan to be prepared by Seller.

3.5.2 Quality Plan outline:

(1) **Overview:**

(a) Purpose and scope of quality assurance program

(b) Description of quality system procedures

(2) **Personnel:**

(a) Roles and responsibilities:

1. Project director(s)
2. Safety manager
3. Project manager
4. Quality manager
5. Environmental manager
6. Construction manager / site manager
7. Project engineer(s)
8. Superintendents and foremen
9. Testers / inspectors (including third parties)

(b) Organization chart (including all personnel listed in Section 3.5.2(2)(a) above)

(c) Reporting responsibilities:

1. Lines of authority
2. Communication procedures
3. Authority to stop work

(3) **Administration:**

(a) Document control:

1. Document control plan / procedure

2. Transmittal process, including naming convention

3. Document revision process / change management

4. Redlines and as-built documents

(b) Routine documentation procedures:

1. Daily, weekly, and monthly reporting

2. Incident reporting

3. Non-conformance reports

4. Technical clarifications / requests for information

5. Notice of design change process

6. Field design change process

7. Request for Information (RFI)

(c) Personnel training:

1. Requirements (competency / certification)

2. Records

(d) Quality meetings

(4) **Inspections, testing, and non-conformance:**

(a) Audits:

1. Schedule of audits

2. Audit personnel

3. Non-conformance reports

(b) Inspections (including frequency, duration, procedures, and documentation for each):

1. Tools and equipment

2. Materials

3. Field work (e.g., civil works, electrical works, structural works)

4. Field tests and laboratory qualifications

5. Checklists and installation procedures

(c) <u>Non-conformance reporting</u>

(d) <u>Issues / conflict resolution process</u>

(5) **Sample forms:**

(a) Non-conformance report

(b) Request for information

(c) Transmittal

(d) Inspections

3.5.3 Other Quality Plan requirements:

(1) The Quality Plan shall be specific to the Project and the Project Site.

(2) The Quality Plan shall be sufficient in scope and detail to convey the means and methods that will be employed by Seller to perform all aspects of the Work.

(3) The Quality Plan shall clearly communicate the anticipated actions of Seller in the event of defects or non-conformance of the Work, including corrective action.

3.6 Safety Plan Requirements

3.6.1 This <u>Section **Error! Reference source not found.**</u> sets forth an outline for the *minimum* contents and requirements of the Safety Plan to be prepared by Seller.

3.6.2 Safety Plan outline:

(1) **General:**

(a) Purpose and scope of safety program

(b) Project Site description

(c) Project Site map

(d) Roles and responsibilities / key personnel / contact information

(2) **Project Site rules:**

(a) Project Site / employee orientation

(b) Project Site- and task-specific training

(c) Stretching program

(d) Firearms / weapons

(e) Motor vehicle operation qualifications and requirements

(f) Heavy equipment operation qualifications and requirements

(g) Substance abuse program

(h) Removal of employees

(i) Subcontractor management

(j) Badging requirements

(k) Tours / third-party visits

(l) Disruption avoidance plan

(m) Incident notification procedures

(3) **Emergency procedures:**

(a) Safety stand-down procedures

(b) Explosion procedures

(c) Severe weather procedures

(d) Bomb threat procedures

(e) Utility emergency procedures

(f) Civil disturbance procedures

(g) Tower rescue procedures

(h) Snake / insect bite and dangerous animals

(i) Spill control and prevention plan

(j) Evacuation procedures

(k) Emergency route map

(l) Emergency contacts and first responder list

(4) **Health and safety programs:**

(a) Job safety and environmental analysis ("**JSEA**") program / pre-task planning

(b) Toolbox talks

(c) Personal protective equipment ("**PPE**") requirements

(d) Fire prevention and suppress procedures

(e) Fall protection program

(f) Material Handling and Storage

(g) Welding and Cutting

(h) Walking / working surfaces

(i) Stairways and Ladders

(j) Scaffold standards

(k) Tower climbing program

(l) Crane and erection safety program

(m) Crane walking procedures

(n) Excavation and trenching program

(o) Hazard communication / hazardous materials program

(p) Electrical safety

(q) Lockout / tagout ("**LOTO**") program

(r) Motor vehicle and traffic safety program

(s) Respiratory protection program

(t) Concrete safety program

(u) Confined space entry program

(v) Inspection / audit program

(w) Incident / injury reporting and investigation program

(x) Hand and power tool safety program

(y) First aid / CPR / medical response program

(z) Bloodborne pathogens

(aa) Permitted work requirements

(bb) Blasting requirements

(cc) Competency requirements

(dd) Hunting safety

(ee) Environmental program

(ff) Working on or near exposed energized parts

(gg) Deenergizing lines and equipment for employee protection

(5) **Required checklists and forms:**

(a) Accident / injury / incident report forms

(b) Site orientation training verification form – employee

(c) Site orientation training verification form – visitor

(d) Stretch and bend sign-in form

(e) Safety audit checklist

(f) Site inspection forms

(g) Critical lift planning forms and checklists

(h) Excavation inspection form

(i) Competency evaluation forms

(j) JSEA form

(k) Toolbox talk form

(l) Rigging inspection forms

(m) Hazardous materials inventory form

(n) Heavy equipment inspection forms (daily, monthly)

(o) Heavy equipment operator certification form

(p) Respirator compliance checklist

(q) Respirator fit test certification form

(r) Form of LOTO permit and extraction form

(s) Form of hot work permit

(t) Form of dig permit

(u) Form of blasting permit

(v) Form of confined space entry permit

3.6.3 Other Safety Plan requirements:

(1) The Safety Plan shall be specific to the Project and the Project Site.

(2) Seller is responsible for creating an energization and de-energization plan for safe operation. The Seller shall coordinate with all applicable parties to coordinate the energization plan. Site safety plans shall detail the process, roles, and responsibilities related to the energization procedure.

(3) Energization and de-energization plans shall be submitted to the Owner for review no less than 30 Business Days before the energization date. The Seller shall hold a meeting with all applicable parties before energization to walk through the energization/de-energization plans.

(4) The Safety Plan shall be sufficient in scope and detail to convey the means and methods that will be employed by Seller to perform all aspects of the Work.

(5) Seller shall be responsible to establish coordination with locally available hospitals and medical facilities to ensure that they will be supporting the project site for nay emergency needs. These details should be part of the site safety plan.

(6) All rigging shall be rated; inspected daily and monthly; and load tested in accordance with the Applicable Standards or other more rigorous requirements set forth in the Safety Plan. The manufacturer-rated capacities shall be legible and permanently affixed. Inspection reports shall be maintained at the Project Site and available for review by Owner. Copies of testing certificates and calibration records for all tooling shall be maintained at the Project Site and available for review by Owner.

(7) Seller shall conduct daily job hazard analysis meetings for each task to be performed in order to identify and mitigate potential hazards prior to beginning Work. Each such meeting shall be specific to the task and shall be conducted at the respective work area. A job hazard analysis form shall be completed daily for each such meeting.

(8) Seller shall conduct site safety orientation (approximately 2-3 hours) for all personnel working on the Project Site, including, but not limited to, Owner, Turbine Supplier, subcontractors, office personnel, and visitors, prior to their being released to work on the Project Site. In addition, there shall be a delivery driver orientation given to all delivery drivers that will visit the site. Personnel who have not attended the site safety orientation and environmental awareness training shall have escorted access around the project site.

(9) Seller shall provide two (2) full-time safety representatives at all times till the final completion of the project. In periods of low activity, these two HSE representatives will be on site on a standby basis. Seller will provide additional safety staff based on the number of employees on site. Seller shall, in all cases where the Seller, or Subcontractor(s) perform any Work during extended or weekend hours, have an HSE representative on-Site till such Work is completed.

(10) HSE representative should have a degree in Health and Safety or equivalent safety experience. Shall be fully dedicated to health and safety with at least half of their time being in the field to ensure adherence with the site safety plan is maintained. Shall have working knowledge of OSHA regulations as well as other applicable agencies related to safe work practices.

(11) Seller shall provide the Owner the weekly hours, number of orientations and incidents for the week on a weekly reporting schedule.

(12) Seller shall conduct daily safety plan of the day meeting at the beginning of each shift including a stretch program, which will occur at the office compound prior to dispatching to site work locations. This meeting can be completed in break-out groups by trade at the respective hob sites. Seller shall conduct a weekly all hands site safety meeting that includes all employees of each Seller for the entire site.

(13) Seller shall document weekly site health and safety inspections with all the corrective actions. Seller shall implement a documented audit program per quarter.

(14) Seller shall establish a Health and Safety Committee consisting of the EPC/BOP Seller and Subcontractor's employees other than management personnel. The committee shall meet at least once per week and document meeting minutes and actions.

(15) Seller shall establish a weekly Site Safety Managers Meeting with published meeting minutes and actions. This meeting shall include the health and safety representatives from each Seller on site.

(16) Seller shall report incidents to Owner's Site Safety Representative as soon as practically possible either verbally or electronically. Seller shall perform follow-up written incident investigations that will include recommended corrective actions within forty-eight (48) hours from incident occurrence and submit the investigation report to the Owner. Final reports are due to the Owner no later than ten (10) days after the incident.

(17) Seller shall liaise and coordinate with local emergency services, including coordination with local "life flight" to identify landing sites available for helicopter emergency evacuation of personnel. Seller will develop a written Emergency Management Plan (EMP) which shall include at a minimum injury response, environmental and weather risks. Two safety evacuation drills shall be conducted, one during early works and another prior to the completion of five (5) wind turbines. A report of these drills shall be submitted to Owner which shall include, at a minimum, a timeline of events and any areas that may need improvement.

(18) Seller shall perform all necessary emergency response drills, to be performed at least quarterly, including coordination with local emergency response officials and hospitals and incorporating the dispatch of ambulance and life flight to the Project Site.

(19) Seller shall immediately report all near misses, accidents, thefts, injuries (including first aid), and safety incidents to Owner's site manager and health and safety representative(s). A written incident report shall be submitted to Owner within 48 hours of each incident.

(20) Seller shall provide all necessary safeguards to ensure safety and security of, at a minimum, the Project Site, equipment, and personnel at the Project Site.

(21) Seller shall ensure medical and first aid. Review all Federal and State regulations for first aid kit and AED inspection and/or registrations. All sites shall have AEDs and personnel trained in their operation.

(22) Seller shall provide drug and alcohol testing for all injuries requiring more than first aid; if drug or alcohol use is reasonably suspected; in the event of equipment damage . Drug and alcohol testing shall be performed as soon after the event as reasonably possible.

(23) Training records shall be retained by the Seller for the duration of construction.

(24) Seller shall provide training for the following but not limited to, site evacuation and emergency awareness training, fall prevention awareness training, mobile equipment training, energy isolation training, confined space training, forklift training and reporting requirements.

(25) Seller shall conduct environmental Orientation shall be of an appropriate length (approximately 1 hour). This orientation shall include at the minimum, overview of the environmental regulatory obligations, including relevant site permits, review of the flora, fauna and archaeological restrictions and housekeeping and recycling requirements.

3.7 Cybersecurity Requirements

General Security Criteria

1. Please confirm you have and maintain security controls to protect the Company's networks, systems, software, Confidential Information, and Data no less rigorous than those set forth in the latest published version of ISO/IEC 27001 – Information Security Management Systems–Requirements and ISO/IEC 27002 – Code of Practice for International Security Management.

2. If providing a web portal or web service, please confirm that web services use HTTPS/TLS version 1.2 or later for all content.

3. Please confirm you encrypt all Company data while at rest as well as when in transit over the network.

4. Please confirm that all Company-related file transfers are encrypted while at rest as well as when in transit over the network.

5. For responses above, please confirm all encryption uses NIST-approved algorithms and key lengths.

6. Please confirm you support federated single-sign-on (SSO) authentication for any Company accounts, whether via web interface or mobile application. You must have the ability to support Azure Active Directory.

7. If you do not support federated single-sign-on (SSO) authentication, please confirm that Accounts provided by you support multi-factor authentication compliant with NIST SP 800 63-3 Authentication Assurance Level 2. Provide documentation that supports compliance and describe supported authentication mechanisms.

8. Please confirm, by provision of supporting documentation, that email sent while under the Contract to the Company by you or by any service: Originates from a domain(s) with a published Domain-based Message Authentication, Reporting and Conformance (DMARC) policy of "reject" and with a published Sender Policy Framework (SPF) policy consisting of valid senders and a "fail" directive (-all). If the optional DMARC "pct" directive is used, "pct" must be set to "100".

9. Please confirm, by provision of supporting documentation, that email sent while under the Contract to the Company by you or by any service passes a Domain-based Message Authentication, Reporting and Conformance (DMARC) authentication check.

10. Please confirm, by provision of supporting documentation, that email sent while under the Contract to the Company by you or by any service is signed by a DomainKeys Identified Mail (DKIM) 2048 bit key.

11. Please confirm, by provision of supporting documentation, that email sent while under the Contract to the Company by you or by any service supports Transport Layer Security (TLS).

12. Please describe your process to disclose known vulnerabilities to the Company related to products or services provided as they pertain to the proposed service.

13. Please describe methods supplied to the Company to verify software integrity and authenticity for any software or patches provided by you as they pertain to the proposed service.

14. Please describe your process for security event monitoring and notification/alert/response plans, including response to security incidents affecting the Company.

15. Please confirm you will notify the Company of a security incident as soon as practicable, but no later than 48 hours after discovery.

16. Please confirm you will coordinate responses to security incidents with the Company that pose a security risk to the Company.

17. Please confirm that all rights to any data provided by the Company shall remain exclusive property of the Company.

18. Please confirm you will not share data with third parties for unrelated commercial purposes, such as advertising or advertising-related purposes.

19. If remote access of any type will be required as part of the service, please fully describe your requirements for remote access.

20. If remote access of any type will be required as part of the service, confirm your ability to conform to Company requirements for intermediate host methods for remote access, such as Citrix or Virtual Desktop,

21. If remote access of any type will be required as part of the service, and if a virtual private network is required, please confirm your ability to terminate in a demilitarized zone network (DMZ). Note that direct virtual private network connectivity to Company corporate networks is always prohibited.

22. If remote access of any type will be required as part of the service, confirm that you will notify the Company when remote or on-site access is no longer needed by your representatives, where applicable.

23. Please list facilities proposed in bid located outside the continental United States.

24. Please list any support staff used during the term of this contract located outside the continental United States.

25. Please confirm you will disclose third parties upon which you depend to deliver the Company offering (such as third-party software, implementation, hosting, for example).

26. Please describe your methods to securely ship and deliver products to the Company as they pertain to the proposed service.

For Hosted or Cloud Services:

27. If your service is comprised in whole or in part of a cloud-based or hosted services solution, please confirm you currently undergo, or are willing to undergo, annual Statement on Standards for Attestation Engagements (SSAE) Service Organization Control (SOC) 2 Type 2 audits ("Audit") for your enterprise or covering the scope of services for the term of the contract with the Company, as appropriate. Note that a datacenter audit alone will not be sufficient. You may include an audit for datacenter/colocation provider for informational purposes.

28. If your service is comprised in whole or in part of a cloud-based or hosted services solution, please confirm that your administrative access complies with NIST SP 800 63-3 Digital Identity at Authentication Assurance Level 2 or higher, where compromise of one factor does

not contribute to compromise of the other factor. Provide compliance documentation and describe supported authentication mechanisms.

3.8 Security Plan Requirements

3.8.1 This Section 3.7 sets forth an outline for the *minimum* contents and requirements of the Security Plan to be prepared by Seller.

3.8.2 Security Plan outline:

(1) General:

(a) Purpose and scope of security program

(b) Project Site description

(c) Project Site map

(d) Roles and responsibilities / key personnel / contact information

(2) Project Site security procedures:

(a) Controlled entry procedures

(b) Badging requirements

(c) Site / employee orientation

(d) Suspicious activity and unauthorized visitor procedures

(e) Security threats / emergency procedures

(f) Firearms / weapons

(g) Site security procedures

(h) Equipment security procedures

(i) Security guards and patrols

(j) Incident notification procedures

3.8.3 Other Security Plan requirements:

(1) The Security Plan shall be specific to the Project and the Project Site.

(2) The Security Plan shall be sufficient in scope and detail to convey the means and methods that will be employed by Seller to perform all aspects of the Work.

(3) Seller shall provide site passports to all project personnel for identification and daily site population tracking purposes. Site personnel shall keep their passports on their person at all times while onsite.

(4) All visitors shall check in with and receive a visitor pass from Security prior to entering the compound area. All visitor passes shall be returned to Security at the end of each day.

(5) A security office shall be located at the compound entrance and supplied with electricity and appropriate toilet facilities as required. The location of the security office shall allow for the security officer to view all persons entering and exiting vehicles without impeding traffic flow. Seller shall ensure that the Security Officer shall be provided a radio, cell phone and a vehicle.

(6) Seller, and Subcontractors shall ensure that their vehicles except for rentals on site temporarily, have placards or company insignias.

3.9 Foundation Inspection Reports

3.9.1 A Foundation Inspection Report shall be provided for each excavation and every drilled pier constructed (if any). Each report shall include the following minimum information:

(1) Information on the foundation excavation, including, but not limited to, date, ambient air temperature, line name, structure number, location, structure type, foundation type, size and condition (e.g., dry excavation, casing, slurry) of excavation, soil conditions, depth to rock, depth to water, and method of disposal of excavated/displaced material.

(2) Concrete and concrete placement information, including, but not limited to, concrete supplier, concrete mix number, batch tickets (including batch time), number of cubic meters placed (including time of placement for each truck), concrete temperature, results of concrete testing, name of person performing concrete testing, number of test cylinders cast, placement and compaction method (e.g., free fall, tremie, slurry displacement, pumped), curing measures, and protection against freezing or heat.

(3) A delivery ticket shall be prepared for each load of concrete delivered, including, but not limited to, the number of cubic meters delivered, the quantities of each material in the batch, the ambient temperature at the time of delivery, the time at which the cement was added, the amount of water able to be added at the pour site, and the numerical sequence of the delivery. The delivery ticket shall be handed to the authorized representative of Seller by the truck operator at the time of delivery, and a copy of each delivery ticket shall be included in the Foundation Inspection Report.

3.10 Rigging and Tooling

3.10.1 All rigging shall be rated; inspected daily and monthly; and load tested in accordance with the Applicable Standards or other more rigorous requirements set forth in the HSSE Plan (as defined in this specification). The manufacturer-rated capacities shall be legible and permanently affixed. Inspection reports shall be maintained at the Project Site and available for review by Owner.

3.10.2 Copies of testing certificates and calibration records for all tooling shall be maintained at the Project Site and available for review by Owner.

3.11 Fencing, Walls, and Gates

3.11.1 All permanent fencing and gate materials shall be galvanized in accordance with ASTM A392.

3.11.2 Unless stated otherwise, fencing shall be 8-foot-high (7-foot fence plus 1-foot barbed wire), anti-climb, chain link, perimeter fencing. Fencing fabric shall be woven into a 2-inch galvanized diamond mesh.

3.11.3 Barbed wire shall be a minimum of 2-strand, #12-1/2 steel wire gauge with 4 half-round barbs of #14 steel wire gauge at 5-inch spacing. After weaving, the wire shall be galvanized per ASTM A121. Barbed wire fencing posts shall be galvanized, standard-weight steel pipe. At least three (3) lines of barbed wire shall be provided when used.

3.11.4 Unless stated otherwise, or as necessary to complete the Work, gate widths shall be consistent with road widths, wherein all gate posts shall be set outside of the road width area.

3.11.5 Sufficient space and graded area shall be provided near each gate to allow truck turning.

3.11.6 All corner posts and gate posts shall be set (embedded) in concrete.

3.11.7 All gates shall be designed to adequately contain livestock without being pushed open, bending, or otherwise failing. Further, all gates shall be designed to adequately prevent opening due to wind conditions expected at the Project Site.

3.11.8 A gate shall be installed at every location where a roadway penetrates an existing fence line at the Project Site. Each such gate shall be a double-hung, prefabricated, finished metal gate. Each such gate shall be a minimum 40-feet-wide manual swing gate during construction and downsized to 20-feet-wide swing gate for operations with a pipe frame and manufacturer’s standard coating finish; complete with hinges and latching hardware; complete with a metal hinge post and removable center post; lockable; and each gate post shall be a heavy metal square or round set in concrete.

3.11.9 Cattle guards shall cover the full road width and be installed level and provided with a stable base capable of sustaining heavy loads without shifting or settling.

3.12 Signage

3.12.1 The Seller shall erect directional and access signage on each access road intersection in accordance with the Seller’s traffic management plan

3.12.2 Temporary signage shall be legible and of sufficient durability to last the duration of construction activities.

3.12.3 Temporary signage shall be approved by Owner prior to installation.

3.12.4 All signage and equipment marking (including numbering and labeling) are subject to approval by Owner.

3.13 Dust Control

3.13.1 Water used for dust control shall be treated to ensure no negative impacts to human health and ecology, including downstream environments.

4.0 GEOTECHNICAL WORK SPECIFICATIONS

4.1 General Provisions

4.1.1 All geotechnical, geophysical, and other similar subsurface investigations and testing described herein shall be completed before commencing the applicable Work.

4.1.2 The geotechnical engineering report shall be utilized for the design and construction of all Project structures. All foundations shall be designed with consultation of a licensed geotechnical engineer.

4.1.3 The maximum loads (including load factors) applied to the foundations and used for design shall be determined from the structure design of the supported structure considering load cases and Applicable Standards associated with the particular structure type.

4.1.4 Foundation designs shall neglect or degrade soil strength properties at the top of the foundation as a result of frost or disturbance during drilling per recommendations of the geotechnical engineer.

4.1.5 The Project Site premises shall at all times remain free from accumulations of waste materials or rubbish resulting from the subsurface investigations.

4.1.6 All field investigations and all laboratory testing shall comply with the Applicable Standards, including the most current, applicable ASTM standards.

4.2 Field Investigations

4.2.1 Geotechnical borings and material sampling shall be provided at the following minimum frequencies:

(1) Coordinated with the Project Site requirements for Wind, Solar and BESS.

(2) Project Substation: minimum of five (5) locations at the Project Substation.

(3) Interconnection Line: each angled and dead-end structure, respectively, as well as any additional borings and samplings necessary to ensure that adjacent borings are no more than one (1) mile apart.

4.2.2 Geotechnical borings and material sampling shall be provided at the following minimum depths:

(1) All borings: minimum depth of 35 feet below base of foundation, or greater if specified below.

(2) Project Substation: to a minimum depth necessary to provide sufficient information for the data and recommendations required in the geotechnical engineering report.

(3) Interconnection Line: to a minimum depth necessary to provide sufficient information for the data and recommendations required in the geotechnical engineering report.

4.2.3 Sufficient rock core samples shall be obtained from each boring to adequately characterize and test the material, including coring from the point at which competent rock is encountered and until the appropriate boring depth is achieved (at a minimum). All core samples shall be delineated and digitally photographed in color. Unaltered rock core samples shall be placed in a core box and taken to a laboratory for analysis.

4.2.4 Additional geotechnical and geophysical investigations shall be performed as necessary to adequately describe and characterize the Project Site materials and provide the data and recommendations required in the geotechnical engineering report. These shall include, but not be limited to, standard penetration tests, and Shelby tube samples, additional borings, test pits, seismic refractions, cone penetrometer soundings, *in situ* testing, and other similar or related methods.

4.2.5 If using rock anchor foundations, a rock analysis shall be performed to identify the presence of fissures, rock joints, or other discontinuities that will control the overall strength of the rock mass, including, but not limited to, rock mass rating, rock classifications, depth of overburden, rock quality designation, joint spacing and orientation, stratifications, rock material strength, and water pressure in joints.

4.2.6 Soil resistivity testing shall be completed using the Wenner Four-Electrode method.

4.2.7 Existing utilities in the vicinity of borings or other subsurface test locations shall be identified and protected.

4.2.8 Borings shall be backfilled with cement-bentonite grout and in a manner and with materials required under the applicable laws of the location of the Project Site. Excess cuttings shall be disposed of by Seller in accordance with the applicable Requirements and subject to Owner approval.

4.2.9 Borings shall be drilled using methods that minimize the potential for disturbance, sloughing or mixing of materials within samples. When water is encountered in a hole in cohesionless materials, rotary wash drilling methods with bentonite or polymer slurry shall be used, maintaining a positive head in the borehole at all times.

4.2.10 Unless explicitly stated otherwise, all rock core sampling shall be complete, full-boring-length samples. Such coring shall span from the point at which competent rock is encountered and until the appropriate boring depth is achieved (at a minimum).

4.2.11 All core samples shall be delineated and digitally photographed in color. Unaltered rock core samples shall be placed in a core box and taken to a laboratory for analysis.

4.2.12 Seller shall obtain 24-hour water level readings in boreholes or install piezometers for long-term water level readings as required to determine prevailing groundwater levels.

4.2.13 A geologic review should consist of a review of the geologic data along the Project alignment. This review should identify and document areas of landslides, potential landslides, potential geologic hazards, past (historical) earth movements, and transitions between geologic units. Special consideration should be given to identify active and potential landslide zones.

4.3 Lab Testing

4.3.1 All testing described herein shall be performed by an independent, experienced third party.

4.3.2 Laboratory testing shall be sufficient to provide the data and recommendations required in the geotechnical engineering report, at a minimum. Laboratory testing shall include chemical testing to evaluate corrosion potential and to determine the required cement type for concrete.

4.3.3 At a minimum, laboratory testing shall include the following:

(1) Moisture content (ASTM D2216).

(2) Grain size analysis (per ASTM D422).

(3) Atterberg limits (per ASTM D4318).

(4) Maximum soil density (per ASTM D4253).

(5) Specific gravity (per ASTM D854).

(6) Compaction characteristics of the soil (per ASTM D698 or ASTM D1557 A).

(7) Unit weight determination (per ASTM D653).

(8) Core recovery percentage and rock quality designation when rock is encountered.

(9) Perform multi-channel analysis of surface wave tests.

(10) Soil resistivity testing (per ASTM-G57-95a). Results to be submitted in **Ω**-cm.

(11) Direct shear angle.

(12) Cohesion constant.

(13) Unconfined compressive strength (per ASTM D2166).

(14) Unconsolidated undrained (UU) triaxial compression (per ASTM D2850).

(15) Consolidation test parameters (per ASTM D2435).

(16) Soil corrosiveness (chloride, sulfate, and pH).

(17) California bearing ratio.

(18) Dry and wet densities.

4.4 Submittals

4.4.1 The geotechnical engineering report shall contain the following, at a minimum:

(1) Boring location drawings and coordinates.

(2) Field photographs.

(3) Description of the drilling and sampling program.

(4) Final boring logs.

(5) Description of the geology.

(6) Subsurface and groundwater conditions encountered.

(7) Summary of results of field and laboratory tests performed.

(8) Foundation recommendations (as further described in Section 4.4.2 below).

(9) Specific design criteria for the Project (as further described in Section 4.4.2 below).

4.4.2 Seller's design criteria shall address the following items, as a minimum:

(1) Impacts of new construction on existing facilities.

(2) Factors of safety used in determining allowable foundation loads.

(3) Recommended foundation types for all structures.

(4) Discussion of the dynamic soil properties at the Project Site, including dynamic shear modulus, Poisson's ratio, Young’s Modulus, and shear wave velocity.

(5) Recommendations for designing for seismic issues, including liquefaction potential. Identify the building code site coefficient/site classification for seismic design.

(6) Recommendations for site dewatering and construction practices, including design water level.

(7) For shallow foundations:

(a) Allowable soil bearing values and minimum bearing depths.

(b) Anticipated total and differential settlements.

(c) Uplift resistance.

(d) Lateral resistance.

(e) Subgrade modulus.

(f) Dynamic spring constants for foundations supporting vibrating machines, if applicable.

(8) For deep foundations:

(a) Type of deep foundation (e.g., drilled shaft, rock anchor).

(b) Diameter (or dimensions) and depth of foundation members.

(c) Minimum spacing and group reduction factors.

(d) Allowable compressive, uplift, and lateral capacities, including allowable skin friction and end bearing capacities.

(e) Anticipated settlements and lateral deflections.

(f) Static and dynamic spring constants.

(9) For retaining structures:

(a) Active, passive and at-rest earth pressures for both drained and undrained conditions and requirements for type of backfill.

(b) Required rotation or translation to mobilize active and passive pressures.

(c) Recommendations of methods to insure drained conditions.

(10) Recommendations for slopes:

(a) Temporary excavation slopes and OSHA soil types.

(b) Permanent slopes.

(11) Temporary and permanent excavation support requirements.

(12) Corrosion potential and chemical attack to construction materials.

(13) Recommended cement type in concrete and corrosion protection for buried steel, based on chemical test results. Recommended cement type shall be based on soluble sulfate content in the soil and ACI recommendations.

(14) An evaluation of the expansive, dispersive, and collapsing nature of the on-Site soil materials and discussion of design features to resist these tendencies.

(15) Recommendations for earthwork requirements including acceptable fill materials, moisture contents, compactive effort, lift thickness, proofrolling, equipment, and compaction testing.

(16) Recommended aggregate gradations for general fill, load bearing fill, granular road base, and granular surfacing.

5.0 CIVIL WORKS SPECIFICATIONS

5.1 General Provisions

5.1.1 Seller is responsible for all surveying, layout and control work, including establishing and maintaining survey control points for the duration of the Work and conforming to the Seller provided ALTA survey.

5.1.2 Seller shall be using the excavated topsoil and excavated material for final dressing of the site. Any additional topsoil, vegetation, organic material, rock, earth, sand and debris shall be removed and disposed by the Seller as per approved procedures and permit requirements. Soils shall not be relocated throughout the project site, unless approved by Owner.

5.1.3 Seller is responsible for restoring all temporarily disturbed areas prior to the completion of the Work. This shall include all crane paths, crane pads, lay down areas, storage areas, road shoulders, collection system trenches, temporary access roads, etc. which should be fully remediated including decompaction as necessary.

5.1.4 Seller is responsible for ensuring, in agricultural areas (wheat, hay, and other actively farmed fields), that all backfill areas impacted by the Work are free of rock to a minimum depth per landowner and environmental agreements.

5.2 Design Working Life

5.2.1 The design working life of the civil works shall be a minimum of 30 years.

5.2.2 The design of the civil works shall be consistent with the following storm events:

(1) Roadways (including all drainage facilities, such as swales and culverts) shall be designed for a 25-year, 24 hours storm event, while being able to safely convey a 100-year, 24 hours storm event.

5.3 Project Site Preparation

5.3.1 Project design shall consider existing Project Site conditions with respect to, at a minimum, soil characteristics, permit conditions, site clearing, grading, and drainage including existing floodplains and floodways.

5.3.2 Clearing and grubbing requirements:

(1) Clearing, grubbing, removing and disposing of all vegetation and debris shall be understood to include felling and disposal of trees, brush, and other vegetation within the project limits as shown on the design drawings or as designated by the Owner

(2) Verify limits of clearing and features designated to remain, are clearly labeled and tagged prior to start of work; resolve any areas of confusion prior to start of work.

(3) Stripping shall be understood to consist of excavation and removal of all topsoil and organic matter.

(4) Topsoil shall be stockpiled for later use during landscape reclamation activities. Topsoil shall be stockpiled only in areas designated where it will not interfere with construction operations or existing facilities. Stockpiled topsoil shall be reasonably free of subsoil, stumps, roots, debris, and stones larger than two (2) inches in diameter. Topsoil shall not be used as structural fill. Appropriate erosion control measures shall be utilized on stockpiled topsoil. If the topsoil strata are such that there are more than 2 distinct layers impacted, then each layer shall be stockpiled separately and returned in reverse order, unless agreed upon in writing with Owner.

(5) Debris, rubbish, shrubs, organic matter, and vegetation from developed areas shall be grubbed and removed from the Project Site in accordance with applicable permit instructions and other pertinent Requirements. Burning or burying of materials on site shall not be permitted unless otherwise specified. No fill shall be placed in wetlands, environmentally or culturally sensitive areas unless a permit/approval has been received to do so.

(6) Root mats and stumps shall be completely removed from the Project Site construction areas, holes refilled with select material and compacted adequately for the ultimate expected loading for the material used and graded to drain. Any pockets of organic laden soils, and/or deleterious materials should be excavated to competent soils before proof rolling and placing structural fill.

(7) Except in areas to be excavated, backfill stump holes and other holes from which obstructions are removed, with suitable materials, and compact in accordance with contract documents.

5.3.3 Removal of or damage to trees without written approval of Owner is prohibited outside the designated disturbance areas. Trees shall be adequately protected, including protecting tops, trunks, and roots of existing trees at the Project Site which are to remain, as follows:

(1) Box, fence around, or otherwise protect trees before any construction Work is started.

(2) Do not permit heavy equipment or stockpiles within branch spread (dripline) of trees.

(3) Trim or prune to obtain working space in lieu of complete removal when possible. Conduct operation as follows:

(a) With experienced personnel.

(b) Conform to good horticultural practice.

(c) Preserve natural shape and character.

(d) Protect cuts with Owner-approved tree paint.

(4) Grade around trees as follows:

(a) Trenching: where trenching is required around trees which are to remain, avoid cutting the tree roots by careful hand tunneling under or around the roots. Avoid injury to or prolonged exposure of roots.

(b) Raising grades: where existing grade at a tree is below the new finished grade and fill not exceeding 15 inches is required, place 1 to 2 inches of clean, washed gravel directly around the tree trunk. Extend gravel out from trunk on all sides at least 20 inches and finish 2 inches above finished grade at tree. Install gravel before earth fill is placed. Do not leave new earth fill in contact with any tree trunks.

(c) Lowering grades: re-grade by hand to elevation required around existing trees in areas where new finished grade is to be lower. As required, cut the roots cleanly 3 inches below finished grade, and cover scars with tree paint.

(5) Remove when damage occurs and survival is doubtful, following approval by Owner.

(6) Replace with similar item when damaged through carelessness and so requested by Owner.

5.3.4 All underground utilities, pipelines, and other buried facilities shall be located and marked before construction activities, and such items shall be appropriately considered in the Project design.

5.4 Blasting

5.4.1 Blasted material shall be crushed and screened for use as fill on access roads and in other areas of the Project Site assuming the aggregate meets the appropriate geotechnical specifications for this application. Seller shall be responsible for verifying that the quantity and quality of such rock is suitable for use as aggregate at the Project Site.

5.4.2 Controlled blasting will be used to create a precise rock profile without significant final surface irregularities.

5.4.3 Owner shall be notified prior to the use of explosives at the Project Site, and such blasting shall be completed, at a minimum, in accordance with the applicable permits and Seller-furnished blasting plan.

5.4.4 Seller shall prepare blasting plans and procedures for all blasting work to be performed at the Project Site, as required. Such plans and procedures shall include, at a minimum, a description of safety buffer zones, parameters for blasting times during the day and approved certification as required from the authority having jurisdiction, technical report to define detailed parameters, define blast hole alignment, locations, diameters, quantity required, drilling slope and depth, type of explosive, quantity of explosive, blasting sequence, features of fuses, detonators, delayers, triggers and any other special devices.

5.4.5 When the use of explosives is necessary for the Work, Seller shall use the utmost care not to endanger life or property and shall comply with all applicable laws and other Requirements and conduct the necessary advance notifications.

5.4.6 Under no circumstance shall caps or other exploders or fuses be stored, transported, or kept together with powder.

5.4.7 All explosives shall be handled in a secure manner, and all such storage places (if permitted) shall be marked clearly "DANGER - EXPLOSIVES" or as otherwise required by law.

5.4.8 All permits and licenses required for blasting shall be obtained, paid for, and maintained by Seller.

5.4.9 Blasting shall be performed only by persons who are qualified, competent, and thoroughly experienced in the use of explosives for rock excavation.

5.4.10 Charge holes shall be located properly and drilled to correct depths for charges used.

5.4.11 Charges shall be limited in size to the minimum required for reasonable removal of material by excavating equipment.

5.4.12 Excessive overbreak or damage to adjacent structures, exposed cut slopes, equipment, utilities, or buried pipeline and conduit shall be avoided as follows:

(1) With properly designed pattern.

(2) By use of Owner-approved explosion mats.

5.4.13 Blasting near utilities, pipelines, or facilities (buried or above-ground) shall be subject to approval of owning agency and Owner.

5.4.14 Before delivery of any explosives to the Project Site, Seller shall have obtained a blasting endorsement on their public liability and property damage insurance policy.

5.4.15 Seller shall control debris resulting from blasting, including minimizing, to the extent practicable, the size of said debris. Seller shall use the utmost care not to endanger life or property, and to comply with all applicable laws and conduct the necessary advanced notifications.

5.4.16 Blast mats shall be utilized as required in sensitive areas, including, but not limited to, archeologically sensitive areas, environmentally sensitive areas, existing Project Site facilities, and other Project infrastructure.

5.5 Excavation, Filling, and Backfilling

5.5.1 Different types of excavations based on the type and consistency of soil and rock are provided by the design and/or as requested by Owner. The Seller shall provide his own excavation plan for any excavation activity and shall submit it to Owner for approval before commencing any work. The excavation plan shall contain all the relevant information detailing the means, procedures and scheduling to implement the excavation activities, any environmental conditions and geotechnical characteristics. The Seller shall update the excavation plan as the work progresses.

5.5.2 The excavation plan for all working locations shall include the excavation procedure, type and transport of all the earthmoving equipment, any type of shoring or reinforcement that may be needed for supporting the excavation walls, drainage measures and procedures, blasting procedures, stockpiling and storage procedures for reusable excavated material, detailed work schedule.

5.5.3 Stability of excavation sides shall comply with local codes, ordinances and requirements of agencies having jurisdiction. Shore and bracing are permitted in case of space restrictions or depending on stability of the excavated material. Remove shoring carefully to prevent caving or collapse of excavation. The sides and slopes of the excavation shall be maintained in safe condition until backfilling is complete.

5.5.4 Materials suitable for use as fill at the Project Site shall include only materials that are free of debris, roots, organic matter, frozen matter, coal, ashes or cinders, and as recommended by the geotechnical engineering report.

5.5.5 All excavations shall be maintained in a safe, clean, and sound condition up to the time of concrete placement. The stability of all excavations shall be maintained by providing adequate sheeting, shoring, and bracing to support any lateral earth pressure. Stability considerations shall include the surrounding land surfaces that may impact the Project or nearby improvements. Sheeting, shoring, and bracing shall be removed as backfilling proceeds.

5.5.6 Permanent slope and rock stability measures shall be part of the Project design and shall incorporate the recommendations and requirements set forth in the geotechnical engineering report. Safe stabilization for all slopes, regardless of the type of rock or soil conditions, shall be guaranteed including protection of all personnel and structures against any damage from cave-ins, heaving, or other earth movements.

5.5.7 All structure foundations shall be surveyed and staked prior to excavation. The methods of staking and final alignment of the concrete caisson, anchor bolts, reinforcing steel, stub angles, and embedment sections shall be designed such that the finished condition of the Work meets the requirements for alignment, position, elevation, and rotation.

5.5.8 Seller shall be responsible for locating buried utilities and other underground obstructions prior to any excavation. For underground gas and oil pipelines, it may be required, that the pipeline owner be on site always while the work is occurring within the pipeline easement. Seller shall coordinate such activities with pipeline owners prior to starting work so that the project schedule is not impacted. Excavation by hand tools without any mechanical means shall occur when it is not possible to proceed with earthmoving machines, or a special precision and/or care is needed to avoid any damage to existent underground cables, pipes, sewers, equipment's, objects and manufactured items in general, or other special situations. The Seller shall bear the full cost associated with repairing any damage done to underground utility lines caused by work performed by the Seller. Should uncharted, or incorrectly charted, utilities be encountered during excavation, stop work and contact the Owner immediately.

5.5.9 When excavation reaches the required subgrade elevations, notify the Owner and geotechnical engineer and they will make the inspection of conditions. If the project geotechnical engineer determines that the bearing materials at required subgrade elevations are unsuitable, continue excavation until suitable bearing materials are reached. This shall be after approval from the Owner and geotechnical engineer is received.

5.5.10 Correct unauthorized excavation, including areas over excavated by error, at Sellers' expense.

5.5.11 Stockpile of excavated materials shall be protected from erosion. Do not permit topsoil to be mixed with subsoil. As a guideline, topsoil (from topsoil excavation) shall be deposited, loosely, in heaps with a maximum height of 15 feet and excavated soil (excluding the topsoil from excavation) shall be deposited in subsequent layers, with a slope angle equal to the natural friction angle of the soil. If stockpiles left undisturbed for more than 30 days, then they need to be stabilized. Direct surface water away from the stockpile to prevent erosion, runoff and deterioration of materials.

5.5.12 Prevent surface water and groundwater from flowing into excavations and accumulate. Remove water to prevent softening of foundation bottoms, undercutting foundations which may cause the soil changes that that can impact the structural stability of the foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines and other dewatering systems necessary to convey the water away from excavations. Establish temporary drainage ditches or other diversions outside the excavation limits to convey rainwater or water removed from excavations. Do not use any trenches or other excavations for permanent structures as temporary drainage ditches.

5.5.13 Dispose water from the work in a suitable manner that causes no damage to adjacent property and does not interfere with the traffic flow or other construction activities. Water shall be disposed of in such a manner as not to be a menace to public health and in accordance with Environmental Protection Agency, Corps of Engineers, state water quality control division standards and permits and project storm water pollution prevention plan or environmental plan.

5.5.14 Seller shall be responsible for maintaining a temporary, highly visible fencing around excavations that exceed 4 feet in depth. Such temporary fencing will be used for protecting against fall hazards for site personnel, other people on site, ranch livestock etc. Setback for any temporary fencing shall be a minimum of 6 feet from the edge of the excavation. Carry out daily checks on the conditions and completeness of temporary fencing and carry out repairs if necessary.

5.5.15 All excavations shall have at least two (2) means of ingress and egress.

5.5.16 All foundations shall bear on undisturbed soils or structural fill. Conform to all design elevations and dimensions within acceptable tolerances for placing and removing of concrete formwork, conducting inspections and other construction activities.

5.5.17 Protect excavation bottoms against freezing when atmospheric temperature is less than 35°F or as per design requirements.

5.5.18 Proof roll subgrade with loaded rubber-tired equipment for a total equipment weight greater than 25 tons to determine soft areas or as per design requirements. After passing proof roll test, road base material, foundation mud mat will be placed on the subgrade. Additional tests for subgrade compaction shall be completed as per design requirements, which may include but not limited to checking the moisture content, in-situ density and degree of compaction. The Seller may be asked by the Owner to implement remedial measures and repeat these tests if the compaction requirements are not met.

5.5.19 Structural fill lifts shall not exceed a thickness of 8 inches. Other fill lifts shall not exceed a thickness of 12 inches.

5.5.20 Embankments (fill and cut) shall have a slope of 3H:1V or flatter. All embankment fill material shall comply with the design requirements. The material shall be uniformly spread in layers and the required degree of compaction should be achieved. The compaction is 95% of standard proctor density or as per the design documents. The embankment construction shall be done with minimal slope to avoid rainwater stagnation and soil softening and to prevent soil washout.

5.5.21 Earthwork activities shall be sub-divided in smaller sections/areas to reduce the time lapse between completion of the layers and placement of new layers above. The Seller shall follow the design guidelines for new embankment constructed on an existing embankment. Embankments to support roads and service yards shall have slopes as per the design/project documents. Areas no longer being actively grades shall be temporarily or permanently stabilized per permit conditions.

5.5.22 The excavated materials may require crushing and screening prior to backfilling of foundations if they do not meet the design specifications of backfill material. The tests that need to be performed as per a minimum shall be particle size distribution, Atterberg limits and abrasion resistance. This is applicable to the material available for backfilling after blasting activities. The Seller shall provide crushing and screening plant in compliance with applicable standards/codes and shall obtain the required approvals from the local authorities. Seller shall submit the crushing and screening plant report to the Owner for review and approval prior to commencing work. The report shall include, but not limited to size of the plant, location of the plant, schedule of crushing activities, permits, compliance with emission standards including pollution, dust and noise.

5.5.23 The material produced from crushing and screening shall be tested as per the frequency mentioned in the design documents. The crushing and screening plant shall be capable of supplying high quality materials in the quantity required. The crushed material should be capable of being handled by earthmoving machines.

5.5.24 The backfill material shall meet the design requirements as this will be spreading the structural loads to the subgrade. To check the material properties, the Seller shall perform tests as per the frequency mentioned in the design documents. For special situations, as per the Owner's request or as per the design, the Seller may be asked to perform these tests with greater frequency under additional compensation or to perform additional test.

5.5.25 Fill activity includes filling soils with compaction into road excavations, trenches, general grading applications and backfilling for foundation excavations. The material for backfilling can be the same as the material excavated if it meets the design requirements as per the design/project documentation.

5.5.26 Soil proposed for fill and backfill shall be approved by geotechnical engineer prior to use. The backfill or fill layers shall be tested during placement and compaction operations. The number of tests shall be made in a quantity to ensure that uniform compaction for each lift is suitably achieved.

5.5.27 Ensure areas to be backfilled are free of debris, snow, ice and water and that ground surface es are not in frozen conditions. Do not use muddy or frozen fill materials. Moisture condition of the fill material shall be as required to achieve design compaction. Compact backfill material in layers not exceeding a thickness of 8".

5.5.28 Use hand tampers or vibrating compactors at foundations or similar locations inaccessible to large equipment and rollers. Rolling equipment shall not be used immediately to the foundations.

5.6 Laydown Yard

5.6.1 The laydown yard shall be sufficient in size to allow for simultaneous (i) storage of equipment, including any Owner-Supplied Equipment, that will not be stored at the Wind Turbine Generator Pads; (ii) storage of office trailers and other temporary facilities; (iii) parking for approximately 20 Owner vehicles; and (iv) regular construction traffic.

5.6.2 The laydown yard shall be covered throughout with crushed rock surfacing. All crushed rock surfacing at the laydown yard shall conform, at a minimum, to the specifications prescribed in Section 5.8 (*Crushed Rock Surfacing*) herein.

5.6.3 The laydown area shall remain suitable for use in all weather conditions.

5.6.4 The laydown yard shall have a two percent (2%) grade, or less if required, for the safe storage of equipment, or to meet manufacturer's requirements for storage of equipment. The surface of the yard shall be free from potholes and ruts and shall allow for free drainage of surface water.

5.6.5 The laydown yard shall comply with the Turbine Supplier Project Site Requirements.

5.6.6 Fencing shall be installed around the perimeter of the laydown yard, and vehicle gates shall be installed at all entrances to the laydown yard. All fencing and gates shall comply with the minimum specifications in Section 3.11 (*Fencing, Walls, and Gates*) herein.

5.6.7 The laydown yard shall have at a minimum two points of ingress/egress which shall be accessible at all times.

5.7 Roads

5.7.1 Seller is responsible for Construction of the project access roads in accordance with the IFC drawings and specifications, including the ability to withstand both the individual and sustained loading requirements of construction traffic associated with the foundation material deliveries, component deliveries, and erection crane travel.

5.7.2 Seller is responsible for conducting a survey to document the existing conditions of the roads to be utilized, prior to the start of and after the completion of the construction activities. This survey shall include video of the roads and Seller will be submitted to the Owner.

5.7.3 All roads shall be constructed within the permitted corridors.

5.7.4 Roads shall be designed, constructed, and maintained adequately to support all anticipated construction loads, equipment delivery (including Owner-Supplied Equipment), mobile cranes, construction traffic usage, and weather conditions to be expected.

5.7.5 Roads shall be designed on the upwind side of the wind turbine generators, substation and other types of obstacles such as mounds or hills.

5.7.6 Roads shall comply with the Turbine Supplier Project Site Requirements.

5.7.7 Road entries, intersections, and turns that will be used by heavy equipment shall be designed to accommodate the longest vehicle anticipated to utilize the road so that it will be able to maneuver through the entire Project Site without leaving the graveled road area.

5.7.8 Roads shall be designed with turnarounds to assist in truck and trailer flow throughout the Project Site. Backup motions for tractor trailers shall be kept to a minimum and are subject to Owner approval.

5.7.9 Dead-end roads shall be designed with adequate turnaround space for a tractor/trailer to turn around without leaving the graveled road area. If backup motions for tractor trailers are necessary, the backup path shall be as straight and short as possible. All turnarounds shall be constructed using the same gravel design as the roads.

5.7.10 Roads shall be designed to have a graveled roadway surface with sub-grade cleared and compacted to at least ninety-five percent (95%) of the maximum density within the moisture content of two percent (2%) below optimum to two percent (2%) above optimum, as determined by ASTM Standard D698, unless a higher level of compaction is required by the geotechnical engineering report.

5.7.11 Roads shall be rocked with crushed rock material over a stabilized subgrade. All such crushed rock surfacing shall conform, at a minimum, to the specifications prescribed in Section 5.85.8 (*Crushed Rock Surfacing*) herein.

5.7.12 Roads shall be constructed within permitted boundaries and shall be subject to grading permit review and approval, if required, from the agency(ies) having jurisdiction.

5.7.13 Roads shall be cleared of overhead obstructions (e.g., power lines). Mark all overhead obstructions with signs and goal posts.

5.7.14 Roads shall be able to accommodate two-way traffic during normal conditions but may be converted to one-way traffic when wide vehicles are entering the Project Site and delivering equipment and/or materials.

5.7.15 Seller is responsible for ongoing regular maintenance of all project and public roads as needed throughout the Work, to include grading, dust control, and snow removal as needed.

5.7.16 Seller is responsible for all surveying and staking out needed to construct the roads in accordance with design plans. The levels and control points and final grade of the roads shall follow the design drawings.

5.7.17 Seller shall be responsible for locating buried utilities and other underground obstructions prior to any excavation. For underground gas and oil pipelines, it may be required, that the pipeline owner be on site always while the work is occurring within the pipeline easement. Seller shall coordinate such activities with pipeline owners prior to starting work so that the project schedule is not impacted. Excavation by hand tools without any mechanical means shall occur when it is not possible to proceed with earthmoving machines, or a special precision and/or care is needed to avoid any damage to existent underground cables, pipes, sewers, equipment's, objects and manufactured items in general, or other special situations. The Seller shall bear the full cost associated with repairing any damage done to underground utility lines caused by work performed by the Seller. Should uncharted, or incorrectly charted, utilities are encountered during excavation, stop work and contact the Owner immediately.

5.7.18 Roads shall be a *minimum* of 20 feet wide.

5.7.19 Roads shall be widened through turns and curves, as necessary. Seller shall provide documentation for required widenings to demonstrate the ability for required vehicles to accommodate turns safely.

5.7.20 Roads shall be designed and constructed with a maximum grade of ten percent (10%) grade. Approaches to pads from access roads shall be designed and constructed sufficiently level so as to allow transport and construction vehicles to work and park on a flat surface.

5.7.21 Roads shall have no more than two percent (2%) crown, unless such roads will be utilized as crane paths, in which case the maximum crown shall be one percent (1%). All roadways, including shoulders, shall be graded so as to self-drain, and must not allow water to puddle.

5.7.22 Maximum allowable rutting is two (2) inches.

5.7.23 Roads shall meet all required design elements at substantial completion.

5.7.24 Maximum vertical crest and dip on roads is six (6) inches vertical to 50 feet horizontal, or less if required by the Turbine Supplier Project Site Requirements.

5.7.25 The longitudinal radii (convex or concave) of roads shall not be less than 750 feet.

5.7.26 The surface of the road shall be free from potholes and ruts and shall allow for free drainage of surface water.

5.7.27 All roadways shall be able to accommodate traffic consisting of general-purpose pickup trucks, SUVs, and bucket trucks, or as required during construction to perform the Work. During construction, equipment delivery trucks shall also be able to safely travel these roadways.

5.7.28 All site entrances/exits shall have a system in place to prevent tracking of mud and other debris onto the public way.

5.7.29 Seller shall procure and install cattle guards, when required. Cattle guards shall be installed level and provided with a stable base capable of sustaining heavy loads without shifting or settling.

5.7.30 Seller shall inventory, analyze and verify all existing bridges and culvert crossings on the Project Site are sufficient for the intended Project use. If any improvements are needed to existing culverts and bridges, Seller shall make these improvements as per planned schedule to not delay any major component deliveries or construction traffic.

5.7.31 The Seller shall modify existing public roads, as required, at the access road intersections and other locations as needed to allow the delivery of the turbine components to the respective foundation locations. Modifications to the existing public road should meet all applicable State DOT and local jurisdictional requirements and follow any road use agreements.

5.7.32 Construction and maintenance of project site roads shall follow all storm water pollution prevention and spill prevention plans.

5.7.33 During winter conditions, carry out snow plowing to provide vehicle access to all turbine locations throughout the construction life of the project. This shall be completed by the Seller as soon as safely practical after a storm event. Seller is responsible for applying sand/salt mixture or all sand mixture in the event of icy conditions on access roads and construction areas.

5.7.34 Seller shall prepare, implement, and manage a detailed traffic management plan that is specific to the Project. The traffic management plan shall clearly identify all haul routes from the nearest highway; proposed traffic flow within the Project Site, including public roads; plans for managing construction, delivery, public, and other traffic at the Project Site during construction; daily concrete truck delivery flow plans; and mitigation measures to reduce risk and impact to non-construction vehicles due to construction activities. The Seller is responsible for all signage, spotters or other requirements to meet state traffic requirements. The Seller is responsible for any agency approval needed prior to any road work.

5.7.35 Seller shall provide temporary signs at public and site access road intersections to provide direction to turbine locations; and at the appropriate locations on public roads to indicate that no wind project traffic is allowed along these roads. These signs shall remain in place throughout the construction period.

5.7.36 Lime treatment of road subgrade to modify the physical and mechanical properties of the soil through chemical reactions is acceptable for road subgrade improvement. Seller shall be responsible for submitting to the Owner the procedure for lime stabilization for review and approval before lime application. The lime treatment procedure shall include but not limited to the following: suitable climatic condition for lime treatment, suitable subgrade soil conditions, measures to mitigate frost conditions and dewatering methods, types of lime, storage and delivery of lime material, material dosage requirements, lime application methods and testing methods. The procedure shall follow the latest editions of all applicable standards. Lime stabilization is preferred for cohesive soils.

5.7.37 For granular soils, cement stabilization methods can be used for road subgrade improvement. It is important to remember that in situations where there is time constraint due to fast pace of construction activity, cement stabilization can be considered as an alternative as the cement treated soils can gain strength much quickly compared to lime treated soils. Seller shall be responsible for submitting to the Owner the procedure for lime stabilization for review and approval before cement application. The cement stabilization procedure shall include but not limited to the following: suitable climatic condition for lime treatment, suitable subgrade soil conditions, measures to mitigate frost conditions and dewatering methods, types of lime, storage and delivery of material, optimum dosage of cement, cement application methods and testing methods, placement and compaction methods. The procedure shall follow the latest editions of all applicable standards. For cement stabilization, Type I Portland Cement conforming to ASTM C150 shall be used. Other equivalent products shall be submitted for review and approval.

5.7.38 Geosynthetics may be required as per design requirements to filter, drain, separate, protect and reinforce the ground during and after construction. Materials must be delivered to the construction site in their original packaging with labels along with the manufacturer's technical sheets indicating the main specifications and instructions for proper installation. The Owner may request certificates issued by authorized testing laboratories to confirm the physical, mechanical, hydraulic and durability properties stated in the technical sheets. Materials must be stored on the construction site in their original packaging and be protected from weather and exposure to direct sunlight must be avoided.

5.7.39 Joint types between geotextile sheets can be overlapping, sewn or, with adhesive strips, staples, adhesives (gluing) or hot melt and tying. Geotextiles for filtering can be installed outdoors or underground on horizontal, sloped and vertical surfaces. They can be used around perforated pipes or in trenches. Geotextiles must be installed in a stable position during construction of drains and during burial. If installed in drainage trenches to be filled by gravel, geotextile tarps must be positioned and adhered to the trench bottom and to the walls to avoid tension stress when the drain is filled. The Seller shall ensure that the geotextile material shall not be in contact with rock or any sharp objects.

5.7.40 Geogrid is a geosynthetic formed by a network of integrally connected elements to allow interlocking with surrounding soil, rock, earth and other surrounding materials to function primarily as reinforcement. Geogrids shall not decompose and must be non-toxic, rodent and micro-organism proof, chemically inert and ultraviolet (UV) ray stable. Geogrids must be installed as per the design requirements and manufacture's specifications. Construction site equipment (such as excavators and cranes) should not be allowed to travel directly on geogrids.

5.8 Crushed Rock Surfacing

5.8.1 Verify gradients and elevation of the subgrade are correct as per design drawings. Proof roll road subgrade using loaded rubber-tired equipment weighing more than 25 tons to detect soft areas prior to any aggregate placement. If unsuitable/soft subgrade is encountered, Seller shall undercut unstable material and stabilize subgrade using structural fill prior to aggregate placement.

5.8.2 The maximum aggregate size for surface fill (i.e., crushed rock surfacing) shall not exceed three (3) inches, including, but not limited to, that used for roadways, Project Substation, and laydown yard.

5.8.3 Spread and compact aggregate base material in lifts of thickness no greater than 6 inches.

5.8.4 Unless explicitly stated otherwise, all crushed rock surfacing shall be of thickness required by Project Site loading requirements, including those set forth in (i) the Turbine Supplier Project Site Requirements and (ii) the geotechnical engineering report.

5.8.5 Unless explicitly stated otherwise, all aggregate shall conform to local department of transportation requirements.

5.8.6 An aggregate job mix formula shall be established prior to the start of fill operation based on recommendations from the final geotechnical engineering report. This mix shall not be changed without prior approval of Owner. Testing data, including sieve analysis, shall be submitted for all aggregate sources.

5.8.7 Road aggregate characteristics shall be tested as per frequency of testing mentioned in the design requirements. For construction of crane pads/roads, the material must be placed in lifts not exceeding 6 inches or as per the design and should be properly compacted while providing adequate drainage of runoff water away from the pavement surface. The characteristics of the material shall be tested for of grain size analysis, compaction, Atterberg limits, soundness of aggregate, LA abrasion and CBR tests.

5.8.8 Restore all the permanent access roads to meet the road surfacing design conditions at the end of the project.

5.8.9 Finish surfaces by rolling with smooth steel wheel roller. Repair soft and yielding areas that develop in the final rolling.

5.9 Drainage and Erosion Control

5.9.1 The working areas of the Project Site shall be well drained during and after construction, respectively. All drainage shall be away from buildings and foundations.

5.9.2 Seller shall be responsible for submitting Stormwater Pollution Prevention Plan to Pacific Corp for review and approval prior to any site disturbance. Implementing and maintaining a comprehensive storm water pollution prevention plan (SWPPP) during the course of construction. This shall include all required permit submittals. The SWPPP shall be a live document, subject to review and adaptation throughout construction – a final SWPPP will be provided as part of the turnover documentation robustly capturing any residual maintenance requirements.

5.9.3 Roadway cross sections shall be shaped to move water away from the road, such as crowning or cross-slopes, and roads shall be designed and constructed to prevent water ponding. Storm water shall not channel flow across constructed roads.

5.9.4 Controls shall be provided to protect the water quality and shall be in accordance with all Requirements, including applicable laws, applicable permits, and the Seller-provided SWPPP.

5.9.5 Seller shall provide all excavation, embankment preparation, drainage contours and culverts necessary to prevent excessive erosion and degradation of site due to water runoff.

5.9.6 Culvert pipe ends, swales, and ditches shall be designed to control concentrated flow velocities and minimize erosion and siltation. Corrugated metal pipes are most widely used for drainage applications including storm sewers, culverts, and storm water detention and infiltration systems in the wind projects. These pipes can be made of steel or aluminum. Corrugated coupling bands, galvanized steel or aluminum to match pipe, minimum 10-inches (250-mm) wide; connected with two neoprene O-ring gaskets per and two galvanized steel bolts.

5.9.7 Verify trench is cut to the dimensions, and elevations are as indicated on the Construction Drawings. Remove large stones which could damage piping or impede backfilling or compaction. Dewater excavations to maintain dry conditions and preserve final grades at bottom of excavation. Place bedding material at trench bottom, level continuous layer not exceeding 8-inch compacted depth; compact to 95 percent of the modified proctor maximum dry density. Install pipe as per manufacturer’s instructions. Seal joints watertight. Keep pipe and fittings clean until work is completed. Lay pipe to alignment and slope gradient noted on the design. Protect pipe and bedding from damage or displacement until backfill operation is in progress.

5.9.8 Riprap shall be placed primarily for culvert outlet protection and embankment slope protection. Riprap shall be tested as per frequency of testing mentioned in design documents. LA abrasion test and soundness test shall be completed for testing the riprap. Riprap shall be irregular shaped rock; 2-inch minimum size, 12-inch maximum size; solid and non-friable. Do not place riprap over frozen subgrade surfaces. Installation thickness of riprap shall be of minimum 6 inches.

5.9.9 Wetlands impacts shall be avoided to the maximum extent practicable and are subject to regulatory approval or other applicable Requirements.

5.9.10 All storm water flows shall be returned to their original drainage patterns and the Project shall not increase flow rates from their historic levels.

5.9.11 Sheet flows shall be collected in roadside drainage swales and conveyed to culverts or channels to safely pass storm water flows.

5.9.12 Culverts or low-water crossings shall be placed under roads where required to pass existing storm water concentrated flows.

5.9.13 Erosion and sediment control, both during and after construction, shall be provided as required by the Requirements to retain sediment onsite and to control the erosion of embankments, temporary and final exposed slopes, and temporary stockpile(s).

5.9.14 All practicable erosion control devices shall be installed and maintained in good working order throughout construction to prevent the unauthorized discharge of material into a wetland or tributary. These controls shall be maintained until permanent erosion controls are in place.

5.9.15 Silt fences, check dams, drainage ditches or swales, straw mulch, and pre-manufactured geotextiles, geotubes, geogrids, cellular geoweb, and other similar items (collectively, the "**Best Management Practices**") shall be utilized as appropriate. Use impervious materials to cover stockpiles when unattended or during rain event. Erosion control measures shall be inspected and maintained daily to ensure their continued effectiveness. No heavy machinery in a wetland or other waterway. Seller shall prepare maps showing location and type of BMPs installed and used for Project Site.

5.9.16 Synthetic, toxic, or otherwise harmful erosion-control materials shall be made inaccessible to livestock on or adjacent to the Project Site during the construction period.

5.9.17 Construction operations shall be continuously monitored by Seller to avoid creating conditions that could lead to excessive erosion of soil with surface runoff from Work areas. Site drainage shall be provided to ensure that water does not "pond" on or near the project facilities constructed by the Seller. Special attention shall be paid to wind turbine foundation areas, substation areas, O&M facilities, and access roads.

5.9.18 Run off from all site roads, parking areas and any areas liable to be contaminated by oil shall be managed in accordance with the Spill Prevention Control and Countermeasure Plan or Storm Water Pollution Prevention Plan.

5.9.19 Seller shall provide construction dust control at the project throughout the duration of the Work, including furnishing of all labor, equipment, and materials, including water and/or equivalent duct control products, necessary for dust control and as necessary to reduce the risk of dust becoming a nuisance. Dust control methods to be reviewed by the Owner prior to implementation.

5.9.20 Local agencies may enforce requirements that limit certain construction activities during a portion of the year (e.g., due to storm events). These requirements shall be incorporated into the proposed SWPPP, erosion control plan, and Project Schedule.

5.9.21 Seller is responsible for maintaining a log of all storm events, the impacts and corrections as required under the SWPPP.

5.9.22 Seller shall document, record and maintain all documentation relating to SWPPP. The SWPPP package shall be submitted to the Owner upon final completion of the project.

5.9.23 Seller shall be responsible for repairing drainage tile systems damaged during the installation of the foundations, collection system, crane walks, or any other activity with the potential to damage drain tiles. Seller shall recognize locations of drain tile by GPS and flagging/staking. All repair made to drain tiles shall fully comply with local Codes and standards and Landowner requirements. Seller shall include the GPS coordinates, photo documentation and field report and submit to the Owner as per the quality job book.

5.10 Site Restoration

5.10.1 Seeding shall occur during a time / season when the probability of successful seed germination is maximized. Hydro-seeding is acceptable for slopes. Material used in the seeding process will be weed free certified.

5.10.2 Prior to re-seeding, Seller to obtain approval from Owner and landowners on reseeding and the desired seed mix. Active agricultural fields should not be reseeded.

5.10.3 Seller shall restore the erection areas to pre-construction conditions at the completion of the project.

5.10.4 All temporary structures, buildings, temporary concrete footings and slabs, and scaffolding furnished by the Seller during the construction shall be removed, and the involved areas shall be left in their intended or original condition.

5.11 Testing and Quality Control

5.11.1 All testing described herein shall be performed by an independent, experienced third party. Seller shall notify Owner of all testing schedules at least 30 days in advance of testing activities.

5.11.2 All roadways and compacted areas shall be tested to demonstrate they meet stated design criteria and are fit for purpose.

5.11.3 Roadway testing shall include the following, at a minimum:

(1) Maximum dry density and optimum moisture content: per ASTM D698 or ASTM D1557

(2) In-place density by nuclear methods (shallow): per ASTM D2922

(3) Aggregate sampling: per ASTM D75

(4) Sieve analysis of fine and coarse aggregates: per ASTM C136

(5) California Bearing Ratio of laboratory-compacted soils: per ASTM D1883

(6) Sand equivalent value: per ASTM D2419

(7) Liquid limit, plastic limit, and plasticity index: per ASTM D4318

(8) Roadway subgrade and surfacing compaction shall be verified at a minimum of every 1,000 feet. Roadway subgrades shall be proof-rolled over the entire length.

(9) Aggregate base shall be analyzed with a sieve at a minimum of every 2,500 cubic yards.

5.11.4 Copies of testing reports shall be submitted to Owner within 10 days of completing such test. Testing reports shall include a summary of testing procedures and acceptance criteria.

6.0 STRUCTURAL WORKS SPECIFICATIONS

6.1 General Provisions

6.1.1 All buildings, support structures, foundations (including Turbine Foundations), and equipment pads shall be constructed on competent material. All loose materials shall be removed from excavation bottoms. Unsatisfactory foundation subgrade material shall be removed and replaced with compacted structural fill material or with suitable concrete.

6.1.2 All buildings, foundations, meteorological towers, equipment supports, and other structures shall be designed in accordance with the latest edition of the Applicable Standards.

6.1.3 As further described in Section 3.0 (*Geotechnical Specifications*), the geotechnical engineering report shall be utilized for the design and construction of all Project structures. All foundations shall be designed with consultation of a licensed geotechnical engineer.

6.1.4 The foundation designer shall perform and detail all appropriate design verifications in a calculation report. The following information shall be included at a minimum:

a. List of all design standards utilized with revisions/edition.

a. List of design load cases based on loading information

b. List of all safety factors, load factors, materials factors, etc. and correlation to the design standard they are taken from.

c. Justification for foundation type and shape based on the Geotechnical Assessment and site conditions.

d. Coordination with Civil Engineer to ensure alignment of final proposed grades with civil site plans.

e. Intended soil improvement justification, improvement type, and locations, as needed.

f. Concrete Exposure Class.

g. Environmental Analysis (seismic)

h. Stability Checks:

i. Differential Settlement

ii. Foundation Stiffness

iii. Soil Bearing Capacity

iv. Gapping Requirements

v. Overturning & Sliding

i. Structural Analysis Checks:

    i. Concrete Design (Raft, Pedestal, etc.)

    ii. Anchorage Design (Bolt length, embedment plates, etc.)

    iii. Fatigue Assessment.

6.1.5 Foundation designer may specify ground improvements as needed if the soil below the foundation does not comply with required strength and compressibility properties.

a. Soil Substitution

    i. Existing soil below the foundation shall be removed and replaced with more suitable soils. Foundation designer shall ensure that backfill has sufficient bearing capacity and soil compressibility to dissipate pressure to deeper native soils. Soil substitution area shall be wider than the foundation footprint.

b. Stone Column & Rigid Inclusion

    i. Foundation designer shall be permitted to utilize stone column techniques as needed to supplement existing soils. If used, the design should following international design guidelines and recommendations as provided by DNV or IEC to determine adequacy of design. Owner may request the use of a finite element analysis model to conform design approach.

c. Foundation Subsurface Void Grouting

    i. If other techniques are not found suitable for the project, foundation designer may recommend void grout filling within the foundation influence zone to supplement soil strength.

6.1.6 The maximum loads (including load factors) applied to the foundations and used for design shall be determined from the structure design of the supported structure considering load cases and Applicable Standards associated with the particular structure type.

6.1.7 All relevant site parameters shall be identified to ensure that load effects transmitted from wind turbine are sufficiently captured in foundation design. The primary contributor is typically the wind load, however consideration shall be given, where necessary, to other factors such as snow loads, seismic loads, ground water buoyancy, etc.

6.2 Project Substation Foundations

6.2.1 All Project Substation buildings, support structures, foundations, and equipment pads shall be designed in accordance with the Applicable Standards and other applicable Requirements, and the type of foundations required and allowable bearing values for soil and rock shall be as recommended by the geotechnical engineer based on the subsurface conditions found in the geotechnical engineering report. All loose materials shall be removed from excavation bottoms. Unsatisfactory foundation subgrade material shall be removed and replaced with compacted structural fill material or with 2000-psi concrete. Total foundation settlements will be limited to one (1) inch or as required by applicable building or industry codes, and equipment supplier's recommendations.

6.2.2 Equipment foundations shall be of reinforced concrete including all formwork, rebar, waterstop, and other similar items.

6.2.3 Main step-up transformer foundation and containment shall be provided with secondary oil containment equal to at least 110% of the volume of oil present in the transformer in addition to the volume of precipitation for a 100-year storm event over the area of the containment; a calculation shall be provided by Seller to demonstrate compliance with this requirement. Oil containment shall be a concrete containment with a sump placed within the containment area.

6.2.4 Equipment support structures shall be low profile (non-lattice) framing consisting of galvanized structural steel tubing and rolled shapes as the basic structural element. Steel support structures shall be designed, fabricated, and erected in accordance with the provisions of the AISC.

6.2.5 Reinforced concrete support structure foundations and equipment pads shall be designed and constructed in accordance with the provisions of ACI 318, ASTM A615, and allowable soil bearing pressures resulting from site soil sampling, laboratory testing, and geotechnical analysis and recommendations set forth in the geotechnical engineering report.

6.2.6 Reinforced concrete, cast-in-place drilled piers utilizing stub angles (lattice tower structures) or anchor bolts (tubular steel pole structures) to attach the structure to the foundation are the preferred foundation types.

6.2.7 Requirements and restrictions for access, site disturbances, conduits for power and communications, and other similar items shall be incorporated into the foundation design as appropriate.

6.2.8 For stub angle type foundations, a minimum of four (4) inches of clear space is required from the outermost reinforcing steel to the side of the excavation.

6.2.9 For anchor bolt type foundations, a minimum of six (6) inches of clear space is required from the outermost reinforcing steel to the side of the excavation.

6.2.10 The anchor bolt embedment length shall be not less than the development length for the strength of concrete specified.

6.2.11 Compression/uplift type foundations shall be straight piers and shall not be belled on the bottom. The parameters shown in Table 1 (*Stub Angle Type Foundation Parameters*) shall be used to design stub angle (compression/uplift loaded pier) type foundations:

Table 1: Stub Angle Type Foundation Parameters

Description	**Load Factor***	**Criteria**
Settlement, individual pier	1.1	0.50 inch
Differential settlement measured against other piers in the same structure	1.1	0.25 inch
Predicted ultimate capacity, compression (bearing)	Safety factor of 2.0 over maximum factored loads	
Predicted ultimate capacity, uplift	Safety factor of 2.0 over maximum factored loads	
* Note: Load Factors for the NESC Combined Ice and Wind District Loading (e.g., NESC Heavy) shall be applied in lieu of the Load Factors in this table.		

6.3 Overhead Power Line Structure Foundation Design

6.3.1 Information presented in this Section 6.3 shall apply to both Interconnection Line structure foundations and Collection System Circuit overhead structure foundations, as applicable, and unless explicitly stated otherwise.

6.3.2 Structure foundations shall be surveyed and staked prior to excavation.

6.3.3 Reinforced concrete support structure foundations and equipment pads shall be designed and constructed in accordance with the provisions of ACI 318, ASTM A615, and allowable soil bearing pressures resulting from site soil sampling, laboratory testing, and geotechnical analysis and recommendations.

6.3.4 Reinforced concrete, cast-in-place drilled piers utilizing stub angles (lattice tower structures) or anchor bolts (tubular steel pole structures) to attach the structure to the foundation are the preferred foundation types.

6.3.5 Compression/uplift type foundations shall be straight piers and shall not be belled on the bottom. The parameters shown in Table 1 shall be used to design stub angle (compression/uplift loaded pier) type foundations.

6.3.6 For stub angle type foundations, a minimum of four (4) inches of clear space is required from the outermost reinforcing steel to the side of the excavation.

6.3.7 For anchor bolt type foundations, a minimum of six (6) inches of clear space is required from the outermost reinforcing steel to the side of the excavation.

6.3.8 The anchor bolt embedment length shall be not less than the development length for the strength of concrete specified.

6.4 Overhead Power Line Structure Design

6.4.1 Information presented in this Section 6.4 shall apply to both Interconnection Line structures and Collection System Circuit overhead structures, as applicable, and unless explicitly stated otherwise.

6.4.2 Appropriate construction grades set forth in the current version of NESC C2 shall be utilized.

6.4.3 Material used on overhead power line structures, cross arms, etc. shall consist of treated wood, fiberglass composite, tubular steel, steel lattice, or a combination thereof.

6.4.4 Structural design of all overhead power line structures, including, but not limited to, the tower, conductor cable, OPGW, shield wire, and insulator hardware, shall be in accordance with all applicable loading conditions and sagging/tension limits set forth in the Applicable Standards.

6.4.5 Structure configurations shall be designed in a way that all required electrical clearances are met as set forth in the Applicable Standards.

6.4.6 Vertical clearances of conductors above ground, all obstacles, and overhead power line components shall be maintained as defined in the Applicable Standards with clearances maintained assuming the maximum final sag (after creep) and including consideration of expected snow and drifting.

6.4.7 All clearances shall be maintained assuming the worst case (smallest clearance) wire condition, either initial tension/sag conditions or final tension/sag (after creep) conditions.

6.4.8 Sag and tension limits shall conform to the requirements set forth in the Applicable Standards, including, but not limited to, the latest version of NESC C2.

6.4.9 Deflection line angle ranges per structure configuration shall meet design requirements.

6.4.10 Structure configurations shall be designed for a maximum shield angle of 30° measured from the shield wire outward to the phase position.

6.4.11 Guys and guy anchors (if required) shall be sited within existing easements.

6.4.12 Structures shall be guyed as required using Class A, zinc-coated, high-strength, stranded steel (ASTM A475), guy material.

6.4.13 Any outer guy wire that is near a road or could present a safety hazard shall have a yellow safety shied to enhance visibility.

6.4.14 All angle and dead-end structures shall be of a self-supporting design.

6.4.15 All structures shall be designed to withstand, without failure or permanent deformation, the applicable loadings set forth in the Applicable Standards, including, but not limited to, the latest version of NESC C2

6.4.16 Stability shall be provided for the structure as a whole and for each structural element.

6.4.17 The non-linear behavior of the structure, under load, shall be incorporated into the design of the structure.

6.4.18 The structure design calculations, fabrication details, and fabrication drawings shall be supplied to Owner for review prior to fabrication.

6.4.19 Loading combinations for both "all wires intact" and "all wires removed from one side" conditions must be considered for terminal dead-end structures.

6.4.20 Suspension attachments for conductor and shield wire shall not be in uplift at a temperature of 0°F.

6.4.21 All wire systems (OPGW and conductor) shall be designed to prevent wire damage due to Aeolian vibration.

6.4.22 The design shall incorporate manufacturer (wire and damper manufacturers) recommendations for vibration protection of conductors and OPGW/shield wires.

6.5 Overhead Power Line Assemblies and Component Design

6.5.1 Information presented in this Section 6.5 shall apply to both Interconnection Line structures and Collection System Circuit overhead structures, as applicable, and unless explicitly stated otherwise.

6.5.2 All assemblies, hardware, and components of assemblies shall be designed to meet the strength requirements set forth in the Applicable Standards, including, but not limited to, the latest version of NESC C2, and shall be verified that all standard or non-standard material, assemblies, hardware, and components of assemblies meet the strength requirements for the application and intended use.

6.5.3 All non-standard material shall be approved by Owner prior to implementing its use in design.

6.5.4 Any piece of hardware in an insulator assembly must, at a minimum, match the ultimate strength of the insulator.

6.5.5 All hardware shall be selected such that the hardware supports the defined loads without exceeding the factored strengths as specified by the hardware manufacturer.

6.5.6 The parts of each assembly, including insulators, shall be verified that they can be assembled properly.

6.5.7 Assemblies shall be articulating so that undue binding or overstressing will not occur during wire movements.

7.0 COMMUNICATIONS SYSTEM SPECIFICATIONS

7.1 General Provisions

7.1.1 The Communications System shall be designed with data continuity and reliability as priority.

7.1.2 All monitoring and control devices and systems shall be suitably zone protected against lightning electromagnetic impulses in accordance with IEEE C37.90.1.

7.1.3 The Communications System shall be compliant with all Applicable Standards, including NERC Functional Model Registered Entity function, NERC Reliability Standards, Regional Entity Standards, approved regional variances, and/or FERC Orders as defined by NERC/FERC orders and Owner interpretation. Further, the Communications System shall comply and be designed to work in accordance with applicable system operator approved protocols, operating guides, standards, business practice manuals, and/or approved rules. In so far as either a state utility commission or provincial authority has instituted additional regulations, the communications system should be designed to accommodate where no conflict exists with NERC or FERC. Design should include parameters for operating under conditions specified by rules stated hereto as well as capability to function on an evidentiary basis.

7.1.4 The design deliverables shall include but not limited to, integrated control and monitoring systems and communication networks schedule, description and technical specifications of monitoring and control systems, SCADA architecture, fiber optic design, SCADA points list, SCADA RTU program, HMI interface screens, data and telephone specifications, bill of materials, fiber patch panel drawings, logic diagrams and functional control diagrams.

7.1.5 All Communications System design and construction shall conform to the Wind Turbine, Solar PV, or Battery Energy Storage System Supplier's requirements.

7.2 Design Working Life

7.2.1 The design working life of the Communications System equipment shall be a minimum of 30 years.

7.3 Civil Works Requirements

7.3.1 All civil works for the Communications System shall comply with the applicable specifications in Section 5.0 *(Civil Works Specifications*).

7.3.2 Excavation by blasting for the Communications System is prohibited.

7.3.3 Trench widths shall be kept to a minimum to allow sufficient space for equipment installation.

7.3.4 The trench bottom shall be firm for the entire length and width.

7.3.5 Trenches shall be kept free from water.

7.3.6 Conduit and cable shall not be placed on frozen ground.

7.3.7 All splice pits (if used) and backfill shall be compacted to a minimum of 85 percent (85%) of standard proctor density, unless otherwise noted on the design drawings.

7.3.8 Backfill shall be free of debris and sharp objects.

7.4 System Functionality

7.4.1 The Control and Monitoring systems shall be designed to meet the Wind Turbine, Solar PV, or Battery Energy Storage System drawings and specifications, Interconnection Agreement requirements, PPA requirements and Owner's design guidelines and standards.

7.4.2 The Communications System shall be capable of centrally and remotely monitoring, controlling, and recording the performance of the Project Substation equipment, permanent meteorological towers or weather stations, Wind/Solar/Battery Systems, wind turbine supplier wind farm SCADA and other critical sensors.

7.4.3 The Communications System design shall include configuration files and a comprehensive data points list and protocol specification for communications between all Project components requiring communications, data transfer, and control monitoring using the fiber network integrated into the Communications System. Such configuration files shall have the ability to be configured by Owner, and Seller shall furnish development application software for each configurable device.

7.4.4 The Communications System shall include the necessary equipment (hardware and software) for the exchange of signals with Project Substation equipment to support grid monitoring. Seller is responsible to provide design and drawings, supply, install and test all necessary Ethernet and fiber optic cable networks to maintain all communications.

7.4.5 The Redundant Real Time Automation Controllers (RTACs) must share the signals and measurements from the switchgear and switchyard protection relays, network switches, check meter, WTG/PV/BESS SCADA, PPA and GIA utilities, MET towers, FAA lights and any other devices as required. The Substation SCADA will also make data available to the local HMI, WTG/PV/BESS SCADA, Off-takers, and to the Plant SCADA.

7.4.6 The RTACs will be provided with industrial standard protocols mainly DNP3, MODBUS, serial and TCP-IP versions, master, and slave. The RTACs shall have the ability to post the event reports from the relays to the web interface.

7.4.7 The HMI will be connected to the automation controllers, to protection relays switches, and the substation LAN network for remote access. The HMI screens shall follow the one-line electrical drawing and substation equipment layouts.

7.4.8 The Communications System shall include the necessary equipment (hardware and software) for the exchange of signals with the permanent meteorological towers to support data monitoring.

7.4.9 The Communications System shall include the necessary equipment (hardware and software) for the exchange of signals and integration of any required reactive compensation devices (e.g., capacitor banks, reactors).

7.4.10 Remote monitoring, control, and reporting of the Communications System equipment shall be available through a web-based configuration accessible from a standard internet browser. The system shall be connected to the internet at all times and shall remain behind an Owner-managed firewall.

(1) Owner shall have unlimited access to Project data through the web-based system.

(2) Owner shall have no limitation on number of users through web-based system.

(3) Varying levels of access to the web-based system shall be permitted through secure login and user permissions.

7.4.11 Upon loss of utility power interconnection or failure of utility power, restart of the instrumentation and control system to a fully functioning condition should require no local manual operations. Synchronization shall be performed automatically.

7.4.12 The equipment IP addresses and networking security shall be aligned to Owner standards and recommendations.

7.5 Fiber Network

7.5.1 Fiber optic cable shall be installed in the same trench as the Collection System Circuit power cabling.

7.5.2 When fiber cables are installed in a trench, the fiber cable shall be placed in conduit or continuous innerduct; the fiber cable shall be rated for underground use; and there shall be a suitable locating cable installed in the innerduct/conduit. Innerduct shall have a minimum diameter of 1.25 inches.

7.5.3 Fiber optic shall be separated from any power cables when co-located in a trench.

7.5.4 All turbinefiber cables shall consist of a minimum of 12-strand single mode fiber. Single mode fiber is preferred for all equipment at the wind facility, however multi-mode shall be permitted only for instances of equipment limitation for substation devices only.If metallic armored fiber optic cable is used, protection from induced voltage shall be installed.

7.5.5 All fiber cables shall be designed with a minimum of fifty percent (50%) spare fiber, and at least an additional six (6) feet of fiber cable supplied at each end.

7.5.6 All communications cables, including fiber cables, shall be appropriately labeled with a permanently attached label at both ends. Labels shall be sequentially numbered.

7.5.7 The fiber system shall be designed for a minimum of five (5) dB system margin.

7.5.8 The fiber system design shall be a fiber ring topology or a “daisy-chained” system.

7.5.9 Conduits for fiber entry into the WTG/PV/BESS areas shall include a pull string for pulling the cable.

7.5.10 Fiber cables may be routed through Project Substation control cable trenches with other control wiring provided that a high-visibility color innerduct is used for identification and protection of the fiber cables.

7.5.11 All splices shall be fusion splices.

7.5.12 Maximum attenuation:

(1) 0.36 dB/km at 1310 nm.

(2) 0.22 dB/km at 1550 nm.

7.5.13 Terminations shall be completed with either an approved fiber optic pigtail kit or with approved mechanical connectors and an approved fanout kit.

7.5.14 Data collection loops shall be designed so that a loss of a power circuit does not cause a loss of data collection from the Turbines during the power outage.

7.6 Monitoring and Control Requirements

7.6.1 Design and installation of the Communications System shall be provided with all hardware, telemetry, communication and other requirements as required by the interconnection utility.

7.6.2 The substation shall have a Phasor Measurement Unit (PMU) system for synchrophasor data. The PMU system can be either built into the protective relays or a stand-alone system. The PMU system needs to have local PDC storage capability.

7.6.3 The Communications System shall be provided with the following supervisory screens, at a minimum.

(1) Project Substation one-line diagram, including all breakers, switches and transformers and the real-time status of each (current, power, voltage, power factor, and reactive power, as applicable).

(2) Project Substation alarms and notifications:

(a) Status of all relays

(b) Status of all alarms and notifications

(3) Main power transformer status, including the following for each main power transformer:

(a) Operation and fault status, including alarms

(b) Relay statuses

(c) Temperatures (winding, oil)

(d) Tap changer position

(4) Breaker status, including the following for each medium- and high-voltage breaker:

(a) Operation and fault status, including alarms

(b) Relay statuses

(c) Breaker readings (current, power, voltage), including per Collection System Circuit

(5) Control building status, including the following:

(a) Operation and fault status, including alarms

(b) Enclosure alarms (fire/smoke alarm status, enclosure temperature, intrusion, etc.)

(c) Battery charger voltage and status

(d) Intrusion detection

(e) HVAC status

(6) WTG/PV/BESS status, including the following:

(a) WTG/PV/BESS status (e.g., online, offline for maintenance, curtailed) for each unit

(b) WTG/PV/BESS generation level for each unit

(c) Total Project power

(d) Atmospheric conditions

(7) Other supervisory screen requirements:

(a) All major components (e.g., breakers, transformers, meteorological towers) shall be listed separately.

(b) Alarms and faults shall be color-coded where applicable (e.g., green, yellow, red).

7.6.4 The Communications System shall include control functionality for the following, at a minimum:

(1) Active power

(2) Reactive power

(3) Frequency

(4) Voltage

(5) Power factor

(6) Noise-related operations

7.7 Reporting and Storage Requirements

7.7.1 All reporting shall be in Generation Availability Data System ("**GADS**"), wind format.

7.7.2 SCADA system reporting shall include, at a minimum, the following for the Project Substation, permanent meteorological towers/weather stations, and WTGs/PV Inverters/BESS PCS:

(1) Performance parameters, availability, operation counters, faults, and alarms

(2) Browsing and filtering of historical data

(3) Creation of pre-defined and custom reports

(4) Interface and operational procedure for interaction with existing Owner assets as defined by Owner

7.7.3 All stored data and generated reports shall be exportable as ASCII and Microsoft Excel formats.

7.7.4 The system shall not permit unwarranted tampering with or changing of raw data or functionality.

7.7.5 Seller shall design and provide connectivity and data sharing form/to the Interconnection utility.

7.8 Data Storage Requirements

7.8.1 All data monitored by the Communications System shall be recorded and stored. Local controllers shall have sufficient buffer for at least 30 days of data storage in the event of power loss.

7.8.2 Historical data shall be stored in an SQL database or Owner-approved equivalent for the life of the Project. Data shall be stored in the database as no higher than 1-minute averages, with accompanying statistical values including, but not limited to, minima, maxima, and standard deviation. All data shall be retrievable.

7.9 Data Integration

7.9.1 Seller shall include the design with the standardization and synchronization required by the Owner's control center or Plant SCADA to integrate the new wind site including naming convention, alarms configuration, point definitions, HMI screens, ISO, PPA requirements, WTG/PV/BESS model, Substation details, etc.

7.9.2 Provide all hardware and software necessary to interface and transmit all required monitoring and control data from/to substation Owner's SCADA system (RTAC), WTG/PV/BESS SCADA and the other communication devices of Owner's Control Center.

7.9.3 Testing and commissioning of the integration shall be included as a milestone on the plan schedule.

7.10 Testing and Quality Control

7.10.1 All testing described herein shall be performed by an independent, experienced third party. Seller shall notify Owner of all testing schedules at least 30 days in advance of testing activities.

7.10.2 All communications system equipment shall be tested to demonstrate it meets stated design criteria and is fit for purpose.

7.10.3 Communications system testing shall include the following, at a minimum:

(1) All testing specified in the Applicable Standards, including NETA.

(2) All testing reasonably recommended or required by the applicable equipment suppliers.

(3) All exposed cable sections shall be visually inspected for physical damage or manufacturing defects. Such inspections shall be performed prior to and during installation.

(4) Verify all alarms, indications and analog quantities are communicated and received properly by the RTU and displayed correctly on the HMI.

(5) Verify all communication channels (intra- and inter-Project Substation), including Project Substation LAN, operate as expected.

(6) Verify fiber optic system performance (power losses, splice or connector losses, etc.) using optical domain reflectometer (“**OTDR**”). All such testing shall be done with an OTDR in both directions of the strands. For single-mode fiber, test both directions at 1310 nm and 1550 nm.

(7) All fiber optic cable shall be visually inspected and OTDR-tested prior to installation.

(8) Provide system functionality and compatibility at the control room / O&M Building.

(9) Test each cable and strand on every fiber run from termination to termination.

(10) Provide entire Project Site testing to ensure proper operation of all data points into the component gateways and testing of all data points provided to third parties with that party.

7.10.4 Copies of testing reports shall be submitted to Owner within 10 days of completing such test. Testing reports shall include a summary of testing procedures and acceptance criteria.

8.0 PROJECT SUBSTATION SPECIFICATIONS

8.1 General Provisions

8.1.1 The Project Substation shall be designed and constructed to a high level of reliability and shall meet or exceed the requirements set forth by the interconnection utility.

8.1.2 The Project Substation shall be designed and constructed in accordance with the Project Electrical Studies, as defined below:

(1) Short Circuit Study: short circuit analysis of collection system circuits, Substation, and transmission interconnection line, including secondary values on WTGs. The short circuit analysis and study shall be utilized in Seller’s electrical designs to support relay coordination study and equipment specification.

(2) Reactive Compensation Study: reactive power flow report, including power factor study at Point of Interconnection. The study shall identify reactive compensation required to meet the Technical Specifications, including the requirements of interconnection for power factor and voltage regulation, and including any capacitor bank and/or reactor requirements. The study shall include varying combinations of active power (no load, partial load, full load) and voltage (min. 0.95 to 1.05 pu) at the Point of Interconnection.

(3) Harmonic Analysis Report: power quality analysis or harmonic monitoring at the Point of Interconnection and Substation shall be used to determine the harmonic resonance and flicker conditions within the Project, and demonstration that the Project design meets the harmonics distortion requirements in the Technical Specifications (including IEEE 519), including any necessary filtering or mitigation to be provided by Seller. If the Transmission system is found to be source of the harmonics, the Transmission Operator shall be responsible for the required mitigating actions.

(4) Insulation Coordination Report: study to ensure the insulation coordination requirements of IEEE C62.22-2009 have been satisfied within the Project electrical design, including proper application of surge arresters to safeguard electric power equipment within the collection system circuits, Substation, and transmission interconnection line against hazards of abnormally-high voltage surges of various origins.

(5) Transient Overvoltage Report: study to confirm any system modifications required to adequately limit transient overvoltage on the collection system circuits, including determination of the transient overvoltage levels on the collection system circuits after feeders have been isolated from the Substation due to a line-to-ground fault, and determination of the maximum energy required to be absorbed by each surge arrester on the collection system circuit feeders.

(6) Substation Grounding Report: grounding system study of ground grid conductors and interconnection (if any) with the ground grid. The study shall confirm that the grounding system maintains touch and step voltages within tolerable limits, and shall be prepared in accordance with the procedures, data, and recommendations given in IEEE 80. The study shall determine the ground potential rise with respect to remote earth.

(7) Effectively Grounded Report: study to confirm the Project is considered effectively grounded, as defined in IEEE C62.92.1-2000.

(8) Substation AC System Study: calculation of the capacity of the low-voltage AC systems in the Substation to determine size of station service.

(9) Substation DC System Study: calculation of the capacity of the batteries and chargers within the Substation with the DC service required for the equipment at the substation, as determined from a load profile developed for all DC loads. The study shall determine if the minimum voltages are maintained as specified and required by equipment vendors. The DC system shall be sized to accommodate future loads for ultimate switchyard configuration.

(10) Substation Bus Ampacity Study: calculation of bus ampacity in the Substation based upon continuous current rating as given on the one-line diagram and Project Site-specific conditions.

(11) Substation Bus Structural Analysis Study: analysis of bus structural design in the Substation including bus, insulators, bus structures, and foundations, and based upon the most stringent combination of wind, fault current, and ice load factors, as defined in the Technical Specifications.

(12) Substation Bus Design Study: analysis of the performance of the buses, disconnect switches, and separately-mounted current transformers within the Substation to confirm that the ampacity, structural integrity, vibration, and required mechanical and electrical ratings are in accordance with the methods and recommendations of IEEE 605. Bus design, including gust factor, exposure height factor, importance factor, and corona considerations, shall be in accordance with the procedures and data given in IEEE 605.

(13) Substation Lighting Study: lighting illumination calculations for the Substation to determine the illumination levels within the new substations that will be achieved with added luminaries.

(14) Substation Lightning Study: direct stroke protection analysis for lightning at the Substation based upon Project Site-specific determinations for thunderstorm days, thunderstorm duration, isokeraunic levels, exposure, and other similar factors. The direct stroke protection system design shall include analysis using the rolling sphere method of the electrogeometric model given in IEEE 998. The direct stroke protection system design shall be in accordance with the procedures, data, and methods given in IEEE 998.

(15) Arc Flash Study: arc flash hazard analysis of the Equipment, including all energized equipment in the WTGs, collection system circuits, Substation, transmission interconnection line, and O&M Building. This analysis shall be performed in accordance with the latest version of NFPA-70E and IEEE 1584. Study shall inform incident energies for labels and PPE requirements. Arc flash stickers shall be prepared by Seller based on these results. Seller shall provide the stickers and detailed location guidance on where stickers are to be applied.

(16) Protection Coordination Study: relay and protection equipment coordination study, including detailed calculations, one-line and three-line diagrams, fuse curves, coordination curves, protected equipment data, and relay set points. This study shall include the WTG equipment (including switchgear), collection system circuits, Substation, and transmission interconnection line. A narrative philosophy statement shall be submitted for comment before completing the coordination study. The relay settings shall be coordinated with that of the WTG's switchgear. The applicable trip curves and settings will be sent to the Turbine Vendor for review.

8.1.3 Project Substation basic impulse level shall be at least 200 kV for the 34.5-kV system and subject to Owner approval on the high-voltage system (to be determined based on the Project voltage level). Design of the high-voltage and 34.5-kV systems shall be for a short circuit rating calculated based on the results of a Seller-furnished short circuit study.

8.1.4 Minimum conductor clearance criteria shall be per the NESC. Clearances shall be increased at locations where required for equipment and personnel access.

8.1.5 No splices shall be made within the Project Substation, including both power and instrument and control conductors. Shields may be spliced where necessary to permit connection to the Project Substation ground system.

8.1.6 Conductors shall be terminated, labeled, tied, and bundled at each end.

8.1.7 Project Substation equipment paint shall be ultraviolet resistant. The coating shall consist of rust-inhibiting epoxy primer, standard intermediate coating, and two (2) finish coats of paint. The total coating shall be a minimum of five (5) mils dry. The paint color shall be an ANSI 70 sky grey color, unless otherwise approved by Owner.

8.1.8 All manufacturer installation instructions for all components shall be obtained and followed.

8.1.9 Backup power at the Project Substation shall be provided from two (2) sources. The interconnection line and local distribution system may each be utilized as a source, although the battery system may not be utilized as one of these sources. A standby generator, conforming with the requirements set forth in RFP Appendix A-7.25 (*ZS-020 Substation Equipment AC Standby Generator System*), shall be installed if two sources of backup power are not available.

8.1.10 Bird and animal protection at the Project Substation shall be provided following Owner Standards referenced in Appendix "A-7".

8.2 Design Working Life

8.2.1 The design working life of the Project Substation equipment shall be a minimum of 30 years.

8.3 Civil Works Requirements

8.3.1 All civil works for the Project Substation shall comply with the applicable specifications in Section 5.0 *(Civil Works Specifications*).

8.3.2 Excavation by blasting for the Project Substation is prohibited.

8.3.3 Trench widths shall be kept to a minimum to allow sufficient space for equipment installation.

8.3.4 The trench bottom shall be firm for the entire length and width.

8.3.5 Trenches shall be kept free from water.

8.3.6 Conduit and cable shall not be placed on frozen ground.

8.3.7 Project Substation equipment shall have wind and seismic withstand capability in accordance with the Applicable Standards, including IEEE 693 and AISC's "*Manual of Steel Construction*".

8.4 Conductors

8.4.1 All cable furnished shall conform, at a minimum, to the requirements included in Table 2 (*Summary of Cable Requirements*):

Table 2: Summary of Cable Requirements

Cable Type	Description
Low-voltage power	600 volts, single-conductor, Class B stranded copper; EPR or XLP insulated; CSP or CPE jacketed.
Low-voltage power	600 volts, three-conductor; concentric lay, stranded copper with a ground wire in the interstices; FRXLPE or FREPR insulation; CSP, or CPE jacketed overall.
Control	Control cable, 600 volt, multiple-conductor, as required, stranded copper, 10 AWG, 12 AWG, 14 AWG; multiple-conductor, XLP insulation; CSP, or CPE jacketed overall.
Instrumentation	Instrumentation cable, 600 V, flame retardant single-and multiple-twisted pairs and triads, shielded instrument cable with individually shielded pairs, overall shield, and overall jacket; FRXLPE or FREPR insulation; CSP, or CPE jacketed overall. (Single pair or triad 16 AWG, multi-pair or triad 18 AWG).
Lighting and receptacles	Lighting circuit runs totally enclosed in conduit, NEC Type RHH-RHW-USE with XLPE insulation for use in outdoor or unheated areas.
Shielded control	Control cable, shielded, 600-volt, multiple conductor, as required, stranded copper, 10 AWG, 12 AWG, 14 AWG; multiple conductor, XLP insulation; CSP, FRPVC or CPE jacketed overall

8.4.2 Power conductor size and ampacity shall be coordinated with circuit protection devices.

(1) Conductor size shall be determined for 125% of connected load at the design basis maximum outdoor ambient temperature.

(2) Below-grade power cable conductor size shall be determined in accordance with the methods in IEEE 835.

8.4.3 Installation of conductors shall be understood to include placement, splicing, and terminating conductors; coiling and taping of spare conductors; identification, testing, and verification of each circuit, cable, and conductor.

(1) Manufacturer's pulling or side wall tension shall never be exceeded.

(2) Recorded cable tension reports shall be provided to Owner.

8.4.4 Insulated cable, conductors, and conductor accessories shall be furnished and installed in accordance with the requirements of these Specifications and the recommendations given in IEEE 525. Insulated cable, conductors, and conductor accessories shall be furnished in quantities sufficient for a complete installation as indicated in these Specifications.

8.4.5 All Project Substation cables shall have wire end connectors.

(1) Connectors, sizes 12 - 2 AWG, shall be vinyl or nylon pre-insulated ring-tongue type

(2) Connectors, sizes 1 AWG – 750 kcmil, shall be uninsulated two-hole rectangular tongue.

8.4.6 The cable furnished shall be flame retardant construction in accordance with the applicable ICEA standards and suitable for wet or dry locations.

8.4.7 All cable shall have surface printing showing manufacture's name, insulation type, jacket type, conductor size, conductor type, voltage rating, and numbered footage markers.

8.5 Voltage Transformers

8.5.1 All voltage transformers shall be connected through indoor, panel mounted, voltage injection test switches. Each voltage transformer neutral shall be brought through into the control building for termination and single point grounding within the associated protection relay panel.

8.5.2 All voltage transformers shall be a 2 winding, 0.3 class unit, suitable for outdoor installation. Turn ratios shall be determined by Seller.

8.5.3 Capacitive Coupled Voltage Transformers ("**CCVT**") shall have the facility for grounding through an external grounding switch.

8.6 Current Transformers

8.6.1 All current transformers shall be connected through indoor, panel mounted, current injection test switches. Each current transformer neutral shall be brought through into the control building for termination and single point grounding within the associated protection relay panel.

8.6.2 The facility for short circuiting the secondary tails of all current transformers, with removable links, must be provided. All current transformers are to be connected through indoor, panel mounted current injection test switches.

8.7 Main Step-Up Transformers

8.7.1 The main step-up transformer(s) shall be sufficiently sized to allow the full Project capacity to be delivered to the point of interconnection.

8.7.2 The main step-up transformer(s) shall be in accordance with IEEE standards and the requirements set forth in Table 3 (*Summary of General Requirements for Main Step-Up Transformers*) herein, at a minimum.

Table 3: Summary of General Requirements for Main Step-Up Transformers

Description	Value
Quantity	See Section 8.7.5
Type	Oil filled, hermetically sealed, outdoor installation
Voltage ratio	TBD* / 34,500 / 13,200 Volts (*: varies by Project)
Phases	3
Windings	3 (HV, MV, Tertiary)
Steady state temperature rise	65°C above ambient
Frequency	60 Hz
Impulse levels	TBD kV (HV), 200 kV (MV), 110 kV (Tertiary)
Vector group	YNynd11
Cooling	ONAN / ONAF / ONAF
Tapping range	±5%, 2.5% steps, manual control (DETC)
Paint finish	ANSI 70 sky grey color
Guaranteed losses	Not used
Temperature gauge	Required
Pressure level indicator	Required
Pressure relief device	Required
Oil sampling valve	Required
Filling orifice	Required
Tank ground tag	Required
Oil level indicator	Required
Grounding	Solid (primary and secondary windings) Buried delta (tertiary winding)

8.7.3 Applicable standards include, but not limited to:

(1) Berkshire Hathaway Energy EBU PX-S02 Substation Equipment – Collector Substation Main Power Transformer

(2) C57.12.00, General Requirements for Liquid-Immersed Distribution, Power and Regulating Transformers.

(3) C57.12.10, American National Standard for Transformers 230 kV and Below 833/958 Through 8333/10 417 kVA, Single-Phase, and 750/862 Through 60 000/80 000/100 000 kVA, Three-Phase without Load Tap Changing: and 3750/4687 through 60 000/80 000/100 000 kVA with Load Tap Changing—Safety Requirements.

(4) C57.12.70, Standard for Terminal Markings and Connections for Distribution and Power Transformers

(5) C57.12.80, Terminology for Power and Distribution Transformers.

(6) C57.12.90, Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers and Guide for Short-Circuit Testing of Distribution and Power Transformers

(7) C57.13 Standard Requirements for Instruments Transformers.

(8) C57.19.00, General Requirements and Test Procedure for Outdoor Power Apparatus Bushings.

(9) C57.19.01, Performance Characteristics and Dimensions for Outdoor Apparatus Bushings.

(10) C57.91, Guide for Loading Mineral-Oil-Immersed Transformers.

(11) C57.92, Guide for Loading Transformers.

(12) C57.93, Guide for Installation of Liquid-Immersed Power Transformers.

(13) C57.98, Guide for Transformer Impulse Tests.

(14) C57.109, Guide for Liquid-Immersed Transformer Through-Fault Current Duration.

(15) C57.116, Guide for Transformers Directly Connected to Generators.

(16) C57.120, Loss Evaluation Guide for Power Transformers and Reactors

8.7.4 An electronic impact recorder with GPS capability shall be installed by the manufacturer; if rail shipment is specified, an additional impact recorder shall be mounted on the railcar. The impact recorder shall be furnished with a sealed protective cover. Immediately prior to scheduled pickup of the transformer, the supplier shall start the recorder and verify it is operating properly.

8.7.5 Each main step-up transformer shall have a 150-MVA rating (ONAN, 65°C). The Project shall incorporate parallel main step-up transformers in 150 MVA increments, where each such transformer is identical and interchangeable (mechanically and electrically). Load from each Collection System Circuit shall be split evenly across each transformer. Example: a 250-MW project shall incorporate two (2) 150-MVA main step-up transformers with approximately 125 MW on each unit. If a project intends to use a transformer larger than 150-MVA, the proposal must include complete specifications for the proposed transformer. The proposed transformer will be subject to Owner approval.

8.8 Station Service Transformer

8.8.1 The station service transformer shall be sized according to the Seller-provided AC system study.

8.8.2 The station service transformer shall be in accordance with the minimum requirements set forth in Table 4 (Summary of General Requirements for Station Service Transformers).

Table 4: Summary of General Requirements for Station Service Transformers

Description	Value
Quantity	1
Type	Oil filled, pole-mounted, outdoor installation
Voltage ratio	34,500 / 120 / 240 Volts
Phases	1 or 3 (depending on Project electrical design)
Windings	2 (MV, LV) Copper
Steady state temperature rise	65°C above ambient
Frequency	60 Hz
Impulse levels	200 kV
Vector group	Dyn1
Cooling	ONAN
Tapping range	±5%, 2.5% steps, manual control
Paint finish	ANSI 70 sky grey color
Guaranteed losses	Not used
Temperature gauge	Required
Pressure level indicator	Required
Pressure relief device	Required
Oil sampling valve	Required
Filling orifice	Required
Tank ground tag	Required
Oil level indicator	Required
Grounding	Solid (LV winding) Un-grounded delta (MV winding)

8.9 Circuit Breakers

8.9.1 Applicable IEEE Standards include, but not limited to:

(1) C37.09 IEEE Standard Test Procedure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis

(2) C37.04 IEEE Standard for Rating Structure for AC High-Voltage Circuit Breakers

(3) C37.12 IEEE Guide for Specifications of High-Voltage Circuit Breakers (over 1000 Volts)

(4) C37.11 IEEE Standard Requirements for Electrical Control for AC High-Voltage (>1000 V) Circuit Breakers

(5) C37.06.1 American National Standard Guide for High-Voltage Circuit Breakers Rated on Symmetrical Current Basis Designated

(6) C57.13 IEEE Standard Requirements for Instrument Transformers

(7) C37.09 IEEE Standard Test Procedure for AC High-Voltage Circuit Breakers with Rated Maximum Voltage Above 1000 V

(8) High-side circuit breakers shall be in accordance with the minimum requirements set forth in Table 5: Summary of General Requirement for High-Side Circuit Breakers

8.9.2 High-side circuit breakers shall be outdoor, air insulated, three-pole, single-throw, 60 Hertz, dead-tank design with dual trip coils, alarms, interlocks and contacts necessary to meet the Project design and PacifiCorp High Voltage Circuit Breaker spec. Such circuit breakers shall utilize SF6 gas as the interrupting medium. Such breakers shall consist of three sections: high-voltage compartment, mounting provisions, and low-voltage compartment.

Table 5: Summary of General Requirement for High-Side Circuit Breakers

Description	**Value**
Quantity	TBD* (*: Varies by Project)
Nominal Line-to-Line System Voltage (kV)	TBD* (*: Varies by Project)
Maximum Operating Voltage (kV)	TBD* (*: Varies by Project)
Rated Power Frequency	60 Hz
Rated Current (Amps)	TBD* (*: Varies by Project)
Power Frequency Withstand Voltage	TBD* (*: Varies by Project)
Withstand Full wave Lightning Impulse Voltage (BIL – kV Peak	200 kV
Short Circuit Breaking and Short Time Withstand Current	40 kA
Peak Withstand Current	170 kA
Short Circuit Making Current	170 kA
Interrupting Time	3 cycles
Closing and Latching Current (kA, Peak)	40 kA
Transient Recovery Voltage (Peak Value)	70 kV
Temperature Rating Range (Min/Max)	-50°C/+50°C

8.9.3 34.5kV circuit breakers shall be installed for protection of the Collection System Circuits, capacitor banks, and reactors. Such circuit breakers shall be outdoor, distribution, 60 Hertz, vacuum or SF6 circuit breakers consisting of three sections: high-voltage compartment, mounting provisions, and low-voltage compartment unless alternative design is approved by Owner.

(1) Collection System Circuit Breakers

(a) Collection System Circuit Breakers must be used withgrounding transformers (see section 8.13)unless high speed grounding circuit breakers are used.

(b) Collection system circuit breakers shall be in accordance with the minimum requirements set forth in **Table 6: Summary of General Requirements for Collection System Circuit Breakers**

Table 6: Summary of General Requirements for Collection System Circuit Breakers

Description	Value
Quantity	TBD* (*: Varies by Project)
Nominal Line-to-Line System Voltage (kV)	34.5kV
Maximum Operating Voltage (kV)	38kV
Rated Power Frequency	60Hz
Rated Current (Amps)	1200A
Withstand Full wave Lightning Impulse Voltage (BIL – kV Peak)	200kV
Short Circuit Breaking Current	31.5kA
Short Time Withstand Current	31.5kA
Interrupting Time	3 cycles
Closing and Latching Current (kA, Peak)	31.5kA
Transient Recovery Voltage (Peak Value)	70kV
Bushing Current Transformers (Two Each per Pole on Both Sides of Breaker)	Relaying Accuracy Class 200
Temperature Rating Range (Min/Max in Deg C)	50°C to +50°C
Space Heater Voltage for Control Cabinet (operated at 120vac)	240 V
Configuration (Construction for Three Poles)	Single Frame
Control Voltage (Trip and Close Schematic)	125vdc
Charging Motor Voltage	125vdc
Lamp and Maintenance Receptacle in Control Cabinet	120vac
Tank Type	Dead Tank, Self-Supporting, Free-Standing, Weatherproof

(2) Collection System Grounding Circuit Breakers

(a) Collection system grounding circuit breakers do not require grounding transformers (see section 8.13). The grounding-type circuit breaker will short all three phases of the load side of the collector breaker to ground when a collector breaker is opened in the system.

(b) Collection system grounding circuit breakers shall be in accordance with the minimum requirements set forth in Table 7: Summary of General Requirements for Collection System Grounding Circuit Breakers

Table 7: Summary of General Requirements for Collection System Grounding Circuit Breakers Table 6: Summary of General Requirements for Collection System Circuit Breakers

Description	**Value**
Quantity	TBD* (*: Varies by Project)
Nominal Line-to-Line System Voltage (kV)	34.5 kV
Maximum Operating Voltage (kV)	38 kV
Rated Power Frequency	60 Hz
Rated Current (Amps)	1200 A
Withstand Full wave Lightning Impulse Voltage (BIL – kV Peak)	200 kV
Dielectric Strength Withstand (60Hz, 1 minute)	80 kV
Short Circuit Breaking Current	31.5 kA
Short Time Withstand Current	31.5 kA
Circuit Breaker Peak Making Current	85 kA
Grounding Breaker Peak Making Current	34 kA
Circuit Breaker Rated Opening Time	30 msec
Circuit Breaker Rated Closing Time	40 msec
Circuit Breaker Rated Arcing Time	4 to 11 msec
Mechanical Switching Time	12-16 msec
Maximum Electrical Switching Time	12 msec
Bushing Current Transformers (Two Each per Pole on Both Sides of Breaker)	Relaying Accuracy Class 200, Cast Resin, 600 VACc insulation level
Temperature Rating Range (Min/Max in Deg C)	50°C to +50°C
Space Heater Voltage for Control Cabinet (operated at 120vac)	240 VAC
Configuration (Construction for Three Poles)	Single Frame
Control Voltage (Trip and Close Schematic)	125 VDC
Charging Motor Voltage	125 VDC
Lamp and Maintenance Receptacle in Control Cabinet	120 VAC
Tank Type	Dead Tank, Self-Supporting, Free-Standing, Weatherproof
Supporting Frame	Galvanized Steel
Interrupting Medium	Vacuum

Grounding Switch – High-Speed (make after break)	Three-Pole, Mechanically Interlocked
Initiation of Grounding Switch Operation	Automatic

(3) Capacitor Bank Circuit Breakers

(a) Capacitor bank circuit breakers need to withstand transients which occur when connecting and disconnecting capacitor banks. These breakers require more attention to the making capacity than many other breaker types.

(b) Capacitor bank circuit breakers shall be in accordance with the minimum requirements set forth in Table 8: Summary of General Requirements for Capacitor Bank Circuit Breakers

Table 8: Summary of General Requirements for Capacitor Bank Circuit Breakers

Description	**Value**
Nominal Line-to-Line System Voltage (kV)	34.5 kV
Rated Maximum Voltage	38 kV
Power Frequency Withstand Voltage	80 kV
Lightning Impulse Withstand Voltage (BIL)	200 kV
Power Frequency Rating	60 Hz
Rated Continuous Current	600 A
Short Circuit Making Current	40 kA (31.5 kA)
Peak Withstand Current	100 kA
Short-Time Symmetrical Withstand	40 kA (31.5 kA)
Transient-Making Current (Specify HF)	18 kA Peak
Transient Inrush Frequency (Specify HF)	4630 Hz
Short Circuit Interrupting Current	TBD*
Duty Cycle Closing Time (ms at 125Vdc)	TBD*
Capacitive Switching Current/Duty	600 A
Fault Closing Withstand Capability	40 kA (31.5 kA)
Bank Breaking Current (Back-to-Back)	600 A
Pre Insertion Resistor Rating in Ohms (at 5000kVAR)	90 Ohms
Pre Insertion Resistor Withstand Rating	40 kA (31.5 kA)
Bushing Current Transformers (Relaying Accuracy)	C200
Operating Temperature Range (Degree C)	-50°C to +50°C
Space Heater Voltage for Control Cabinet (operated at 120vac)	240 VAC
Control Power Voltage	125 VDC
Auxiliary Power voltage	120 VAC

*: To be determined by system studies

(4) Reactor Bank Circuit Breakers

(a) Reactor bank circuit breakers require special considerations for inserting and de-energizing reactor banks.

(b) Reactor bank circuit breakers shall be in accordance with the minimum requirements set forth in Table 9: Summary of General Requirements for Reactor Bank Circuit Breakers.

Table 9: Summary of General Requirements for Reactor Bank Circuit Breakers

Description	Value
Nominal Line-to-Line System Voltage (kV)	34.5 kV
Rated Maximum Voltage	38 kV
Power Frequency Withstand Voltage	80 kV
Lightning Impulse Withstand Voltage (BIL)	200 kV
Power Frequency Rating	60 Hz
Rated Continuous Current	600 A
Short Circuit Making Current	40 kA (31.5 kA)
Peak Withstand Current	100 kA
Short-Time Symmetrical Withstand	40 kA (31.5 kA)
Transient-Making Current (Specify HF)	18 kA Peak
Transient Inrush Frequency (Specify HF)	4630 Hz
Mechanism	Spring Operating, Open-Close
Reactive Switching Current	350 A
Interupter Type	Single Gap SF6
Fault Closing Withstand Capability	40 kA (31.5 kA)
Operating Temperature Range (Degree C)	-50°C to +50°C
Space Heater Voltage for Control Cabinet (operated at 120vac)	240 VAC
Control Power Voltage	125 VDC
Auxiliary Power voltage	120 VAC

8.9.4 Circuit breakers shall contain bushing current transformers for metering and/or protective relaying applications. Current transformers utilized for metering shall be provided with accuracy levels as required by the applicable metering standards of entities which will be installing metering within the station.

8.9.5 Mounting provisions shall be formed-steel supports that mount the breaker to a foundation and provide height adjustment.

8.9.6 The low-voltage compartment of the circuit breakers shall contain the control components and operating mechanism including anti-condensation heaters.

8.9.7 The stored energy mechanism shall drive a common shaft which operates all three phases and the auxiliary switches for breaker position contacts.

8.9.8 The control enclosure shall contain the relays, meters, and switches for the breakers.

8.9.9 The circuit breakers shall have provisions for mounting the protective relays in the control cabinet and remotely.

8.10 Shunt Capacitor Bank

8.10.1 The shunt capacitor bank shall be medium voltage, three-phase, internally-fused, single stage, open-rack, ungrounded, horizontal mounting type capacitor bank. The cap bank shall include an interlockable, gang-operated grounding switch, intended to ground the complete assembly for maintenance purposes.

8.10.2 Applicable IEEE Standards include, but not limited to:

(1) IEEE 18 IEEE Standard for Shunt Power Capacitors

(2) IEEE 1036 IEEE Guide for Application of Shunt Power Capacitors

(3) C37.99 IEEE Guide for the Protection of Shunt Capacitor Banks

(4) IEEE 693 IEEE Recommended Practices for Seismic Design of Substations

8.10.3 Shut capacitor banks shall be in accordance with the minimum requirements set forth in Table 10: Summary of General Requirements for Shunt Capacitor Banks.

Table 10: Summary of General Requirements for Shunt Capacitor Banks

Description	Value
MVAR Rating of Cap Bank (At Nominal Volt & Freq)	TBD*
Nominal Line-to-Line System Voltage (Kv)	34.5 kV
Maximum Operating Voltage (Kv)	38.0 kV
Temperature Rating Range (Min/Max in Deg C)	-50°C to +50°C
Fuse Technology	Internally-Fused Capacitor Design
Rated Power Frequency	60Hz
Rated Current (Amps)	TBD*
Lightning Impulse Withstand Voltage (BIL in kV)	200 kV

Ground Switch (Three Phase Group Operated)	600A

*: to be determined based on power flow study and power factor requirements provided in interconnection agreement

8.11 Shunt Reactor Bank

8.11.1 The shunt reactor bank shall be 34.5 kV phase to phase or 19.92 kV phase-ground designed for outdoor applications consisting of a single 3-phase step of a specified MVAR inductive reactance. The 3-phase step(s) shall consist of three (3) air-core shunt reactor coils, each rated at one-third of the full MVAR rating. The air-core shunt reactor coils are interconnected to form a wye connection with the other phases. Shunt Reactor steps shall be switched using a reactor switching device.

8.11.2 Applicable IEEE Standards include, but not limited to:

(1) IEEE C57.21 – IEEE Standard Requirements, Terminology and Test Code for Shunt Reactors Rated Over 500 kVA

(2) IEEE C37.109 – Guide for the Protection of Shunt Reactors

(3) IEEE C37.015 – Application Guide for Shunt Reactor Switching

(4) IEEE 693 – Recommended Practice for Seismic Design of Substations

8.11.3 Shunt reactor banks shall be in accordance with the minimum requirements set forth in

Table 11: Summary of General Requirements for Shunt Reactor Banks

Description	**Value**
MVAR Rating of Reactor Bank (At Nominal Volt & Freq)	TBD*
Nominal Line-to-Line System Voltage (kV)	34.5 kV
Maximum Operating Voltage (kV)	38.0 kV
Temperature Rating Range (Min/Max in Deg C)	-50°C to +50°C
Rated Power Frequency	60 Hz
Rated Current (Amps)	TBD*
Lightning Impulse Withstand Voltage (BIL in kV)	200 kV
Basic Insulation Level (BIL) phase-to-ground, kV_{peak}	250 kV
Mounting Arrangement	Trefoil

*: to be determined based on power flow study and power factor requirements provided in interconnection agreement

8.12 Disconnect Switches

8.12.1 Applicable IEEE Standard includes, but not limited to:

(1) C37.30.3 IEEE Standard Requirements for High-Voltage Interrupter Switches, Interrupters, or Interrupting Aids Used on or Attached to Switches Rated for Alternating Currents Above 1000 V

8.12.2 High-side, motor-operated, line disconnect switches shall be provided for isolation of the main step-up transformer and Collection System Circuits from the high-side bus system.

8.12.3 High-side breaker disconnect switches shall be outdoor, non-load break, 3-phase gang, manually operated.

8.12.4 All switches shall include contacts and interlocks wired for protection and control with provisions for padlocking for personnel safety and maintenance. All switches shall have hard-wired interlocks and shall be designed and implemented to prevent operation in an undesired state.

8.12.5 High-side, motor-operated, line disconnect switches shall be installed for isolation of the Interconnection Line.

8.12.6 34.5-kV disconnect switches shall be outdoor, non-load break, 3-phase gang, manually operated. These switches shall provide isolation of 34.5-kV breakers, reactors, capacitor banks, and/or grounding transformers, as applicable.

8.13 Grounding Transformers

8.13.1 Grounding transformers shall be sized to effectively ground the portion of the Collection System Circuit that is disconnected from the main Project Substation 34.5-kV bus when the Project Substation feeder or collector breaker is open. Grounding transformers are not needed when grounding circuit breakers are used. See Section 8.9.3.

8.13.2 See Section 8.7.3 for applicable IEEE Standards.

8.13.3 The duration of time that the grounding transformer shall provide effective grounding shall be determined assuming that the Collection System Circuit was at full rated generation at the time when a fault condition occurs on the Collection System Circuit, the time required for the collector breaker to trip due to the fault condition, and the additional time that the isolated Wind Turbine Generators on the Collection System Circuit continue to contribute energy to the fault after the collector breaker opens.

8.13.4 Effective grounding shall be as defined in IEEE Standard 142 and meet the following two conditions, at a minimum:

(1) The positive sequence reactance is greater than the zero sequence resistance ($X1 > R0$)

(2) The zero sequence reactance is less than or equal to three (3) times the positive sequence reactance ($X0 <= 3X1$).

8.14 Space Heaters

8.14.1 Breakers and other outdoor equipment shall be furnished with space heaters (if not already provided by manufacturer of the equipment) that are thermostatically controlled and shall be rated single phase 240V for operation on 120V and shall include personnel protection screens.

8.15 Surge Arrestors

8.15.1 High-side voltage surge arrestors shall meet the requirements of ANSI C62.11 for Station Class installation in a 60-Hertz outdoor installation. Surge arrestors shall be provided on the high-voltage bushings of the main step-up transformer.

8.15.2 34.5-kV surge arrestors shall meet the requirements of ANSI C62.11 for Station Class installation in a 60-Hertz outdoor installation. Surge arrestors shall be provided at the 34.5-kV breakers.

8.15.3 Equipment surge arrestors shall be station class, metal-oxide type surge arrestors for outdoor use and polymer housing. Surge arrestors shall be shatterproof.

8.16 Rigid Bus

8.16.1 Design of the bus systems shall be in accordance with IEEE 605, at a minimum.

8.16.2 Loading and seismic performance shall be in accordance with the Project design and Project Site location. Such information is subject to verification by Seller.

8.16.3 Rigid bus, at a minimum, shall be seamless, Schedule 40 tube made of 6063-T6 aluminum alloy fabricated per ASTM B241.

8.16.4 A damping conductor shall be furnished in all horizontal bus.

8.16.5 Bus shall have one-quarter inch (1/4”) drain holes in all bus/fittings that could possibly trap water.

8.16.6 Station post insulators shall be of sufficient strength to support the rigid bus and shall be ANSI 70 gray color.

8.17 Connectors and Fittings

8.17.1 Connectors and fittings shall be of the proper size and design to assure permanent, secure, and low-resistance connections.

8.17.2 Connectors and fittings shall be all welded for aluminum tubing connections and compression or puddle-welded type for aluminum cable connections.

8.17.3 Tubular aluminum welded splicing sleeves shall be used for necessary splices in aluminum tubing.

8.17.4 For connections between aluminum tubing and cable, use a welded tubing-to-terminal pad connector and a compression-type cable-to-terminal pad connector on the end of the cable.

8.17.5 Rigid bus connections to transformers, breakers, CCVTs, or freestanding current transformers are prohibited.

8.17.6 For electrical pad connections, stainless steel hex-bolts, hex-nuts, flat washers, and Belleville washers shall be provided. Belleville washers shall have a minimum compression rating of 4,000 pounds. Bolt lengths shall be sized to provide minimal projection beyond hex nut to prevent excessive noise due to corona, but entire hex nut must be engaged.

8.17.7 For copper to aluminum connections, stainless steel bolts shall be used for copper to aluminum bar or rod connections and faced or sleeved aluminum connectors shall be used for cable connections.

8.17.8 All connections between stranded aluminum AAC or ACSR-type conductors and equipment stud terminals shall be made with a stud-to-pad type stud connector and a compression-type cable-to-pad type conductor termination.

8.17.9 All dead-end fittings, terminals, splices, and other similar items for ACSR and other types of stranded aluminum conductor AAC shall be tubular compression type fittings. In no case shall any type of stranded aluminum conductors be used with bolted or clamp-type fittings, except for through-type connections to surge arresters on transformers. At least five percent (5%) extra dead-end body filler plugs for each type used shall be provided.

8.17.10 Stranded and tubular copper bus work, where used, shall have connectors and fittings with a minimum of four (4) bolts or two (2) “U”-bolts on each side of each joint.

8.17.11 Fittings shall develop the full strength of the conductor and shall be capable of carrying the full current capacity of the conductor.

8.17.12 Fittings for shield wire dead ends, splices, and taps shall conform to the following:

(1) Shield wire dead-end fittings shall be compression type with bolted jumper connection. Shield wire insulators shall be located as indicated.

(2) Compression sleeves for shield wire tension splices shall be used which will develop at least ninety percent (90%) of shield wire strength.

8.17.13 “Alcoa Filler Compound” shall be furnished for application in conductor dead-end bodies and Alcoa No. 3 Electrical Joint Compound (Alnox), or approved equal for aluminum connections. At least five percent (5%) overage shall be furnished for all filler compounds furnished.

8.17.14 Bus support clamps for rigid bus shall be fixed or slip type as required to firmly support the bus but allow for temperature expansion and contraction.

8.17.15 Bolted ground connectors and flexible type grounding jumpers shall be provided for operating handles of disconnect switches.

8.17.16 All transformer and oil circuit breaker stud connectors shall be tinned bronze material.

8.17.17 All grounding connectors in contact with galvanized structures shall be tinned bronze material.

8.17.18 All compression tees are to be open type compression run and 4-hole NEMA pad tap.

8.17.19 Bundled jumpers from power circuit breakers to disconnect switches shall be furnished.

8.17.20 For disconnect switch connections, NEMA-type terminal pad connectors shall be provided with at least four (4) bolts.

8.17.21 All materials furnished shall have mechanical and electrical ratings, types, sizes, and other similar items coordinated with adjacent hardware and fittings.

8.17.22 All hardware furnished shall be static-free type.

8.17.23 Ground jumpers shall be provided direct from switch-operator ground pad to ground connector on operating handle or mechanism of switch. No other ground connection is to be made to pad. Ground mat(s) shall be furnished at each switch-operator.

8.17.24 Bus grounding stud, welded or swaged, shall be furnished as indicated.

8.17.25 Wire guides and bundle conductor spacers shall be provided as required and indicated to maintain adequate clearance and support on cable jumpers, connections, and overhead lines.

8.18 Grounding System

8.18.1 The grounding system/grid shall be installed throughout the Project Substation, including beyond the substation fence line.

8.18.2 The ground grid shall be designed in accordance with IEEE 80, PacifiCorp Engineering Handbook Section 6B.6-Substation Grounding and using SES-CDEGS software or Owner-approved equivalent.

8.18.3 The Project Substation grounding system shall be an interconnected network of bare #4/0 AWG copper conductor and copper-clad ground rods (ground wells may be used instead of ground rods if dictated by the soil analysis). The system shall be designed such that Project Substation personnel are protected from the hazards that can occur as the Project Substation grounding system provides the earth return electrode during power system phase to ground faults.

8.18.4 Ground resistivity testing shall be performed *prior* to final design to determine ground analysis parameters. The ground resistivity shall be measured with the methods given in IEEE 81.

8.18.5 The Project Substation grounding grid shall be designed in accordance with the methods and recommendations of IEEE 80. The grounding system shall have adequate capacity to dissipate heat from ground current under the most severe conditions in areas of high ground fault current concentrations, with grid spacing such that safe voltage gradients are maintained. Ground conductors shall be sized for fault duration of 0.5 seconds.

8.18.6 Ground conductor size shall be sized accordingly to specific ground conditions and equipment requirements.

8.18.7 Bare conductors to be installed below grade shall be spaced in a regular pattern that is consistent with the grounding analyses. Each junction of the grid shall be bonded together by an exothermal welding process. Above ground shall be NEMA two-hole connectors.

8.18.8 Grounding connections shall be made to fences and equipment. Equipment grounds shall conform to the following general guidelines:

(1) Grounds shall conform to the NESC.

(2) All equipment grounding connections shall be connected to the ground grid.

8.18.9 All Project Substation bus and equipment support structures shall be connected to the station ground grid. Metal support structures in direct metallic contact with other metal structures do not require a separate grounding connection to the station ground grid. Fences shall be grounded in accordance with the requirements of the NESC.

8.18.10 The ground grid shall extend at least three (3) feet outside the perimeter fence of the Project Substation and shall be bonded to the fence as required to meet acceptable levels of both touch and step potential and ground potential rise per PacifiCorp Substation Grounding standards.

8.18.11 A minimum of six (6) inches of *washed* crushed aggregate shall cover the entire Project Substation footprint, including those areas reserved for future build-out, *plus* a minimum of three (3) feet outside the perimeter fence, in order to help reduce touch and step potentials. A greater level of washed crushed aggregate shall be installed if necessary, to meet the Requirements and satisfy the recommendations set forth in the geotechnical engineering report. The minimum resistivity shall be 3,000 ohm-meters. Crushed rock shall conform to ASTM C33, gradation 1.5 to No. 8 particles.

8.18.12 All grounding materials required shall be furnished new and undamaged in accordance with the following requirements, at a minimum:

(1) Rods:

(a) 5/8-inch x 10-foot (minimum) copper-clad standard type or as grounding calculations required.

(b) The copper cladding shall be electrolytically bonded to the steel rod or bonded by a molten welding process.

(c) Cold rolled copper cladding is not acceptable.

(d) Soil conditions may require ground rods to be drilled.

(2) Cable:

(a) Bare: soft-drawn copper, Class B stranding, ASTM BB.

(b) Insulated: soft-drawn copper; Class B stranding with green-colored PVC insulation; UL 83; Type TW, THW or THHN.

(3) Wire mesh: copper clad; 6 AWG; 6-inch x 6-inch mesh spacing; copper weld or Owner-approved equal.

(4) Bus and bars: soft copper; cross section not less than 1/8-inch thick by 1-inch wide; ASTM 8187.

(5) Exothermal welds: molds, cartridges, materials, and accessories as recommended by the manufacturer of the molds for the items to be welded. Cadweld heavy duty or Owner-approved equal. Molds and powder shall be furnished by the same manufacturer.

(6) Flush ground plates: Cadweld B-162 Series, B-164 Series, or Owner-approved equal ground plates with NEMA hole spacing.

8.18.13 All clamps, connectors, bolts, washers, nuts, and other hardware used with the grounding system shall be made of copper. Compression fittings above grade are prohibited.

8.19 Lightning Protection

8.19.1 Lightning protection shall be designed in accordance with IEEE 998.

8.19.2 Overhead shield wires installed on the take-off towers and lightning masts shall be provided for protection from direct lightning strikes.

8.19.3 The shield system shall be adequately tied into the Project Substation ground grid.

8.19.4 Steel masts for direct stroke protection shall be round tapered seamless extruded or spun aluminum tubes.

(1) The overall height of the masts above grade shall be determined from the direct stroke protection study, as more particularly described in Exhibit [TBD] (*Scope of Work*).

(2) Masts shall have a single uniform taper from top to bottom.

(3) Each mast shall be capped with a suitable finial.

(4) Each mast shall be equipped with an internal vibration dampening device.

(5) The design of masts shall have a safety factor of two (2) based on the allowable yield stress for the mast material in accordance with the latest ASCE specifications governing design of structures.

(6) The horizontal deflection at the top of each free-standing mast shall be limited to L/20 of its height above foundation.

(7) Each mast shall be installed on a concrete foundation with galvanized steel anchor bolts. Foundations, bolts, and welding shall be in accordance with the Requirements, including Section 5.0 (*Structural Works Specifications*).

(8) Each mast shall be provided with two grounding pads located 12 inches above the foundation.

8.20 Lighting

8.20.1 A lighting system shall be furnished for the Project Substation. The lighting system shall provide personnel with illumination for Project Substation operation and maintenance under normal conditions, and means of egress under emergency conditions. Dark sky lighting is recommended.

8.20.2 The power supply for the lighting system shall be from 120/208 or 277/480 volt, 3-phase, 4-wire lighting panel. Single-phase lighting is also acceptable.

8.20.3 The lighting system shall be designed in accordance with IES standards to provide acceptable illumination levels.

8.20.4 Lighting sources and fixture selections shall be based on the applicability of the luminaries for the area under consideration.

8.20.5 Lighting levels shall meet, at a minimum, the requirements of the NESC, including Table 111-1 therein.

8.20.6 Outdoor lighting shall be LED type.

8.21 Equipment Labeling

8.21.1 All major equipment and devices shall be properly labeled per Owner Standards with nameplates made of laminated three-ply plastic, equal to Lamicoid to meet Applicable Standards (including those for safety) and other Requirements.

8.21.2 Nameplates shall be a minimum of 1/8-inch thick, with yellow outer layers on a black core.

8.21.3 Nameplate edges shall be chamfered.

8.21.4 Nameplates shall be fastened to the equipment by using a minimum of one (1) blank rounded screw on each end.

8.22 Substation Video Surveillance

8.22.1 For purposes of the Proposal, a CCTV system will not be installed at the Project Substation, although Seller shall install conduits and gang boxes (including covers for gang boxes) and leave appropriate space for future installation.

8.23 Electrical Equipment Enclosures

8.23.1 Control cabinets, pull boxes, and junction boxes shall be in accordance with NEMA standards and type number and shall be suitable for the Project location conditions. Minimum design shall be:

(1) Indoor: NEMA 1

(2) Outdoor: NEMA 3, stainless or aluminum.

8.23.2 All enclosures shall be provided with pad-locking provisions.

8.24 Battery System

8.24.1 All battery systems shall conform, at a minimum, to the Applicable Standards of IEEE, ANSI, and NEMA, as well as other applicable Requirements.

8.24.2 Batteries shall be provided with racks, connection devices, tools, instruction books, protection shield covers, rail protection system, and other standard items. They shall also include redundant fans for the required ventilation. Such fans shall be installed directly above the location where batteries are to be installed.

8.24.3 Battery charger requirements:

(1) Two (2) fully-rated, self-cooled battery chargers shall be installed. The battery chargers should be connected in parallel to charge the batteries simultaneously.

(2) Project Substation battery chargers shall be 125VDC output, sized as required for eight (8)-hour recharge while serving continuous load.

(3) Chargers shall include an AC circuit breaker in the charger input circuit to provide a disconnect point and overcurrent protection. Chargers also shall include DC ammeters, DC voltmeters, AC power failure alarm relays, high/low DC voltage alarm relays, ground detection alarm relays, and battery temperature compensation systems which reduce the charge rate if necessary.

(4) Chargers shall maintain output voltage within plus or minus one-half percent (0.5%) from no load to full load, with an input power supply deviation in voltage level of plus or minus ten percent (10%) and an input power supply deviation in frequency of plus or minus five percent (5%).

(5) Chargers shall automatically vary the charging rate in accordance with the requirements of the Project Substation battery.

(6) Each battery charger-eliminator furnished shall be self-regulating, natural cooled, solid-state silicon controlled full wave rectifier type designed for single and parallel operation with the batteries specified under the Specifications. Charger shall be able to provide the DC load requirements in the event that battery is disconnected.

(7) The chargers will be served from the Project Substation AC system.

(8) Solid-state electronic circuits shall have AC and DC transient voltage protection and shall be designed to recharge a totally discharged battery without overloading and without causing an interrupting operation of AC or DC circuit breakers.

(9) Charger shall be a full capacity charger, and shall have the capacity to recharge the battery in eight (8) hours following complete discharge. Charger shall also have an equalizing charge mode. Battery charger will be self-regulating after charging levels are manually selected. Battery charger shall be manufactured in NEMA 1 enclosures suitable for placement in an indoor, environmentally controlled atmosphere. Charger shall require only front access, and will allow either top or bottom conduit/cable entry.

8.24.4 The Project Substation shall include a DC system, including, but not limited to, batteries, two (2) battery chargers, and panelboards.

(1) Battery size shall be determined using the battery load profile.

(2) Nominal voltage shall be 125VDC with 60 cells.

(3) Batteries shall be capable of being recharged to rated capacity from a discharge down to zero (0) volts per cell, following an equalization charge.

(4) Batteries shall be capable of being recharged within eight (8) hours following a complete discharge.

(5) Design shall be based on an eight (8)-hour discharge time to 1.75 volts per cell and the voltage is to be maintained for the minimum 30-year life of the battery.

8.24.5 Each battery cell shall be wet cell, lead-acid pasted plate-type with lead-calcium alloy plate grids or sealed type with 30-year expected life. Cell containers shall be sealed, clear, shock absorbing, heat resistant plastic, with electrolyte high and low-level markers and spray-proof vents. Batteries shall be manufactured for full float service with a high discharge rate, low deterioration rate, and low maintenance. Batteries shall be supplied complete with all accessories (e.g., battery rack, inter-cell connectors). Racks shall be a two (2)-step configuration with proper seismic design for the location.

8.24.6 The DC panel and bolted breakers shall have a main bus current rating as required to supply the connected load. The continuous current ratings and interrupting ratings of the feeder breakers shall be based on the available fault current and the characteristics of the connected loads or the battery chargers.

8.24.7 The capacity of each battery shall be determined in accordance with IEEE 485 and the specifications herein. With the battery initially fully charged at the floating voltage specified, and with the battery chargers disconnected, the battery shall be capable of supplying the duty cycle specified. The ambient temperature during the duty cycle shall be 25°C.

8.24.8 The duty cycle for battery sizing shall include:

(1) One (1) minute at the level of current required to operate all Project Substation circuit breakers plus the continuous load.

(2) 478 minutes of continuous load (actual but not less than 15A).

(3) One (1) minute at the level of current required to operate all Project Substation circuit breakers plus the continuous load.

8.25 Raceway

8.25.1 Raceway shall conform, at a minimum, to the recommendations included in IEEE 525.

8.25.2 Raceway that contains multiple cable circuits shall have all cables with identical insulation ratings.

8.25.3 Individual raceway systems shall be established for the following services:

(1) 600-volt control cable.

(2) Special electrical noise-sensitive circuits.

(3) Fiber optic cable.

8.25.4 Hot-dipped, rigid galvanized conduit (after fabrication) shall be used for above-ground power and control cables.

8.25.5 Flexible conduits shall be used only at locations where vibration is required. The maximum contiguous length of flexible conduit shall be three (3) feet.

8.25.6 All raceway and conduit locations shall be coordinated with other equipment and structures. All raceway and conduit shall be installed perpendicular or parallel to the major equipment and bus structures.

8.25.7 All raceway and conduit shall be installed in a neat, rectangular form. Special attention shall be given to securing a neat appearance.

8.25.8 All raceway materials required shall be furnished new and undamaged in accordance with the following requirements, at a minimum:

(1) Duct: polyvinyl chloride, Schedule 40 PVC in accordance with NEMA TC-2.

(2) Couplings: plastic, for use with duct previously specified and "duct-to-steel" adapters as required, including joint cement.

(3) Spacers: plastic high impact, interlocking, base and intermediate type

(4) Factory bends and sweeps: Schedule 40 PVC, three (3)-foot minimum radius.

(5) End bells: plastic.

(6) Plugs: plastic, high impact, tapered to fit end bell provided.

(7) Duct binder: hemp or sisal twine coupling.

(8) Riser termination: rigid hot-dip galvanized mild-steel coupling.

(9) Riser bends: rigid steel conduit elbows, factory or field made, three (3)-foot minimum radius, 90 degree, entirely concrete encased below grade; hot-dip galvanized rigid mild steel in accordance with ANSI C80.1 and UL 6; the conduit interior and exterior surfaces having a continuous zinc coating with an overcoat of transparent enamel or transparent lacquer.

8.26 Protective Relaying

8.26.1 Protective relaying shall provide secure and selective isolation of equipment when necessary during faults, abnormal or hazardous operating conditions. All protective relaying equipment will meet all recommendations contained within:

(1) PacifiCorp FACILITY CONNECTION REQUIREMENTS FOR TRANSMISSION SYSTEMS

(2) , IEEE Std 666-1991 IEEE Design Guide for Electric Power Service Systems for Generating Stations

(3) IEEE Std C37.102 IEEE Guide for AC Generator Protection

(4) IEEE Std C37.110 IEEE Guide for the Application of Current Transformers Used for Protective Relaying Purposes.

8.26.2 All relays shall be microprocessor-based and wired to RTAC with IRIG-B time stamping. The RTAC shall integrate all relaying.

8.26.3 All relays shall be made by Schweitzer Engineering Laboratories.

8.26.4 All relays shall have the ability to interface with both serial and ethernet connections.

8.26.5 Relay panels shall be located in the Project Substation control building and shall include all hard-wired and soft-wired protection and control interlocks. Relay panels shall be installed in a new control room.

8.26.6 Protective relaying design and equipment selection shall be provided in accordance with the Requirements, including, but not limited to, the Applicable Standards and prudent electrical industry practices.

8.26.7 All protection device settings shall be provided for Owner's review no later than 60 days prior to the system energization date.

8.26.8 Programming of devices shall be provided in electronic format native to the device.

8.26.9 Owner will have the authority to review the final design prior to procurement of equipment.

8.26.10 The interconnection utility shall require review and confirm line protection and signal exchange requirements. Owner shall facilitate such reviews.

8.26.11 Protection shall be provided for all breakers, bus, transformers, 34.5-kV lines, high-side lines, capacitors, and reactors.

8.26.12 The relaying schemes shall monitor and respond to overcurrents, phase faults, ground faults, and other system abnormalities. Protection schemes to be utilized shall include, but not be limited to, overcurrent, over/under voltage, line impedance/differential, bus differential, transformer differential, breaker failure, backup relaying, switch into fault, and sync check.

8.26.13 Annunciation and alarms shall be communicated to the Operator through an RTU that will signal loss of protection integrity including but not limited to: coil monitoring, loss of tripping power, gas pressure, relay failure, and other similar items.

8.26.14 High-side lines shall include primary and backup relaying.

8.26.15 The primary and backup systems shall use redundancy philosophies to minimize common failure modes.

8.26.16 Main step-up transformer protection shall include primary and backup relaying and monitor for oil and winding temperature.

8.26.17 Observe IEEE 1050 for protective instrument grounding.

8.26.18 Revenue grade interchange meters shall be installed on the high-side of the main step-up transformer. Other meters shall be installed on each medium-voltage (34.5-kV) Collection System Circuit feeder and within each Wind Turbine Generator, not required if the SCADA System can register production by Wind Turbine Generator. Revenue metering shall be PacifiCorp standard metering package, a three-phase four wire 3-element grounded installation, owned and maintained by PacifiCorp.

8.26.19 All relays shall have digital read-out on the front.

8.27 Control Building

8.27.1 The control building shall be a new, prefabricated building. All electrical equipment shall be installed in the building prior to shipment.

8.27.2 The control building shall be located within the fenced area of the Project Substation.

8.27.3 The control building shall be grounded and include HVAC.

8.27.4 The control building shall contain a data concentrator and communications processor to collect Project Substation data signals for facility use.

8.27.5 The control building shall include adequate space and clearance for all Turbine Supplier-furnished Turbine SCADA System or Power Plant Controller equipment.

8.27.6 Local user controls shall be included that are capable of overriding the controller if required for any reason. Local controls, including monitoring screens and keyboards, shall be placed in the control building.

8.28 Fencing and Gates

8.28.1 PacifiCorp chain link fencing and gate standard A-7.10.2 Section 02810 supersedes any information provided below.

8.28.2 The Project Substation perimeter shall be fenced. The fence shall be tied into the Project Substation grounding grid.

8.28.3 At least one (1) vehicle gate shall be installed at the Project Substation. The vehicle gate shall be a double-hung, 20-foot-wide (minimum), manual, rolling gate. At least 10 remote-entry devices shall be supplied and programmed by Seller for Owner's use.

8.28.4 At least one (1) walk gate shall be installed at the Project Substation. The walk gate shall be a lockable, single-hung, 4-foot-wide, swing-gate for personnel access.

8.28.5 All fencing and gates shall comply with the minimum specifications in Section 3.11 (*Fencing, Walls, and Gates*) herein.

8.29 Testing and Quality Control

8.29.1 All testing described herein shall be performed by an independent, experienced third party. Seller shall notify Owner of all testing schedules at least 30 days in advance of testing activities.

8.29.2 All Project Substation equipment shall be tested to demonstrate it meets stated design criteria and is fit for purpose.

8.29.3 Project Substation testing shall include the following, at a minimum:

(1) All testing specified in the Applicable Standards, including NETA.

(2) All testing reasonably recommended or required by the applicable equipment suppliers.

(3) All exposed cable sections shall be visually inspected for physical damage or manufacturing defects. Such inspections shall be performed prior to and during installation.

(4) Insulation testing of all installed cables.

(5) Point-to-point wiring checks of all installed wiring.

(6) After completion of wiring installation work, all circuits shall be tested for continuity, grounds, shorts.

(7) Breaker function testing.

(8) PT/CT turns ratio and polarity testing.

(9) Breaker contact resistance testing.

(10) Ground resistance and continuity testing.

(11) Surge arrestor testing.

(12) Instrument transformer testing.

(13) Ground grid testing.

(14) Relay functional testing.

(15) Disconnect switch testing.

(16) Reactor / capacitor bank testing (if applicable).

(17) Control building testing.

(18) Minimum main step-up transformer testing, all on the purchased unit(s):

   (a) All tests identified as "Routine" in IEEE C57.12.00 Table 18 and performed in accordance with IEEE C57.12.90.00.

   (b) Temperature rise at the maximum 65°C rating.

   (c) Temperature indicator accuracy test.

   (d) Induced potential test with the transformer connected at high voltage, with the transformer's own bushings in place, accompanied by partial discharge monitoring (to conform to ANSI C57.12.90).

   (e) Impulse tests on all winding terminals, with the transformer's own bushings in place.

   (f) Switching surge tests on the high-voltage winding, with the transformer's own bushings in place.

(g) Test all control wiring for continuity, grounds, and correct connections; and test operation of all relays, indicators, switches, lights, and interlocks.

(h) Resistance measurements of all windings on the rated voltage connection and all load tap connections. Test results shall be reported in ohms at 85°C

(i) Double insulation power factor tests conforming to Method II in Table 4 of Article 10.10 of ANSI C57.12.90. The power factor shall be equal to or less than 0.5% at 20°C.

(j) Perform the supplier's standard tests on each surge arrester.

(k) Zero sequence.

(l) SFRA, at factory and at Project Site.

8.29.4 All Project Substation foundations shall be tested in accordance with Section **Error! Reference source not found.** (***Error! Reference source not found.***) herein.

8.29.5 Copies of testing reports shall be submitted to Owner within 10 days of completing such test. Testing reports shall include a summary of testing procedures and acceptance criteria.

9.0 INTERCONNECTION LINE SPECIFICATIONS

9.1 General Provisions

9.1.1 The Interconnection Line shall be designed and constructed to a high level of reliability and shall meet or exceed the requirements set forth by the interconnection line and substation shall be outfitted with PacifiCorp's standard avian safety devices.

9.1.2 The Interconnection Line shall be designed and constructed in accordance with the Project Electrical Studies, as defined in section 8.

9.1.3 Minimum clearance for energized parts of overhead portions of the Interconnection Line shall at a minimum meet or exceed requirements specified in the applicable permits, including, but not limited to, those set forth in the current edition of the National Electric Safety Code. Electrical clearances shall be maintained in the design and construction of all jumper assemblies.

9.1.4 PLS-CADD software shall be utilized to spot and perform detailed analysis and design of the Interconnection Line. Copies of all PLS-CADD electronic design files shall be provided to Owner in final form at the conclusion of the Project. Copies of preliminary PLS-CADD electronic design files shall be provided to Owner with each preliminary design. The ellipse amplitude safety factor in PLS-CADD shall not be less than 1.0.

9.1.5 The Interconnection Line, when in operation, shall be corona free and shall not cause radio or television interference, nor excessive noise in excess of requirements set forth in the Applicable Standards, applicable permits, or other applicable Requirements.

9.1.6 If it is determined by the meteorological report that an area is prone to icing, galloping should be considered.

9.1.7 Weather cases and loading criteria shall be developed by Seller based on requirements set forth in the Applicable Standards, including, but not limited to, NESC C2 (Current Version), as well as the Project-specific meteorological study.

9.1.8 All manufacturer installation instructions for the installation of all Interconnection Line components shall be obtained and followed.

9.2 Design Working Life

9.2.1 The design working life of the Interconnection Line equipment shall be a minimum of 30 years.

9.3 Civil Works Requirements

9.3.1 All civil works for the Interconnection Line shall comply with the applicable specifications in Section 5.0 *(Civil Works Specifications*).

9.4 Structural Works Requirements

9.4.1 All Interconnection Line structures, foundations, assemblies, and components shall be designed and constructed in accordance with the applicable structural works specifications in Section 5.0 (*Structural Works Specifications*).

9.5 Structure Spotting

9.5.1 Structure spotting and profile generation shall be completed with PLS-CADD. All structure spotting shall be based on profile data provided by the surveyor and aerial mapper, right-of-way, landowner input, routing constraints, permitting conditions, and field investigation.

9.5.2 All structure spotting shall be based upon the profile data provided by the design and shall consider data from routing constraints and field investigation.

9.5.3 Site specific structure locations and site specific constraints are as determined by the design data.

9.6 Conductors, Shield Wire, and OPGW

9.6.1 All conductor cables, shield wire, and OPGW shall be installed by controlled tension methods.

9.6.2 Pre-stressing of any type of wire shall not be permitted without the prior written approval of Owner.

9.6.3 If conductors are bundled, all conductors in any one bundle shall be sagged simultaneously and all shall be clipped in on the same day.

9.6.4 Each sag span and control span shall be measured with surveyor's transits to verify exact span lengths, prior to sagging.

9.6.5 All conductor cables, shield wire and OPGW sag spans and control spans shall be measured before sagging.

9.6.6 Conductor cables, shield wire, and OPGW shall be installed in accordance with IEEE's "*IEEE Guide to the Installation of Overhead Transmission Line Conductors*", Standard No. 524, and sagged to within a tolerance of three (3)-inch sag increase and no sag decrease. Transits shall be used for sagging and shall be maintained in good operating condition and checked for accuracy and adjusted, if necessary, a minimum of once per week during sagging operation.

9.6.7 Conductor cables, shield wire, and OPGW shall not be dead-ended and clipped sooner than two (2) hours and should be fully tensioned within 24 hours of initial stringing. In no case shall more than 72 hours elapse between the stringing of conductor/ground wires and their final tensioning.

9.6.8 No single conductor cable within a bundle shall be more than one (1) inch from its sag position relative to the other conductor cables.

9.6.9 No more than one (1) splice or repair on anyone (1) conductor in any one (1) span shall be made. Splices shall be a minimum of 25 feet from any structure.

9.6.10 Wire tension limits shall be in accordance with the Applicable Standards, including, but not limited to, latest version of NESC C2 (Current Version).

9.6.11 The exact location where each reel of conductor was installed shall be recorded.

9.6.12 Final sag measurements, including but not limited to each sag span's record date, span number, span length, ruling span, wire temperature, ambient temperature, initial sag for the span, time in blocks, time of day and sag measurements, shall be recorded.

9.6.13 OPGW (including a primary and secondary (redundant) OPGW) shall be installed the entire length of the overhead route and coordinated with the SCADA System/communication/protection specification.

9.6.14 OPGW shall include a minimum fiber count of 48, single mode.

9.6.15 OPGW design tension limits shall be specified in the Project-specific sections.

9.6.16 Stringing tensions for the OPGW shall not exceed twenty percent (20%) of the ultimate cable strength.

9.6.17 Splice locations shall be selected and provided with weatherproof splice boxes suitable for the selected OPGW.

9.6.18 At each splice location, a 50-foot coil of spare wire shall be maintained.

9.6.19 Spare wire may be coiled on the pole, placed in an underground vault, or coiled in an aerial slack storage device.

9.6.20 The OPGW shall be solidly bonded to the steel pole with a braided soft drawn copper jumper and steel structures shall incorporate a welded grounding nut for that purpose.

9.6.21 Shield wire shall be minimum 3/8-inch, 7-strand EHS steel wire.

9.6.22 Shield wires and OPGW shall be bonded to the pole grounding system using a suitable ground wire.

9.7 Insulators and Hardware

9.7.1 Non-ceramic, porcelain, or toughened glass insulators shall be used for both suspension and dead-end applications and types (non-ceramic, porcelain, or toughened glass) or manufacturer of insulators shall not be mixed.

9.7.2 Insulator length, strength, and required number shall be determined based on loading requirements, switching surge and lightning requirements, and by contamination levels.

9.7.3 All surfaces of metal parts shall be relatively smooth with no projecting points or irregularities, which may cause corona.

9.7.4 Nuts shall be hexagonal and of corona-free design.

9.7.5 All non-ceramic insulators shall include grading rings on the energized end of assemblies 138kV and up. Extra high voltages may require additional grading.

9.7.6 All ferrous material except stainless steel shall be hot dip galvanized to conform to ASTM A153.

9.7.7 Cotter keys shall be austenitic stainless steel and each piece shall be marked for identification with the manufacturer's part or catalog number.

9.7.8 The standard porcelain insulator unit to be used is a 5.75-inch by 10-inch bell with a ball and socket coupling.

9.7.9 Insulators shall be wet-process porcelain.

9.7.10 Materials shall be packaged in weather-resistant cartons or crates suitable for outdoor storage.

9.7.11 The insulators shall be protected with suitable material to prevent damage to the sheds, bell, connections, and/or end fittings during shipping.

9.7.12 Line guards and armor rods shall be installed in conjunction with suspension clamp assemblies.

9.7.13 The center of the armor rods shall be within one (1) inch of the suspension clamp.

9.7.14 The termination of the armor rods shall be within one-half (0.5) inch of each other.

9.7.15 In the assembly of insulators and insulator hardware, every cotter key shall be inspected to ascertain that it is in place and properly seated and spread.

9.8 Grounding

9.8.1 All overhead poles shall be grounded locally at each pole.

9.8.2 The ground should consist of a copper ground wire connected to a 0.5-inch, coated, carbon steel ground rod.

9.8.3 Grounding systems shall be designed in accordance with all Applicable Standards and best engineering practices.

9.8.4 Maximum resistance shall be no greater than 10 ohms. If ground resistance is greater than 10 ohms, special grounding designs shall be prepared.

9.8.5 A ground resistance test shall be done at every structure.

9.9 Lightning Protection

9.9.1 The Interconnection Line shall be protected against lightning by the use of shield wire(s).

9.9.2 The shield wires shall be located so as to intercept lightning strikes and prevent direct strikes to the conductors.

9.9.3 Position of shield wires, ground resistance, and electrical parameters of the line insulation shall be coordinated to produce a calculated performance equal or superior to the standard value.

9.9.4 The isokeraunic level of the area of the line shall be determined by Seller and shall be used in the design of the shielding/grounding system.

9.9.5 The method of grounding and the required ground resistance to minimize the outage rate shall be calculated.

9.10 Marking and Lighting

9.10.1 All Interconnection Line structures shall be marked per FAA standards.

9.10.2 The Interconnection Line marking and lighting system shall comply with the requirements as defined in US DOT-FAA Advisory Circular No. AC 70/7460-1K: *Obstruction Marking and Lighting*.

9.11 Testing and Quality Control

9.11.1 All testing described herein shall be performed by an independent, experienced third party. Seller shall notify Owner of all testing schedules at least 30 days in advance of testing activities.

9.11.2 All Interconnection Line equipment shall be tested to demonstrate it meets stated design criteria and is fit for purpose.

9.11.3 Interconnection Line testing shall include the following, at a minimum:

(1) All testing specified in the Applicable Standards, including NETA.

(2) All testing reasonably recommended or required by the applicable equipment suppliers.

(3) All exposed conductor and OPGW sections shall be visually inspected for physical damage or manufacturing defects. Such inspections shall be performed prior to and during installation.

(4) Resistance testing on grounding grid at each structure location.

RFP Appendix A-1.6 – Battery Energy Storage

Battery Energy Storage System Technical Specification

October, 2021

PACIFICORP
BATTERY ENERGY STORAGE SYSTEM
TECHNICAL SPECIFICATION

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TABLES:

1.0 OUTLINE OF WORK

1.1 General

Owner desires a qualified bidder (Seller) to provide a Battery Energy Storage System (BESS) to be used for grid support applications under a Build Transfer Agreement (BTA) basis at Seller proposed location. The entire BESS facility shall be controlled by the BESS Supervisory Control and Data Acquisition (SCADA) System and Controller as described below in this Technical Specification. The Project includes all the necessary design, engineering, procurement, manufacture, build, construction, commissioning, start-up, testing, performance verification, and Owner personnel training. The Project shall be engineered and constructed according to Industry Standards using prudent utility practices.

1.2 Definitions and Abbreviations

ºC	Celsius
°F	Fahrenheit
A	Ampere, unit of Electrical Current
AC	Alternating Current
AGC	Automatic Generation Control
ASCE	American Society of Civil Engineers
ASTM	American Society for Testing and Materials
BESS	Battery Energy Storage System
BOL	Beginning of Life
BTA	Build Transfer Agreement
Change of Ownership	As defined in the LGIA
Seller	Qualified integration firm and/or OEM vendor
CPT	Control power transformer
dBA	A-weighted decibels
DC	Direct Current
DOD	Depth of Discharge
Down Reserve	The capability of the BESS to inject AC power to the grid at the point of interconnection (POI) in response to remote commands, and/or frequency response
DR	Distributed Resources
EL	Electroluminescence
EN	European Standard
EOL	End of Life
EPC	Engineer-Procure-Construct as the primary or general Contractor
EPS	Electric Power System
Frequency Response	The capability of the BESS to provide response for frequency deviations above and below the frequency set point (or dead band) of the BESS, within the ramp rate limits for the Project

FRT	Frequency Ride-Through
GHS	Global Harmonized System
GHz	GigaHertz
HMI	Human Machine Interface
HV	High Voltage
HV_{AC}	High voltage alternating current
HVAC	Heating, Ventilation & Air Conditioning
Hz	Hertz, unit of electrical frequency
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
Inverter	All inverters in this specification refer to Four-Quadrant, Bidirectional, Smart Inverters.
ISO	Independent System Operator
kHz	kiloHertz
kW	kiloWatt
kWh	kiloWatt-hour
kV	kiloVolt
LGIA	Large Generation Interconnection Agreement
LHFRT	Low and high frequency ride through
LHVRT	Low and high voltage ride through
Load Following	The ability of the BESS to provide real power response to a specific, metered electrical location (i.e., the point of interconnection (POI)) based on the variations of real power demand at the specified location
LPS	Lightning protection system
LV	Low Voltage
MHz	MegaHertz
mil	Unit of measurement for length (thousandth of an inch)
MPT	Main Power Transformer
ms	milliseconds
MV	Medium Voltage
MVT	Medium Voltage Transformer
MVA	Mega Volt Amp
MW	MegaWatt
MW_{AC}	MegaWatt alternating current
MWh	MegaWatt hours
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NVR	Network Video Recorder
O&M	Operation and maintenance
OEM	Original Equipment Manufacturer

Output Frequency Range	The range of frequency under which the Project will operate according to its specification
Output Voltage Range	The range of AC grid voltage under which the Project will operate according to its specification
Owner	PacifiCorp
P/T/Z	Pan/tilt/zoom
PCB	Polychlorinated biphenyl
PCC	Point of Common Coupling
PCS	Power Conversion System
Peak Shaving	The ability of the system to provide power to the grid above a threshold power demand level during peak demand periods to maintain net power demand at the substation below the threshold level.
PID	Proportional Integral Derivative loop control
PLC	Programmable Logic Controllers integrated with the BESS and SCADA System
POI	Point of Interconnection, which shall be where system ties in to the existing Transmission or Distribution Network
Project	BESS for grid support applications
pu	per unit
PV	Photovoltaic
PVC	Polyvinyl chloride
QA/QC	Quality assurance/quality control
QP	quasi-peak
Ramp Rate	The rate, expressed in MegaWatts per minute, that a generator changes its power output.
RAS	Remedial Actions Scheme
Rated Apparent Power	The real or reactive power (leading/lagging) that the BESS can provide at the POI continuously without exceeding the operating limits of the BESS
Rated Continuous Charge Power	The rate at which the BESS can capture energy for the entire SOC range of the BESS
Rated Continuous Discharge Power	The rate at which the BESS can continuously deliver energy for the entire specified SOC range of the BESS
Rated Discharge Energy	Total energy the fully-charged BESS can deliver to the POI at the rated continuous discharge power without recharging.
Revenue Metering Point	There are three Revenue Metering Points: Project Totalizing meter at the POI; the Project BESS (low side of the transformer); and the Project PV (low side of the transformer).
rms	root mean square

SCADA	Supervisory Control and Data Acquisition
SCCR	Short-circuit current rating
SGIA	Small Generator Interconnect Agreement
SOC	State of Charge, measured in % relative to the maximum possible amount of energy that can be stored by the system, with fully charged being 100% and fully discharged being 0%.
SPCC	Spill Prevention Control and Countermeasures
SPD	Surge protection devices
Standby mode	BESS standby mode means that the battery is charged to the specified level and is not providing or receiving power from the grid
SWPPP	Storm Water Pollution Prevention Plan
System Round-Trip Efficiency	The ratio of the delivered output energy of the BESS to the absorbed input energy required to restore it to the initial SOC under specified conditions through the Design Life.
Total Response Time	Starting when the command is received at the BESS boundary and continuing until the BESS discharge power output reaches 100 +/- 2% of its rated power, measured at the POI
Transmission Provider	Rocky Mountain Power
TÜV	Technischer Überwachungsverein (third party factory audit or testing score)
DOT	Department of Transportation
UL	Underwriters Laboratories, Inc.
Up Reserve	The capability of the BESS to absorb AC power from the POI in response to remote commands, and/or frequency response
UPS	Uninterruptible Power Supply
µV/m	microVolts per meter
V	Volt, unit of Voltage (Electric Potential)
VA	Volt-Ampere, unit of Apparent Power
V_{AC}	Volts alternating current
VAR	Volt-Ampere Reactive, unit of Reactive Power
V_{DC}	Volts direct current
VDE	Association for electrical, electronic, and information technologies
VESDA	Very Early Smoke Detection Apparatus
V_{OC}	Open Circuit Voltage
VRT	Voltage Ride-Through
W	Watt, unit of Real Power

2.0 KEY PROJECT TECHNICAL AND OPERATING REQUIREMENTS

Seller has the ultimate flexibility to determine the size and main operational parameters of their proposed BESS system, whether as a standalone system or as a compliment to a wind or solar generating asset, in order to deliver the most value to the Owner. However, the following guidelines are offered to aid in narrowing down the range of available options related to BESS sizing, controls and capabilities to support the Seller in the proposal development process. Further technical details can be found in section 5.1.1, Table 1.

2.1 System Sizing and General Requirements

- For solar paired assets, the BESS AC power capacity base case is 25% of Solar AC rated generating capacity; Seller is free to offer additional options or variations from this base case.
- Standalone utility scale energy storage is typically a minimum of 10MW peak power and can be substantially larger. Seller to offer optimized project size.
- The base case duration is assumed to be 4-hours for all BESS systems, and they will perform energy time shifting and renewable capacity firming functions, but as elaborated below, systems will be evaluated on their flexibility to perform additional services when desired by the Owner;
- Seller can assume that the BESS will typically be cycled to a depth of discharge of 80% of the system rated dischargeable energy capacity;
- Systems should be capable of charging in various modes including constant-current, constant-voltage and constant-power;
- Systems should be capable of achieving a full state of charge at a constant power charge rate of 1.0 (CP of 1);
- For PPAs, Seller can assume that the BESS will be cycled annually at least 200 full DoD cycles. In addition, however rare, the system should be capable 1) of not cycling on some days or 2) of being called upon by Owner to continuously charge and discharge over a 24-hour period on other days.
- Although grid charging of solar paired BESS is not expected to be used during the first 5 years of operation to preserve the ITC benefit, Owner expects all BESS systems whether stand-alone or renewable energy paired storage systems to have the capability to charge from the grid.
- Typical discharge cycle:
    - June through September: 3.5-4.0 hours every evening
    - All other months: 2.5 hours in the evening ramp and 1 hour in the morning

2.2 Operating Strategy & Use Cases

- Primary:
    - The BESS should be capable of ramping toward a charge or discharge target updated every four (4) seconds by the Owner's dispatch signal. BESS shall charge and discharge when load following while also maintaining positive power flow to the POI unless explicitly directed.
    - Typical storage discharge will be used to economically balance external grid load and resources, for instance during evening (and morning) net load ramp(s). Individual batteries and subsystems will be consolidated and managed via a Battery Management System (BMS). Each BESS will have a SCADA System and Controller that receives signals from the Owner's AGC. In addition, CAISO feeds into Owner's AGC. Whether any individual BESS is following one or both (AGC/CAISO) depends on the mode /

    scheduling strategy. In general, Owner wants the generating asset to have the capability to follow either; however, there will be conditions where the resource will not be dispatched in AGC.

- Secondary:
    - The Owner's four-second dispatch signals may reflect five-minute market dispatch signals from CAISO Western Energy Imbalance Market (EIM).
    - The system operator may call for up to maximum discharge for 60 minutes for contingency reserve events [several times per week] or until a battery state of charge limit has been reached [rare].
    - The BESS should respond to significant system frequency deviations with up to maximum discharge for approximately 1 minute [several times per month].
    - The system operator may call for reactive power to provide voltage support. The reactive power capabilities of PCS equipment currently on the market is sufficient to meet the anticipated need for reactive power by supporting +/- 0.95 power factor at the POI, and larger ranges may be required under certain project conditions. Reactive power studies are required to meet the LGIA requirements and project specific details will be addressed

2.3 Augmentation

- Owner will manage augmentation needs and Seller should prepare their cost proposals exclusive of the cost of future augmentation.
    - However, design and pricing must allow for the possibility of future augmentations in proposed site layouts and electrical designs for purposes of developing firm cost proposals. This means allowing for additional site area that may be required and allowing for additional MV circuits to be connected into the substation switchgear as examples. Seller can assume that up to 30% of BOL BESS capacity may be needed over the course of a project lifetime and cost proposals should be inclusive of this supporting infrastructure.
    - Owner will consider additional optional pricing from Seller that includes augmentation

2.4 Flexible Warranties

For all BTA bids, as a part of their RFP bid response, Seller is required to provide 1) a completed Appendix K General Services Contract-Operations & Maintenance Services for Project and 2) Appendix A-10 Plant Performance Guarantee/Warranties. Seller is encouraged to provide a long-term performance guarantee. Owner will require a significant amount of flexibility to operate the BESS in a manner that maximizes overall value for the company, and which may be location specific and change from year to year. Therefore, the Owner will require Seller to offer performance warranties that are flexible and allow for a variation in operating parameters. It is expected that during the RFP process, the parties will be able to develop a formula to forecast the guaranteed degradation rate for the remainder of the contract term based on actual averages and ranges (min, max) of key operational parameters. These may include:

- Constant power charge and range (e.g. CP from 0.9 to 1.1)
- Discharge rate and range (e.g. CP from 0.5 to 1.2)
- Operating temperature
- Annual number of cycles and depth of discharge
- Calendar (degradation)

2.5 Seller Responsibilities

Seller shall provide all required services and materials for the Project to achieve final completion and pass all necessary tests. Seller's responsibilities shall include all permits normally and customarily provided by Seller, design, engineering, equipment procurement, Site preparation work, foundations, installation of all equipment, bulk material and commodities supply, and Site finishing work. Seller also shall deliver project management, construction management, commissioning and startup, and testing of work, all as described herein, including all referenced appendices and standards, which will subsequently become a part of the build transfer agreement.

Seller shall construct all roads, foundations, electrical systems, control systems, monitoring systems, communications, ancillary structures, storage facilities, security systems, and fencing. Seller shall also erect and commission the BESS in the locations and orientations set forth in a proposed site plan and site layout drawing and in accordance with this specification, and all related specifications that relate thereto.

2.6 Conditions of Services

The BESS consists of all the direct current (DC) components from the BESS modules through the PCS plus the MVT. The BESS shall be "Utility Grade" (defined later in this Technical Specification). The balance of the Project (from the output of the PCS to the point of interconnection as defined in the LGIA shall comply with this Technical Specification and be compatible with applicable Owner standards and LGIA requirements. The balance of plant items include but are not limited to:

- Wiring, conduit, trenches and grounding
- Switchgear and current limiters
- Metering, as shown in the LGIA.
- Transformers
- Power poles
- Equipment pads
- Communications to Owner equipment.

The Project shall be designed to maintain the guaranteed performance metrics presented in this Technical Specification. The Project is limited to the use of electrochemical energy storage and PV technologies that have demonstrated appropriate technical and commercial maturity. The Project should include BESS equipment capable of exceeding the technical and operating needs of Owner.

The Project shall include full provisions for training, operation and maintenance of the Project and all associated equipment.

2.7 Preferred Main Supplier List

This section contains a list of preferred materials and equipment suppliers. In the event that Seller is considering the selection of a material or equipment supplier, that is not listed herein, Seller shall request approval from Owner prior to executing any contract for the procurement of such material or with such equipment supplier. Equipment catalog cut sheets shall be submitted for Owner review and approval prior to procurement.

2.7.1 Preferred cable suppliers:

- Prysmian/General Cable
- Southwire
- Okonite

2.7.2 Preferred junction box suppliers:

- Hubbell (Trinetics)
- SolarBos

2.7.3 Preferred pad-mount transformer suppliers:

- Cooper-Eaton
- General Electric
- Howard
- Virginia Transformer

2.7.4 Preferred 34.5-kV disconnect switch suppliers:

- Cleveland / Price
- Morpac
- Roya.
- Southern States
- USCO

2.7.5 Preferred 34.5-kV circuit breaker suppliers:

- ABB (with spring/hydraulic mechanism)
- Siemens
- EMA

2.7.6 Preferred grounding rod suppliers:

- Blackburn
- Weaver

2.7.7 Preferred cable splice suppliers:

- 3M

2.7.8 Preferred fault indicator suppliers:

- Schweitzer

2.7.9 Preferred compression connection suppliers:

- Burndy
- CMC
- Polaris Connectors

2.7.10 Preferred Power Conversion System suppliers:

- Sungrow
- SMA
- TMEIC
- Power Electronics
- Parker

2.7.11 Preferred Battery Suppliers

- LG Chem
- Samsung
- Tesla
- CATL
- Toshiba
- Panasonic

3.0 STUDIES

3.1 Grounding System Study

Seller shall perform studies to determine the parameters for the Project's grounding system in WinIGS, CDEGS or equivalent. Acceptable solutions shall conform to Owner's Standard #10. In addition, Seller shall meet all safety requirements for step and touch potential plus all requirements from the LGIA.

3.2 Electrical System Studies

Seller shall prepare electrical system studies as required to configure the Project and to determine control response and settings. Seller shall develop a positive sequence power flow model and a dynamic model in the latest version of PSSE or equivalent software as required by the grid operator at the point of interconnect. The short circuit and arc flash models and reports will be made in SKM and be made available for Owner's use. Seller shall include in their harmonic study, the harmonic profile of the project in the interconnection requirements. Electromagnetic Transient modeling shall be performed in PSCAD. Studies shall be provided in sufficient detail to demonstrate the functionality as described in this Technical Specification and shall be completed prior to the commencement of detailed design and identified in the project schedule. These system studies shall be updated/as-built with final system design changes and provided to Owner at the end of the Project. These studies, at a minimum, shall address and solve the following concerns:

- Harmonic analysis of the proposed system.
- Minimum system requirements and configuration for proper operation of the BESS (i.e., requirements to stabilize a self-commutated power conversion system [PCS]).
- Minimum spacing requirements between equipment to maintain safe energization and maintenance conditions.

- Battery degradation and expected power output at end of life of the BESS.
- Charge and discharge curves of the project for potential tie into other renewable systems
- Requirements for Volt-Ampere Reactive (VAR) support, peak shaving, battery charging and other support services as described in this Technical Specification.
- Safety requirements for operation compliance with applicable codes and standards.

3.3 Required Dynamic Models

3.3.1 Frequency Models

- Seller shall prepare individual models of the fundamental positive sequence behavior of the BESS.
- Owner shall be provided PSSE models in the version required by the interconnection authority that accurately represent the control characteristics and dynamic behavior of the BESS in response to balanced voltage and frequency disturbances. This model shall be provided with all available information once the 60% design is complete and refined to reflect the final design configuration at IFC.
- Fully detailed equivalent models are required; generic models from the WECC approved model library are preferred if they can accurately model the BESS behavior in response to voltage disturbances and system frequency disturbances.
- The PSSE models shall be validated for accurate representation of disturbances that are within the model's appropriate range of application, using a validated electromagnetic transient model or full-scale testing.
- The PSSE models shall be fully documented.
- The PSSE models must be non-proprietary and shall be accessible to other utilities, system operators, asset owners, and other entities associated with the interconnection.
- The PSSE models shall be updated by Seller prior to any change to the inverter controls or control parameters that affect the dynamic performance.
- Seller shall ensure compatibility of the provided PSSE models with the version of PSSE that Owner utilizes at the start of commercial operation. Upgrades and modification of the models to maintain compatibility with ongoing PSSE versions shall be the responsibility of Seller over the lifetime of system performance.

3.3.2 Model Inputs

The PSSE model should reflect the current design of the power plant and a general network equivalent or detailed network, depending upon interconnection study requirements.

3.4 Electrical Design Parameters

For design purposes, the power system characteristics, at the Project location, and for which the BESS will be required to provide rated output, shall be considered are as follows:

- The nominal power at the POI will be defined by the Seller and duration for the base case is planned at four (4) hours
- Maintain frequency and voltage within the utility set limits
- Supply required real and reactive power at a power factor range set by the utility

In addition, the BESS will be required to operate, without damage, with voltage and frequency ride through characteristics as specified in the LGIA.

3.4.1 Grounding

A suitable equipment grounding system shall be designed and installed for the Project. Seller will be responsible for providing an effective grounding mechanism. Seller shall provide detailed information (such as ground-grid drawings and calculations) for all Project grounding. Seller is responsible for designing and providing the Project system grounding and equipment grounding. The Project grounding system shall provide personnel protection for step and touch potential in accordance with Institute of Electrical and Electronics Engineers (IEEE) 80. Equipment and systems not covered by IEEE 80 shall comply with grounding requirements of National Electrical Code (NEC) 2017. The system also shall be adequate for the detection and clearing of ground faults. The Project grounding system shall be reviewed and approved by Owner.

All exposed non-current carrying metal parts shall be solidly grounded. Particular attention shall be given to prevention of corrosion at the connection of dissimilar material such as aluminum and steel.

All ground conductors shall be stranded copper and may be bare if exposed. Ground conductors in conduits shall be green-insulated. Ground lugs shall be mechanical and rated aluminum to copper. All below grade connections shall be exothermic welds. Step-up transformers and inverters and the Project switchgear shall be bonded to the ground ring at opposing corners of the equipment. Mounting structures shall be grounded in a manner that is sized for maximum available short-circuit current and lightning current (if required).

Seller shall submit to Owner grounding and lightning calculations for assurance of safe step and touch potentials on the Site, in accordance with Owner's standards. Seller shall conduct a ground resistivity test to verify that the grounding system meets minimum requirements for the overall grounding scheme. Interior fencing (including without limitation internal fences around interconnection equipment and inverters) shall be installed and grounded and substation grounding shall be done in accordance with Owner's Standards and Specification, Appendix A-7.11. Fencing around the perimeter of the overall Project Site shall not need to meet the aforementioned Handbook standards but shall be grounded in accordance with local codes. Perimeter fences shall be at least 30 feet from the fence around the interconnection equipment. A ground grid meeting the requirements of IEEE 80 shall be installed in the area of the interconnection equipment.

3.4.2 Bird and Animal Protection

Bird and animal protection at the Project Substation shall be provided following Owner Standards referenced in Appendix "A-7".

3.4.3 Control and Instrumentation Cabling

All cabling shall be new and continuous for each run; splices are generally not acceptable. On a case by case basis, splicing may be reviewed and approved by Owner. All conductors shall be copper.
All cabling, which may be exposed to mechanical damage shall be placed in conduits, wireways, overhead trays, or other enclosures suitable to Owner. All below grade runs shall be in buried conduit unless proximity to a roadway requires concrete duct bank. Alternating Current (AC) and DC circuits shall be installed in separate conduits. Wires shall have identifying labels or markings on both ends. The labels shall identify the opposite end destination.

Control and instrumentation wiring shall be separated from power and high voltage wiring by use of separate compartments or enclosures or by use of separate wireways and appropriate barrier strips within a common enclosure according to the National Electric Code (NEC) or governing standard.

BESS control and instrumentation system wiring shall be bundled, laced and otherwise laid in an orderly manner. Wires shall be of sufficient length to preclude mechanical stress on terminals. Wiring around hinged panels or doors shall be extra flexible (Class K stranding or equivalent) and shall include loops to prevent mechanical stress or fatigue on the wires.

The instrumentation and control cable shields, where applicable, shall be multi-point grounded.

Wiring to terminal blocks shall be arranged as marked on wiring diagrams. Terminal groupings shall be in accordance with external circuit requirements.

Raceway and cable systems shall not block access to equipment by personnel.

3.5 Permitting

Seller shall apply for and obtain all permits and authorizations necessary for construction of the Project. Copies of all applicable permits shall be provided to Owner within five business days after they are obtained or completed. Seller shall provide a permit matrix to Owner for approval.

3.6 Audible Noise

The maximum sound level generated from the BESS and any associated equipment supplied by Seller under any output level within the Project operating range, shall be limited to the maximum allowed dBA level in any direction from the facility fence or building exterior or as required by local or State ordinances. Seller shall comply with all ordinances and regulations that may apply to the BESS installation as determined by the local building codes. Results of noise studies shall be provided for major equipment such as HVAC and PCS units.

Noise produced by the Project and any associated subsystems shall be designed and furnished such that the ambient noise level in the BESS control room, or any typically occupied area with applicable standards in a building shall not exceed 50 dBA.

3.6.1 Compliance Measurements

Seller shall make audible noise measurements before and after commissioning of the Project to verify compliance with the requirements. Seller, immediately upon notification, shall correct any noncompliance. The corrections may include replacement of equipment that is causing noncompliance. Seller shall make these corrections at no cost to Owner. If equipment and facilities must be removed from service, this period will be counted as outages towards the availability guarantee period. The measurements shall be made at three or more selected locations outside the building or facility fence using a Type 1 sound level meter that complies with the requirements of ANSI S 1.4 “American National Standard Specification for Sound Level Meters.”

3.7 Broadband Interference

Seller shall take necessary precautionary measures to ensure that there will be no missed operation, damage or danger to any equipment or system due to broadband interference and effects. The broadband interference includes:

Radio Interference	
AM Band	535 – 1,605 kiloHertz (kHz)
FM Band	88 – 108 MegaHertz (MHz)
Television Interference	
Low VHF Band	30 - 72, 76 - 88 MHz
High VHF Band	174 - 216 MHz
UHF Band	450 - 512 MHz
UHF Band	470 - 806 MHz
Microwave Communication	5.8 – 7.2 GigaHertz (GHz)
	10.7-11.7 GHz
	22.5-23.6 GHz
Wireless Communication	
Cellular Phone	750 - 790 MHz
804 - 894 MHz	
Supervisory Control and Data Acquisition (SCADA)	941 - 960 MHz
Personal Communication Systems	1.80 - 2.00 GHz

Interference to any radio service that requires a license, FCC licensees, military radio frequencies or medical devices is prohibited.

3.7.1 Radio Interference

Seller shall ensure that the Project does not degrade radio reception. The radio interference level along the perimeter of the property shall not exceed 100 microvolts per meter (μV/m) between 0.5 kHz and 30 MHz along a contour of 1,500 feet surrounding the energized Project equipment. This contour ends 500 feet from the energized lines where it tapers to a constant 100 feet from the outermost phase of the distribution lines.

3.7.2 Television Interference

Seller shall ensure that the Project and related equipment does not generate any discharge sources that could degrade television reception. Seller shall take all necessary action to ensure that television reception is not adversely affected.

3.7.3 Wireless Communication Interference

Seller shall ensure that there are no discharge sources from the Project and related equipment that could cause interference with wireless communication systems. Seller shall take all necessary action to ensure that cellular and PCS communication is not adversely affected.

3.7.4 Microwave Interference

Seller shall furnish information concerning any potential interference sources and levels that might emanate from the Project and related equipment that could adversely affect microwave communication. Seller shall take all necessary action to ensure that any microwave system is not adversely affected.

3.7.5 Compliance Measurements

Seller shall make measurements before and after commissioning of the Project for the purpose of verifying compliance with the requirements listed above. Seller, immediately upon notification, shall correct any noncompliance. The corrections may include replacement of equipment that is causing noncompliance. Seller shall make these corrections at no cost to Owner. If equipment and facilities have to be removed from service, this period will be counted as outages towards the availability guarantee period.

A reasonable effort shall be made as the frequency spectra are being obtained to determine the source(s) of the interference at various frequencies. Seller shall perform measurements in such a way as to identify the source of the interference being measured across the frequency range in order to determine if the Project complies with this Technical Specification.

All broadcast signals, radio noise, television interference and broadband interference measurements shall be made with instruments that comply with ANSI C63.2, "American National Standard for Electromagnetic Noise and Field Strength Instrumentation, 10 Hz to 40 GHz - Specification." IEEE Standard 430, "IEEE Standard Procedures for the Measurement of Radio Noise from Overhead Power Lines and Substations" defines the measurement procedures that shall be used.

Radio signal strength shall be measured using instruments with average detectors. Radio noise measurement shall be in quasi-peak levels for AM band and peak levels for FM band. Measurements shall include at least three complete frequency scans at selected locations around the perimeter of the property line. The average values for these measurements shall be reported for each location and radio station frequencies including 1.0 MHz.

1) AM broadcast radio signals from 535 to 1,605 kHz above 100 μV/m shall be measured using a calibrated loop antenna with an instrument that has either an average or root mean square (rms) detector at three selected locations along the 1,500-foot contour line around the BESS and at one or more locations down the distribution lines along the constant 100-foot contour line. The measured radio signal strengths shall be reported along with their call letters and their frequency. Signal-to-noise ratios will be calculated for each measured radio signal. The antenna shall be oriented for maximum pick up of the broadcast signals.

2) Radio noise shall be measured from 500 kHz to 30 MHz using a calibrated loop antenna with an instrument that has both an average (or rms) and a quasi-peak (QP) detector at three selected locations along the 1,500-foot contour line around the Project and at one or more locations down

the distribution lines along the constant 100-foot contour line. The antenna shall be oriented for maximum pick up of the noise.

3) Television and FM broadcast signal strengths, over the frequency ranges specified above, shall be measured using calibrated broadband antennas appropriate for the frequencies being measured and with an instrument that has an average (or rms) detector at three selected locations along the 1,500-foot contour line around the Project and at one or more locations down the distribution lines along the constant 100-foot contour line. The measured radio and television signal strengths shall be reported along with their call letters and their frequency. Signal-to-noise ratios shall be calculated for each measured FM radio and TV signal. The antenna(s) shall be oriented for maximum pick up of the broadcast signals.

   VHF and UHF broadband interference shall be measured over the frequency range of 30 to 2,000 MHz using calibrated broadband antennas appropriate for the frequency range with an instrument that has both an average (or rms) and a QP detector at three selected locations along the 1,500-foot contour line around the Project and at one or more locations down the distribution lines along the constant 100-foot contour line. The antenna shall be oriented for maximum pick up of the noise.

4.0 DESIGN, FABRICATION AND CONSTRUCTION REQUIREMENTS

4.1 General

Seller shall supply the complete permitting, design, engineering, procurement, installation, construction, commissioning, start-up, and performance verification of the Project and LGIA systems for the commercial operation of the Project.

The Project design and construction shall comply with all current local, state, and federal regulations, codes, and applicable standards. The Project fire protection system shall also comply with Owner's insurance requirements.

All equipment supplied shall be designed to ensure satisfactory operation under the specified site temperature conditions and other atmospheric and environmental conditions prevailing at the site.

All equipment, components, and materials shall be new and free of defects in material or workmanship.

Seller shall verify all information provided by Owner, Owner's Seller, and third-party suppliers prior to incorporating the information into Seller's design.

4.2 Building, Structures and Systems

Seller's scope includes but is not limited to providing the following:

- All site preparation including any necessary civil work.
- Site Storm Water Pollution Prevention Plan (SWPPP).
- The BESS will be fully contained in weatherproof, environmentallyconditioned enclosure(s) or building.
- Supports and foundations for all buildings, enclosures, structures, transformers, switchgear, conduit, and overhead cabling.

- Battery cells/modules, battery management system, racks, bus bars, and all necessary electrical and battery equipment necessary for a fully functioning BESS to be housed in modular containers or in a dedicated building. The BESS must be appropriately sized for all necessary augmentation to maintain rated capacity through the required Design Life of the facility based on the use cases and conditions contained in these Technical Specifications.
- All Project Balance of Plant components.
- DC system with voltage sources and panel boards for communications networks and relay protection equipment.
- An uninterruptible power supply (UPS) system for Project control and protection systems and communication equipment to provide orderly shutdown in the event of loss of all auxiliary power.
- Power conversion systems.
- Project related medium voltage (MV) terminations, duct banks and cable routing and collection bus connections including but not limited to AC panel boards, circuit protection, and backup distribution sources with necessary isolation/step-down transformers.

The BESS building/enclosures or components within them shall adequately contain both normal and failure conditions of its constituents with respect to toxic or hazardous substances. Appropriate alarms shall annunciate locally and remotely when hazards are exposed including corrosive or toxic electrolyte/electrodes or fumes and secondary containment means shall be provided if such hazards occur.

Seller shall provide comprehensive safety data sheets (formerly called MSDS) in the new Global Harmonized System (GHS) format as a written chemical inventory of every hazardous chemical in the Project to which employees are exposed. Further, Seller shall be responsible for:

1. Developing and maintaining a hazard communication program detailing the plans in place for safe handling and storage of all chemicals used in normal operations and repair of the Project.

2. Maintaining proper SDS labels and warning signs associated with these same chemicals.

3. Training Owner employees on Project chemical hazards and use of necessary personal protection equipment and precautions as part of the turnover exercise.

Should any of the components within the Project require an operating environment less severe than the site environment, the Project shall provide appropriate conditioning of the enclosed space.

All portions of the Project must be sufficiently hospitable to installation, inspection, and service personnel to not restrict the performance of those duties. The Project is to be automated with no operator presence required.

Seller shall provide a description of any processes special to the de-commissioning of the Project. Seller shall include descriptions for configuration to begin disassembly, making the energy storage components safe at all times, disconnection and disassembly sequence, and packaging/handling/shipping requirements of the BESS. This is not required for the electrical equipment common to commercial/industrial/utility power systems unless directly related to handling of the energy storage components.

4.2.1 Engineering Services

Seller shall design and engineer the Project in accordance with prudent utility practices, with the professional standards, skill, expertise, and diligence of design and construction of professionals regularly involved in utility-grade, utility-scale, grid-connected BESS projects for electric utilities in the United States. The design must conform to the requirements and conditions of all applicable permits and laws, be in compliance with the operating guidelines, and meet Owner specifications.

Seller is responsible for all engineering for the Project. All design drawings, specifications, and calculations shall be signed by a professional engineer-of-record registered in the state or jurisdiction of the project. Seller shall submit to Owner all completed design drawings, data, and documents for review and comment. These engineered design drawings, data, and documents must be submitted to Owner for review and comment before construction is to begin.

Seller is responsible for ensuring that all components are installed above the 100-year flood plain (battery system, PCS, SCADA system, Security System, control building, transformers, etc.).

Any third-party study or independent engineering reviews (such as the geotechnical study) shall be provided to Owner.

4.2.2 Construction Services

Prior to beginning construction, Seller shall provide a comprehensive onsite construction management plan in accordance with all applicable laws and policies and Health, Safety, and Environmental Plans of Seller and if work is performed on Owner property, meet all safety program requirements of Owner including Appendix A Contractor Health Safety and Environmental Requirements, Appendix A Contractor Safety Plan Requirements, and all changes to applicable law and Owner policies. No later than 30 days prior to initial site mobilization, Seller shall prepare and submit such Plans to Owner. Seller shall also provide Owner with an evaluation and appropriate documentation of the safety record for any licensed Subcontractor that will be performing work on the Project. Seller and subcontractors must register with and be approved by ISNetworld or equivalent. The comprehensive onsite construction management plan will clearly establish Health, Safety, and Environmental goals for the Project.

Seller shall assemble, construct, and install with its own labor forces and/or with Subcontractors labor, tools, and equipment necessary to complete the Project, including but not limited to the following Works:

- Site preparation, site grading, site improvements, stormwater management facilities and removal of excess debris.
- DC cabling and junction boxes.
- AC trenching and cabling.
- Inverters, switchgear, and transformers and accompanying supports and/or concrete pads.
- Perimeter security fencing (described in Sections 6.13.3 and 6.3 Project Security).
- Security lighting.
- Installation of the monitoring system and revenue grade metering.

Seller shall provide all utilities necessary during construction, including but not limited to electricity, portable water, sewer/toilets, fuel and communications. Seller shall be responsible for all costs associated with construction power. Seller shall be responsible for removal of all trash and construction debris. Seller shall be responsible to provide its own job trailers, and other temporary facilities for its employees.

4.2.3 Quality Assurance/Quality Control Requirements

Seller shall submit a Quality Assurance/Quality Control (QA/QC) Plan for the proposed project delivery. The QA/QC Plan shall define the systems and procedures which will be used by Seller to ensure that the Project will comply with the requirements detailed in this Technical Specification in addition to any other standards and policies determined by Owner.

Seller shall submit to Owner a copy of its QA/QC Plan for review not later than 45 days after contract execution for Owner review and comment. The Project shall be managed in accordance with the program.

The QA/QC Plan shall include, but is not limited to, such procedures and systems as the following:

- Road construction and compaction.
- Reinforcing steel and conduit placement.
- Concrete placement and testing.
- All wire insulation testing—Megger testing or very low frequency testing.
- Factory testing of batteries, PCS and transformers by the manufacturer.
- Fuse tests.
- Terminations pull testing
- All visual inspections
- Grounding continuity testing
- Earth-ground resistivity testing
- BESS inspection and manufacturer documentation of factory test per the manufacturer's existing program
- Metering and instrumentation calibration testing
- SCADA indication, control and operator interface verification
- Step-up transformer testing
- Weld testing for transformer support including other anchorage
- Weld testing for racking supports
- Inverter phase rotation and matching with utility
- Protective relay settings
- Verification of security camera system operations, including device points, sequences, and communications
- Other Seller-prescribed procedures

All onsite QA/QC testing procedures shall be witnessed and documented by a qualified representative of Seller. Owner shall observe and witness QA/QC as necessary and at its discretion. A qualified engineer of Seller shall date and sign documentation indicating completion and acceptance of each onsite QA/QC test procedure.

4.3 Storage of Materials and Equipment

Prior to the arrival of equipment and materials at the Site, Seller shall install a fenced, secured area and provide security for the storage of such equipment and materials. Seller shall notify Owner of the location and layout of intended staging areas, parking areas, storage areas, office areas, workshops, and other temporary facilities. Temporary construction roads and staging areas not converted to permanent roads (if any) shall be restored in accordance with all permit requirements.

Seller shall be responsible for receiving, protecting, moving and storing all material at the Site in a secure manner and a manner that maintains temperature control for battery cells and modules required under warrantees. Climate controlled facilities should be constructed before battery modules arrive on site as well as other OEM recommended requirements to guarantee temperature controls are maintained for cells so that warrantees are not violated.

4.4 Equipment

As described in detail throughout this document, Seller shall purchase and furnish to the Site all material required to complete the Project, including but not limited to, the following material:

- Miscellaneous steel
- Components (nuts, bolts, clamps, etc.)
- BESS
- PCS
- DC cabling
- AC cabling
- Electrical switchgear
- Transformers
- Remotely accessible data acquisition system
- All materials related to drainage and access roads required by the civil engineering plan
- All electrical conduit and junction boxes
- Concrete equipment pads
- Fencing, gates, lighting, security cameras, and security camera recording equipment
- Communications infrastructure

Each item of equipment to be supplied by Seller shall be subject to inspection and testing during and upon completion of its fabrication and installation as per Owner's LGIA requirements for distribution systems (34.5 kV and below).

Installed equipment and materials shall be new, of good quality and suitable grade for the intended purpose, and not a lower grade or quality than specified in the design and engineering plans or in manufacturers' recommendations. Utility-grade equipment shall be used. Commercial- or residential-grade equipment shall not be acceptable. No equipment shall utilize polychlorinated biphenyls (PCBs).

Seller shall provide a Spill Prevention Control and Countermeasures plan and provide secondary containment where required and to prevent accidental discharge of chemicals. Seller shall provide a list of all major equipment to be purchased, constructed, and installed as part of the Project. The list shall identify both the items and quantities.

4.5 Power Conversion System (PCS)

The PCS is the interface between the DC battery system and the AC system and provides for charging and discharging of the battery and may consist of one or more parallel units. The PCS shall be designed to have Design Life as listed in Table 1.

4.5.1 PCS Requirements

The PCS shall be a smart static device (charger and inverter) using solid-state electronic switch arrays in a self-commutated circuit topology. Line-commutated systems or systems that require the presence of utility voltage or current to develop an AC output are not acceptable. Only commercially proven switch technology and circuit designs are acceptable.

The PCS, in conjunction with the BESS Master Controller, shall be capable of completely automatic unattended operation, including self-protection, synchronizing and paralleling with the utility, and disconnect functions.

The control of the PCS shall be integrated with the overall BESS Master Controller. A proven and established combined instrumentation and control system shall be provided for the BESS SCADA System. Each SCADA system shall feed into a central controller that shall be the primary interface with the Owner's controls and shall be compatible with the utility's existing SCADA system.

The PCS also shall include all necessary self-protective features and self-diagnostic features to protect itself from damage in the event of component failure or from parameters beyond safe range due to internal or external causes. The self-protective features shall not allow the PCS to be operated in a manner that may be unsafe or damaging. Faults due to malfunctions within the PCS, including commutation failures, shall be cleared by the PCS overcurrent protection device(s).

One purpose of the Project is to assist Owner in responding to abnormal utility system conditions. Therefore, Seller shall design the PCS, including its controls, power supplies and connections to sensors, to be immune from utility system voltage and/or frequency transients and similar events. Further, the PCS shall be capable of operating continuously at rated output under the normal voltage and frequency ranges and providing full output for the required operating modes specified.

All PCS components shall be designed to withstand the stresses associated with steady state operation, transient operation and overload conditions as implied by this Technical Specification. Seller shall be responsible to demonstrate that all relevant aspects of overvoltage stresses have been considered.

The PCS shall be housed in a separate room or enclosure within the BESS structure, with provisions to prevent moisture condensation and entrance of rodents, insects, and/or similar material into air intake/exhaust ports or any required structure penetration.

The PCS system shall include provisions for disconnection on both the AC and DC terminal, for maintenance work. Conductor separation must be clearly visible; flags or indicators are not acceptable. These disconnects shall be capable of being locked open for maintenance work. PCS capacitors shall be provided with bleeder resistors or other such means of discharging capacitors to less than 50 V within one minute of de-energization.

An interlock system shall be provided for access to the PCS room or enclosures if live parts are exposed when opened. A visible disconnect switch or draw-out breaker and grounding devices shall be provided for maintenance of the PCS equipment. The interlock system shall prevent access to the PCS equipment until the AC and DC circuit breakers or disconnect switches are open and the PCS bus is grounded.

4.5.2 Interference and Harmonic Suppression

The PCS shall not produce Electromagnetic Interference that will cause interference with instrumentation, communication, or similar electronic equipment within the Project or on Owner’s system. The PCS shall be designed in accordance with the applicable IEEE standards to suppress Electromagnetic Interference effects.

The BESS must meet the harmonic specifications of IEEE 519 and Owner’s power quality standards. Harmonic suppression may be included with the PCS or at the Project AC system level. However, Seller shall design the Project electrical system to preclude unacceptable harmonic levels in the Project auxiliary power system.

Seller shall perform studies to determine required AC harmonic filter types and ratings if filters are required to meet the harmonic specifications. In addition, these studies shall be used to demonstrate that the AC filters do not cause any resonance with Owner’s power system and that the harmonic distortion limits can be met by the filters designed by Seller. Seller shall design the Project to be completely compatible with Owner’s existing capacitor banks and their associated controls. Owner will not be required to change or modify the existing system to accommodate the Project. However, actual compliance will be based on field measurements after commissioning.

4.5.3 PCS Cooling System

The purpose of the PCS cooling system is to remove the heat produced by the PCS operation and transfer this heat to the outside ambient air or to be used as auxiliary heat for the building or enclosures as appropriate.

Either water cooled or air-cooled systems are allowed. However, the final rejection of waste heat shall be to the outside ambient air. No discharge of cooling system water shall be allowed. The cooling system shall be furnished complete with all necessary equipment and facilities, including, but not limited to, interconnecting piping, ductwork, circulating pumps, blowers, heaters, make-up reservoirs, heat exchangers, filters, water treatment plants, instrumentation, automatic controls, alarms and control power.

The cooling system shall be designed such that the failure of any single component of the cooling system will allow the Project to continue to operate at full capacity. All joints and gaskets are designed for high reliability and to comply with seismic requirements.

The cooling circuit for water cooling systems shall be a closed loop de-ionized water or water/glycol mixture recirculating system. Each loop and each branch shall have manual valves to isolate it from the rest of the system without disrupting the operating loop. If a water/glycol system is proposed, Seller shall prepare a Spill Prevention Control and Countermeasures plan and provide secondary containment for accidental discharges of the mixture.

The high purity (high resistivity) water (if used) in the closed loop system shall be circulated through the heat producing electrical equipment at a constant flow rate. A purifying loop to maintain the high purity in the closed system shall be provided.

Seller shall determine the source of the water supply for cooling system make-up water and obtain water service if required.

Non-recirculating (once-through) or recirculating air systems may be proposed, depending on the requirements of the PCS selected by Seller. If a recirculated air system is used, a heat exchanger shall be provided. If a non- recirculated (once-through) air system is used, a two-stage air filtering system shall be provided. The air handling systems shall include filtering which is adequate to keep dust from the interior of the PCS system.

Since the energy to heat or cool the building or enclosures and Project efficiency will be used in the life cycle cost evaluation, Seller is encouraged to provide the most efficient HVAC systems, including auxiliary heat recovery subsystems that are practical.

4.6 Step-Up Transformers

Transformers shall meet transformer efficiency standards. A transformer shall be used by Seller to match the secondary voltage of the PCS to the distribution system. The intermediate output(s) may be at any Seller determined AC voltage.

The transformer may be configured with any Seller specified winding configuration. However, it should be noted that the LGIA requires a grounding transformer to provide a source for ground fault current if the step-up transformer winding configuration does not provide a grounding source on the high side of the transformer. If a grounding transformer is required due to the Seller provided step- up transformer design, the grounding transformer shall be designed, provided and installed by Seller.

Transformers shall be rated for inverter source operation and the environment in which they will operate. The transformer shall be supplied with a no-load tap changer with high-voltage taps capable of operating at 2.5 percent above and below nominal voltage at full rating. The transformer shall be supplied with a disconnect switch on the transformer high-voltage side to isolate the transformer once de-energized. The switch/transformer configuration shall be designed for loop feed. Transformers shall be either dry-type, or oil filled, FR3 or equivalent is not acceptable. Enclosure finish shall be a top powder coat that is designed for a 20-year service life. Seller shall provide and install step-up transformers as provided in the Agreement. Owner shall reserve the right to attend factory witness testing of step-up transformers.

For interconnection to the Transmission Provider’s system Seller shall provide equipment and installation in compliance with the requirements of the Large Generator Interconnection Agreement and Owner’s Standards and Specifications.

The transformer may be used to aid in harmonic cancellation. If the transformers are a liquid-filled type, Seller shall provide an adequate oil containment system, subject to Owner's acceptance. PCBs shall not be used. Seller shall provide a SPCC if transformers are liquid-filled type.

4.7 Revenue Meter

Seller shall provide design inputs to a revenue metering system. Design shall be consistent with requirements as per LGIA.

The metering system design shall adhere to the requirements of Transmission Provider's revenue metering specifications. A bi-directional revenue grade meter shall be installed at each location specified above to measure the energy (kWh) generated by the Project and each generation source. The revenue grade meter shall be American National Standards Institute C12.20 0.2 percent Class Underwriters Laboratories, Inc. (UL) listed, ISO9001 certified, which is accepted by all authorities requiring revenue grade. The meter must have a display for easy reading of current power generation and lifetime generation and shall be compliant with Western Renewable Energy Generation Information System certification requirements for Renewable Energy Credit sales or trading. The Transmission Provider will procure, install, test and own all revenue metering equipment. Seller shall coordinate with the Transmission Provider for the installation.

4.8 Project Switchgear

Switchgear shall be in a National Electrical Manufacturers Association (NEMA) 4 lockable enclosure if located outdoors. Switchgear shall include an auxiliary compartment containing all instrument transformers associated with the protective relays shown in the one-line diagram(s). The protective relay system shall be specified, designed, and installed in accordance with interconnecting utility's requirements. Switchgear monitoring and communication hardware shall be included to meet the requirements of Section 4.7 Revenue Meter and Section 7.0 Supervisory Control and Data Acquisition, and the metering requirements of Owner. Relay current transformers shall be C400 accuracy class at a minimum unless a higher class is required due to saturation current per IEEE C37.110.

Medium-voltage protective device selection and relaying should be based on the use of Schweitzer Electric Laboratories (SEL) relays or approved other, as required and specified in the LGIA.

In general, the interconnection design and components should meet the requirements of the Transmission Provider and the LGIA (including the necessity of a grounding transformer if required).

MV switchgear shall be arc resistant type.

4.9 Protection Requirements and Relay Settings

A complete protective relaying system shall be provided for the PCS and transformer(s) as stated below:

- Inverters equipped with internal relays with 27, 59, 81U/O and voltage-controlled overcurrent 51C functions shall be provided with one utility grade relay with 27, 59, 81 U/O and 51C functions as secondary protection. Otherwise, two utility grade relays and one Owner-designated interrupting device shall be installed to meet the protection requirements.
- Protective relays shall be hardwired to the device they are tripping.
- Interconnection interrupting devices shall have DC trip coils and tripping energy shall be derived from Seller supplied battery separate from the BESS main batteries.

- Owner will review Seller's relay settings and their calibration and test results of those relays to satisfy Transmission Provider's protection practices.
- Seller shall provide phase and neutral overcurrent protection for the PCS transformer(s).
- Protective relays shall have backup power of 125 V_{DC} system supplied by station batteries.
- Relay settings files are to be included following the completion of the IFC design package.

Seller shall use microprocessor type protection equipment compatible with Transmission Provider's relay protection schemes to the extent possible.

The protective relaying and metering shall be integrated with the Project control system and communications channel to the Transmission Provider's SCADA system. However, integration into the Project control system shall not circumvent normal protective relaying functions nor shall any protective relay or revenue metering values be used for control within the project control system. The control system for the BESS and PV systems may use metering values from the revenue meters through a DNP 3.0 link if desired. These values may only be used for indication within the project control system. Metering, separate from revenue metering and protective relays, may be installed for any control purposes at Seller's discretion.

4.10 Points List

The points list shall be included as a deliverable in spreadsheet form. The Master Points List is to include all equipment connections to stakeholder devices including, but not limited to:

- BESS equipment
- Utility
- IEDs
- Reliability entity (ISO)
- Transformer monitoring and control
- BOP SCADA

4.11 Auxiliary Power

Primary AC station service shall be provided from the low voltage side of the Project PCS transformer bus. If required by Seller's design, back-up station service shall be provided by a Seller specified means. All facilities required to provide primary and back-up station service to the Project and building, including auxiliary power transformers, transfer switches, protection and distribution panels shall be Seller's responsibility.

In the event of a loss of the Auxiliary Power connections to Project, primary and/or backup station service may or may not be available. Back-up UPS to power Project controls, pumps and auxiliaries in the event of a total failure of the primary and back-up station service feeds shall be provided for orderly shutdown. The UPS shall be separate from the BESS main battery system and sized for an orderly shutdown of the Project for a loss of station service with the UPS at 80% rated capacity. The UPS shall be housed in a separate location from the BESS main battery to facilitate ease of maintenance.

All auxiliary DC station service requirements for the BESS shall be designed, engineered, furnished and installed by Seller. 125 V_{DC} shall be used for protective relay power.

4.12 Civil/Structural

Seller shall design all systems and site improvements in accordance with applicable codes and standards. Seller shall design necessary road improvements to meet state and local transportation codes and meet or exceed requirements presented by construction equipment, delivery vehicles, and operation and maintenance traffic. All BESS and PV equipment, building or enclosure foundations and structures shall be engineered by or under the direct supervision of a qualified professional engineer or architect registered in the state of the project as applicable. All final (Issued for Construction) drawings, specifications and calculations shall be wet-stamped by Civil/Structural Engineer or Architect registered in the state of the project as applicable. All stormwater calculations and design documents shall be overseen, signed and sealed by a Civil Engineer or Landscape Architect familiar with local codes and requirements, and registered in the state or jurisdiction of the project. All design shall be in accordance with seismic design requirements as specified elsewhere in this Technical Specification, and by the Seller provided geotechnical study.

Seller shall gain access to the site from existing public and private roads. Existing roads shall not be blocked or restricted without prior approval of Owner and local agencies. Seller shall be responsible for damage to public roadways resulting from the work performed. Seller shall also be responsible for the facilities access road's preparation/interconnection with the main road.

Seller shall perform required Site preparation, to include earthworks, SWPPP, and erosion control. Seller shall attempt to minimize earthwork and vegetation disruption for the installation of the Project to the extent it is compliant with the use permits; however, vegetation should be controlled to minimize fire danger and provide the ability to operate and maintain the Project. Any land contours that may affect BESS and PV electrical generation should be included in the BESS and PV system performance estimate. If required, Seller shall import engineered fill to slope the Site and prevent accumulation of standing water. Any direct burial cabling shall be protected with adequate bedding materials to ensure long-term cable integrity. Dust control shall be maintained in accordance with state and local requirements until Final Acceptance is achieved. Seller shall provide other Site maintenance as needed during construction.

Existing structures and utilities that are adjacent to or within the limits of the Project area shall be protected against damage. Seller shall be fully responsible to Owner or other property owners for all repairs in the event of removal or damage of any existing structure, equipment or systems that are intended to remain in place.

4.12.1 Geotechnical Analysis

A geotechnical analysis shall be provided by Seller and performed by a qualified geotechnical engineering firm. The results of the analysis shall be used when designing the foundations for the structures on the Site.

At a minimum, the following should be included in the analysis:

- Review publicly available geotechnical information and reports. This may include soils and geologic maps and literature, photographs, hydroelectric reports, groundwater reports, and water well data.
- Coordination and mobilization of the geotechnical services team for subsurface exploration of the Site. This should include working with the local utilities to mark any existing underground utilities (such as cables, gas lines, piping, etc.). This cannot be conducted until Owner has mitigated the prairie dog permitting requirements.

- Study the Site to determine the presence of faults, ground fissures, and other potential geologic hazards that could affect the structural design and construction of the Project.
- Drilling or digging of exploratory borings and pits. The quantity and depth shall be determined by Seller.
- Performance of cone penetration tests. The quantity and depth shall be determined by Seller.
- Laboratory testing of collected soil samples from the borings and test pits. An evaluation of the in-place moisture content and dry density, gradation, plasticity, consolidation characteristics, collapse potential, expansivity, shear strength, compressive strength, resistivity, chloride content, sodium sulfate content, and solubility potential (total salts) should be conducted.
- Analyze the corrosivity of the soil. Include a recommendation for the type of cement to be used in concrete foundations. Also include recommendations for corrosion protection for underground steel, including rigid metal conduit (such as the need for polyvinyl chloride [PVC] coating).

In addition to the above minimum requirements, local jurisdictional regulations may require site specific hydrologic and infiltration testing. Seller should determine specific requirements and coordinate with geotechnical engineering firm to obtain any required testing information, related to proposed stormwater management facility designs.

A detailed report shall be provided outlining the tasks performed and the results of the testing. Included in the report should be any recommendations for the foundation designs, structural support designs, corrosion protection for both underground steel and concrete, pile drive frequency, minimum pile size, and any geologic conditions that may prevent the development of the Project. Specifically, an opinion on the viability of driven piles as the PV racking supports should be provided.

4.12.2 Environmental Loads

All structures on the Site need to be designed using environmental loads as specified in the American Society of Civil Engineers (ASCE) 7 code book *Minimum Design Loads for Buildings and Other Structures* and the applicable state building code if more stringent requirements. These include wind loads (Chapter 6), snow loads (Chapter 7), rain loads (Chapter 8), ice loads (Chapter 10), and earthquake loads (Chapter 11). Each structure on Site shall be grouped in Occupancy Category II as defined in Table 1 1 of ASCE 7. The corresponding importance factor shall be used for each load calculation.

4.12.3 Excavation

Seller shall perform all common and deep excavation necessary for installation of all foundations and utilities. All excavation shall be in accordance with OSHA regulations. Excavation spoils shall be the Seller's responsibility and may be used for backfill or embankment if suitable, per ASTM D 2487 for this application. Unsuitable or excess excavated material shall be properly disposed of.

Seller shall verify that earth materials exposed in excavations are consistent with those assumed for Seller's foundation designs. If earth materials are different than assumed for particular foundation design, Seller shall modify the design and/or treat the earth material (over excavate, replace, etc.) as necessary to provide foundation meeting design requirements including frost depth.

Seller shall be responsible for making all excavations in a safe manner and consistent with the requirements of the Occupational Safety and Health Administration.

Seller shall provide adequate measures to retain excavation side slopes to ensure that structures, equipment, and persons working in or near the excavation are protected.

Seller shall protect all above grade and below grade utilities. Protect below grade liquid systems from frost.

4.12.4 Construction Surveying

Seller shall furnish all labor, equipment, material and services to perform all surveying and staking essential for the completion of the Project in conformance with the plans and specifications.

Seller shall retain qualified survey crews knowledgeable in proper and up-to-date survey techniques and shall use these qualified survey crews when conducting the survey. Such crews shall be under the supervision of a Professional Land Surveyor registered in the state or jurisdiction of the project.

4.12.5 Fills

Earth fill material adjacent to and below structures shall conform to Seller's design requirements for the structure. Seller prepared specifications and drawings shall indicate the types of soil to use for particular fills, compaction, and compaction testing requirements. These same requirements apply to access roads to the Project site.

Fill shall be placed as uniformly as possible on all sides of structural units. Fill placed against green concrete or retaining walls shall be placed in a manner that will prevent damage to the structures and will allow the structures to assume the loads from the fill gradually and uniformly.

4.12.6 Fencing

The entire site shall be enclosed with a permanent fence in accordance with Owner's Standard #9.

4.12.7 Equipment Pads

All equipment pads shall be located such that adequate personnel access is provided to such equipment. A minimum of 4.0 feet (or 1.5 meters) horizontal clearance from obstructions that would otherwise limit access to the equipment on the pad shall be provided around all equipment pads. The pads shall be sized sufficiently to allow safety and adequate working space around the equipment. The inverter stations, switchgear, substation (if applicable), and other buildings shall be elevated above the Federal Emergency Management Agency 100-year flood plain. The slope of the earthwork around the inverter stations and other equipment shall allow safe and ergonomic access to the equipment and provide for adequate drainage and maintenance. Above ground electrical equipment, including transformers, inverters, PV panels and BESS building or enclosures will be protected with bollards painted yellow.

4.12.8 Foundations and Concrete Work

All foundations and supports must be designed in accordance with the applicable state building code using the calculated environmental loads discussed above and soil properties provided in the geotechnical report. In addition, all placed concrete shall at a minimum comply with ACI 301 and ACI 117 publications. Form materials and required steel reinforcement shall comply with local regulations and site specifications. At a minimum, reinforcing bars shall comply with ASTM A 615 or ASTM A 706 for Low-Alloy-Steel Reinforcing bars.

4.12.9 Corrosion Protection

Corrosion protection shall be utilized on the structures of the Project. The type and amount shall depend on the selected materials of construction and conditions at the Site. A study of these conditions along with recommendations from the geotechnical report shall be used to design the corrosion protection.

The corrosion protection study shall be performed by a qualified corrosion expert and documented with references and calculations showing that the foundations, supports, racking, fasteners, and conduit shall meet a Design Life in aboveground and belowground conditions, as specified in Table 1. If galvanized materials are used, field-applied zinc coatings shall meet American Society for Testing and Materials (ASTM) A780, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings. This standard contains minimum requirements for the material, surface preparation, and application process. For example, repairs to damage due to vibratory pile driving shall conform to ASTM A780.

It is required that all holes in structural members requiring galvanization shall have the holes drilled before the galvanization is applied. Should holes be drilled in the field, galvanizing shall be applied to the exposed steel as specified in ASTM A780. All field welds shall have a field-applied galvanization as specified in ASTM A780. For example, if torque tubes with a 3.0-mil (0.003-inch) hot-dip galvanization are to be welded in the field, a field-applied coating, such as hot stick repair, shall meet or exceed the original 3.0-mil coating thickness of the torque tube per ASTM A780 requirements.

Only steel bolts with pre-applied corrosion inhibitors or stainless-steel bolts and fasteners shall be allowed in the entire mounting structure.

4.12.10 Erosion Control & NPDES Coverage

Seller shall submit a site-specific Erosion and Sedimentation Control Plan. If required by local regulations, this plan is to be reviewed and approved by the local jurisdiction prior to construction. The erosion and sedimentation control plan will be consistent with and incorporate applicable elements of the SWPPP in addition to local regulations. All areas of temporary soil disturbance are to be graded, if necessary, and re-vegetated in a timely manner to limit erosion as required by the local jurisdiction. In addition to the Erosion and Sedimentation Control Plans, depending on state regulation the site may need to apply for coverage under the National Pollutant Discharge Elimination System (NPDES). This coverage is normally issued by the state environmental agency and is normally required for any site disturbing 1 acre or more. Seller to investigate and apply for any permit authorizations related to earth disturbing activities.

4.12.11 Grading and Drainage

The grading and drainage plan shall be designed and installed in accordance with local code and permit requirements. The grading and drainage plan will be consistent with and incorporate applicable elements of the SWPPP and the erosion control plan. All structures required for the drainage plan, if any, shall comply with state standard specifications for drainage facilities. Grading and drainage will be designed to efficiently convey water away from the site, prevent ponding and point source discharge, promote sheet flow of water, and limit long-term maintenance of the Project site. Stormwater Management facility designs if required shall meet all state and local design requirements for Water Quality, Volume and Rate reduction as deemed appropriate for the site.

4.12.12 Dust Control

Seller shall apply dust control materials, at Seller's expense, to minimize raising dust from construction operations and traffic, including but not limited to haul routes, using only dust control mixtures approved by the local jurisdictions.

4.12.13 Site Finish Grade

Seller shall leave the Site in a clean condition upon completion of the work. Efforts shall be made to restore area to a clean condition as soon as practical. Seller shall remove all trash, debris, and stockpiles. The Site access roads shall be returned to a condition that meets the original specification by repairing road damage such as ruts, gouges, and weather damage that may have occurred during construction.

The Site finish grade within the equipment footprint and in areas required for operation and maintenance of the Project shall be fully stabilized in a manner that meets or exceeds local jurisdiction requirements. Provisions of the SWPPP for final storm water drainage shall be implemented.

Seller shall seed and mulch all areas of the Project Site that have been disturbed beyond the permanent portion of the Site and access road, per the SWPPP.

4.12.14 Construction Signage

Seller shall provide temporary signage for local traffic control in accordance with state department of transportation and/or local city requirements and in accordance with Owner's standards.

4.12.15 Human Access

Seller shall make access to all equipment safe and reasonably ergonomic for maintenance staff. For example, if an inverter pad is elevated, the earthwork surrounding the concrete pad shall have a safe approach slope.

The Project shall include a separate room or enclosure to serve as a storage area for tools, spare parts and similar items. Seller shall provide appropriate shelving and lockable cabinets. It shall also include an area for a desk and a file cabinet to store BESS manuals, documents and drawings.

4.13 Mechanical

All mechanical design shall be in accordance with the International Mechanical Code and the International Fire Code, the additional documents incorporated by reference and the additional requirements herein. All mechanical design shall be performed by or done under the direction of a Professional Engineer registered in the state. All Life Safety requirements shall meet all national, state, and local codes, as well as agree with the local Authority Having Jurisdiction.

In accordance with State and Local Laws, all final (Issued for Construction) drawings, specifications, and calculations shall be wet stamped by a Registered Mechanical Engineer in the state where the project is located.

The BESS components shall be fully contained in weatherproof, environmentally-conditioned enclosures or building. The BESS shall have complete and failsafe battery and PCS thermal management systems.

Seller shall provide heating, ventilation and/or space conditioning for the BESS components, as required, to meet the equipment manufacturers' recommendations over the range of site conditions and over the full operating range. Seller shall provide documentation and design calculations supporting the adequacy of the BESS heating, ventilation and/or space conditioning.

Ventilation and space conditioning equipment controls shall be interlocked with the fire protection and suppression systems to operate appropriately in the event of fire.

Ventilation system fans shall be provided with non-return, motor operated dampers. Forced ventilation air streams shall not impinge directly on electrical equipment. Inlet and outlet enclosure dampers shall be of a design that prevents wind driven water and dust intrusion. If required, ventilation systems shall be provided with an interlocked and automatic temperature control system, including appropriate alarming, for each Project building or enclosure.

Space site ambient temperature conditioning as required for the Project enclosure equipment provided shall be provided as complete systems with all accessory items required for proper operation. Consideration shall be given primarily to requirements for efficient conditioning of the installed BESS and PV equipment except in normally occupied areas such as the control room. Normally occupied areas or areas requiring access for local operation shall consider operator comfort in addition to requirements for equipment conditioning. Space air conditioning equipment shall be designed for the loss of one unit without derating of the Project. Where heating or cooling is provided, the equipment shall have a minimum EER, IEER, SEER rating in accordance with the Energy Codes. Space air conditioning shall be provided with an automatic temperature control system, including appropriate alarming, for each Project operational enclosure.

4.13.1 HVAC / Thermal Management

The following is a general summary of the HVAC Requirements for each Project Operational Enclosure.

4.13.1.1 Project Specific Requirements to Determine Equipment Sizing, Quantities & Configuration:

Each Mechanical system and option indicated in this section is dependent on project and enclosure specific requirements. The required information will determine the size, quantity and configuration of the Mechanical Equipment. The required information is noted as follows:

- Location of the Storage Facility – Climate Zone, Outdoor Max and Min Ambient Temperatures
- Storage Building / Container Assembly and Dimensions
- Space Temperature / Humidity Requirements for the Battery Storage Rooms
- Battery Rack Configuration
- Battery Heat Dissipation (BOL – Beginning of Life) & (EOL - End of Life)
- Location of Transformers, PCS (Indoor / Outdoor) – For Indoor – Heat Dissipation
- Available Clearances for Mechanical Equipment (Installation and Servicing)
- Available Clearances for Ductwork
- Fire Protection System(s) Configuration and Control Sequencing

4.13.1.2 Battery Energy Storage Building:

Battery Room(s):

- Provide 3-phase Air-Cooled AC-unit(s) dedicated for each defined array of batteries within each Battery Room. Each AC-unit Supply Air ductwork is to be installed in a manner that directs the supply air via supply air diffusers on to the batteries per the battery manufacturer's recommendations. Each AC-unit is to also have Return Air ductwork that is to be installed above the Supply Air ductwork. Each AC-unit is to be provided with an Air-side Economizer.

- Provide Exhaust Air Fan(s) dedicated to the space to provide ventilation of the space to meet or exceed code compliance of minimum 1 cfm/sq.ft. The Exhaust Air Fan(s) will include 100% stand-by fans. Each Exhaust Air Fan is to be Explosion Proof / Spark Proof. Make up-air to the Exhaust air fans to be provided by the AC-units during normal operations.

- Provide isolation dampers in the ductwork as required in coordination with the requirements of the Fire Protection System(s) Configuration and Control Sequence.

Control Room(s):

- Provide Air-Cooled AC-unit(s) dedicated for each Control Room. Unit shall be ducted to the space with supply air and return air ductwork. Each AC-unit is to meet minimum outside air requirements for the occupied Control Room space. Each unit is to be provided with an Air-side Economizer.

CO2 Room(s):

- Provide One (1) Exhaust Air Fan dedicated to each space to provide ventilation of the space. The Exhaust Air Fan will be ducted into the space with air inlets at the ceiling and extended to the floor level. Each Exhaust Air Fan is to be Explosion Proof / Spark Proof. Make up-air to the Exhaust air fans to be provided by a Passive Air Intake.

Fire Pump Room(s):

- Provide One (1) Exhaust Air Fan dedicated to each space to provide ventilation of the space. The Exhaust Air Fan will be ducted into the space with air inlets at the ceiling and extended to the floor level. Each Exhaust Air Fan is to be Explosion Proof / Spark Proof. Make up-air to the Exhaust air fans to be provided by a Passive Air Intake.

Provide the BMCS and Control Facilities for the Following Typical Systems:

- Battery Room AC-Unit and Ventilation Systems
- Control Room AC-Unit Ventilation Systems
- CO2 Room Ventilation Systems
- Fire Pump Room Ventilation Systems

4.13.1.3 Battery Energy Storage Container(s):

Three (3) options for Mechanical Equipment configurations have been listed. These options are not listed in order of preference.

- Option #1 – AC-units and Fans on top of Storage Container Enclosure:

- Provide Air-Cooled AC-unit(s) dedicated for the defined array of batteries within the Storage Container. The Air-Cooled AC-units are to be install on top of the Storage Container. Each AC-unit Supply Air ductwork is to be installed in a manner that directs the supply air via supply air diffusers on to the batteries per the battery manufacturer's recommendations. Each AC-unit is to also have Return Air ductwork ducted into the Container. Each AC-unit is to be provided with an Air-side Economizer.
- Provide Two (2) Exhaust Air Fan(s). Each exhaust Air Fan is to be installed on top of the Storage Container. Each exhaust fan is to meet or exceed code compliance of minimum 1 cfm/sq.ft. The first exhaust fan will be the base exhaust fan. The second exhaust fan will be a 100% stand-by. Each Exhaust Air Fan is to be Explosion Proof / Spark Proof. Make up-air to the Exhaust air fans to be provided by the AC-units during normal operations.
- Provide isolation dampers in the ductwork as required in coordination with the requirements of the Fire Protection System(s) Configuration and Control Sequence.

- Option #2 – AC-units on Ground, Fans on Roof of Storage Container Enclosure:
  - Provide Air-Cooled AC-unit(s) dedicated for the defined array of batteries within the Storage Container. The Air-Cooled AC-units are to be install on the Ground near the Storage Container. Each AC-unit Supply Air ductwork is to be installed in a manner that directs the supply air via supply air diffusers on to the batteries per the battery manufacturer's recommendations. Each AC-unit is to also have Return Air ductwork ducted into the Container. Each AC-unit is to be provided with an Air-side Economizer.
  - Provide Two (2) Exhaust Air Fan(s). Each exhaust Air Fan is to be installed on top of the Storage Container. Each exhaust fan is to meet or exceed code compliance of minimum 1 cfm/sq.ft. The first exhaust fan will be the base exhaust fan. The second exhaust fan will be a 100% stand-by. Each Exhaust Air Fan is to be Explosion Proof / Spark Proof. Make up-air to the Exhaust air fans to be provided by the AC-units during normal operations.
  - Provide isolation dampers in the ductwork as required in coordination with the requirements of the Fire Protection System(s) Configuration and Control Sequence.

- Option #3 – AC-units Mounted to Side of Storage Container, Fans on Roof of Storage Container Enclosure:
  - Provide Air-Cooled AC-unit(s) dedicated for the defined array of batteries within the Storage Container. The Air-Cooled AC-units (Multiple smaller wall mounted units) are to be install on each side of the Storage Container. Each AC-unit Supply Air ductwork tap into the container is to be installed in a manner that directs the supply air via a supply air diffuser on to the batteries per the battery manufacturer's recommendations. Each AC-unit is to also have Return Air ductwork duct tap into the Container. Each AC-unit is to be provided with an Air-side Economizer.
  - Provide Two (2) Exhaust Air Fan(s). Each exhaust Air Fan is to be installed on top of the Storage Container. Each exhaust fan is to meet or exceed code compliance of minimum 1 cfm/sq.ft. The first exhaust fan will be the base exhaust fan. The second exhaust fan will be a 100% stand-by. Each Exhaust Air Fan is to be Explosion Proof / Spark Proof. Make up-air to the Exhaust air fans to be provided by the AC-units during normal operations.

- Provide isolation dampers in the ductwork as required in coordination with the requirements of the Fire Protection System(s) Configuration and Control Sequence.

- Provide a BMCS and Control Facilities for the Following Typical Systems:
  - Battery Room AC-Unit and Ventilation Systems

4.13.1.4 Quality Assurance for Air-Cooled AC-units:

- Packaged air-cooled condenser units shall be certified in accordance with ANSI/AHRI Standard 340/360 performance rating of commercial and industrial unitary air-conditioning and heat pump equipment.
- Unit shall be certified in accordance with UL Standard 1995/CSA C22.2 No. 236, Safety Standard for Heating and Cooling Equipment.
- Unit and refrigeration system shall comply with ASHRAE 15, Safety Standard for Mechanical Refrigeration.
- Unit Energy Efficiency Ratio (EER) shall be equal to or greater than prescribed by ASHRAE 90.1, Energy Efficient Design of New Buildings.
- Unit shall be safety certified by ETL and ETL US listed. Unit nameplate shall include the ETL/ETL Canada label.

4.13.1.5 Additional Thermal Management Coordination Items:

- Provide a CFD (Computational Fluid Dynamics) Analysis of the Proposed Installation.
- Provide supplemental steel supports where required for all rooftop installations.
- Provide concrete equipment pads where required for equipment placed on the ground/floor.
- Coordinate all structural equipment weights, unit supports and pads.
- Coordinate all Electrical Requirements with the Electrical Seller.
- Coordinate all Fire Alarm Requirements with the Fire Alarm Seller.

4.14 Safety and Project Security

4.14.1 Fire Protection and Suppression

Seller shall design and install a fire protection system that will provide fire detection and fire suppression systems for the buildings and/or enclosures, and equipment that comprise the Project as necessary. The design shall be performed by a licensed Fire Protection Engineer in the state where the project is located, and all design documents shall be signed and sealed by that Engineer.

The fire protection systems shall conform to all national, state, and local codes and standards including, as well as incorporating and implementing the recommendations of the following:

- National Fire Protection Association (NFPA) 850 Recommended Practice for Fire Protection for Electric Generating Plants and High Voltage Direct Current Converter Stations (for transformers and general areas and overall interface with the power station)
- National Fire Protection Association (NFPA) 855 Standard for the Installation of Stationary Energy Storage Systems
- National Fire Protection Association (NFPA) 10 Standard for Portable Fire Extinguishers National Fire Protection Association (NFPA) 13 Standard for the Installation of Sprinkler systems

- National Fire Protection Association (NFPA)15 Standard for Water Spray Fixed Systems for Fire Protection

The fire protection systems shall also comply with when required, as well as incorporating and implementing the recommendations of the following when not fully required by the owner, AHJ, Insurance agent:

- FM Global Property Loss Prevention Data Sheet 2-0, Installation Guidelines for Automatic Sprinklers
- FM Global Property Loss Prevention Data Sheet 2-1, Corrosion in Automatic Sprinkler Systems.
- FM Global Property Loss Prevention Data Sheet 2-8, Earthquake Protection for Water-Based Fire Protection Systems.
- FM Global Property Loss Prevention Data Sheet 2-10r, Dry Pipe, Deluge, Pre-action Valves and Accessories.
- FM Global Property Loss Prevention Data Sheet 2-81, Fire Protection System Inspection, Testing, and Maintenance.
- FM Global Property Loss Prevention Data Sheet 4-1n, Fixed Water Spray Systems for Fire Protection
- FM Global Property Loss Prevention Data Sheet 4-4n, Standpipe and Hose Systems.
- FM Global Property Loss Prevention Data Sheet 4-5, Portable Extinguishers
- FM Global Property Loss Prevention Data Sheet 4-9, Halocarbon and Inert Gas (Clean Agent) Fire Extinguishing Systems.
- FM Global Property Loss Prevention Data Sheet 5-33, Electrical Energy Storage Systems
- FM Global Property Loss Prevention Data Sheet 5-40, Fire Alarm Systems.
- FM Global Property Loss Prevention Data Sheet 5-48, Automatic Fire Detection.
- FM Global Property Loss Prevention Data Sheet 5-49, Gas and Vapor Detectors and Analysis Systems

All fire suppression, detection, and alarm systems shall be designed and installed in accordance with the applicable NFPA codes and standards. All equipment shall be UL listed and/or FM approved, were FM compliance is required by the owner. Seller shall provide a main fire alarm control panel in the control room that shall monitor all fire suppression, fire detection, and fire alarm systems. Additional local fire panels shall be provided as required.

The fire protection system design and associated alarms shall take into account that the Project will be unattended at most times.

Designing engineer and Seller shall calculate and consider the heat content of the battery cell materials, based off the data collected in the UL 9540A testing, in designing an appropriate fire protection system.

Separate fire protection and barrier systems may be used in the battery, PCS and control areas.

All buildings and enclosures shall be designed in accordance to the applicable state and local building, mechanical, fire, and energy conservation codes. Where a building is not provided, life safety and egress requirements shall still be applied and considered in the overall equipment arrangement.

Within 30 days of Effective Date, Seller shall submit its proposed fire detection and suppression philosophy and basic design elements with calculations to Owner and appropriate third parties having jurisdiction. Seller is responsible for obtaining system design approval, installation inspection, and testing as required by Owner and third parties with jurisdiction

4.14.1.1 Fire Separation

Design engineer/ Seller shall provide adequate separation between the BESS and the other buildings, structures, equipment, and systems located on the site. Separation shall be provided by either spatial separation, fire walls/barriers, or exposure protection system such as water spray systems. Separation and exposure protection requirements shall be determined in accordance with the local building codes, FM Data Sheets 1-20 and 5-33, and applicable NFPA standards, including the latest edition NFPA-855, all based off the testing data from UL 9540A

Structures housing the batteries may be divided into multiple battery rooms, separated by two (2) - three (3) hour fire barriers based on referenced codes, in order to limit the potential impact of a fire. The maximum size of a battery room shall be on the order of 3,000 square feet. This area limitation is a guideline and should be adjusted as practical for economic and design efficiencies.

When multiple outdoor battery enclosures are utilized, they shall be separated from each other in accordance with FM Data Sheet 5-33, by either 20 feet or masonry fire barriers, and NFPA-855.

Transformers shall be located and installed in accordance with the location and separation requirements of NFPA 850 and FM Data Sheet 5-4. Transformers shall be provided with a means to contain their oil content without exposing adjacent transformers, buildings, enclosures, or other equipment and structures. Seller shall provide the required spatial separation between the adjacent equipment and buildings or shall provide rated fire separation barriers/walls.

4.14.1.2 Fire Suppression Systems

Fire suppression systems shall be provided for all buildings and enclosures as required. Battery areas shall be provided with a multi- phase fire suppression approach. One such approach is, 1) Clean agent fire suppression system per NFPA 2001 for initial fire control; and 2) double interlocked pre-action sprinkler system per NFPA 13. Both systems will be activated by means of the associated fire detection system. Each battery room shall be provided with an independent fire suppression system. In the engineers selection of systems, they are responsible to provide documentation to the owner, Seller, local Fire Dept, plan reviewer, etc., that states that the designed system is designed to fight the different fire hazards, and fires that can be experienced, such as an electrical (non-thermal runway fire), thermal run away fire, explosion mitigation or prevention, etc. Hazards to be identified by a licensed fire protection engineer in accordance with local, industry, and the latest NFPA standards on battery protection, list of hazards and protection system to be provided to owner and AHJ prior to design for approval.

Where separate battery enclosures are utilized, either outdoors or indoors, the clean agent system discharge can be limited to the battery enclosure with the fire. Where separate battery enclosures are installed indoors, the pre-action sprinkler system shall be extended into the individual enclosures in addition to general building coverage, this method of protection must be approved by the local fire, AHJ and owner prior to design, care should be given to any impacts to the insurance rates of sites protected with

Outdoor battery enclosures are not required to be provided with a pre-action sprinkler system when they are adequately separated from adjacent battery enclosures. Only clean agent fire suppression need be provided for the enclosure. For this case, final water fire suppression will be provided manually by means of fire hoses.

The required concentration of clean agent shall be determined by the manufacture of the battery units via the required UL 9540A testing and must be based on fire suppression test results for the specific battery chemicals being utilized. The clean agent concentration shall comply with the latest NFPA-2001 requirements, including the design concentration factor as outlined in NFPA-2001-2018 section 5.4 and shall allow personnel occupancy of the room/enclosure for at least five minutes without any adverse health effects.

The clean agent system(s) shall be designed using a main gas supply bank. Seller shall determine if an installed reserve bank is required based on the relative availability of the clean agent being utilized, and to comply with local codes and NFPA-2001. As a minimum, Seller shall provide on-site storage of clean agent reserve cylinders for the largest single clean agent system and the means for quickly replacing the used cylinders with the uninstalled reserve cylinders, it is highly recommended that the

Abort switches shall be provided for each clean agent system installed in a building, or a min of one (1) abort switch for each container of batteries installed outside. The abort switches must be in the hazard area located close to all exit doors and be within distance of doors as stated in NFPA-2001 All required warning signs shall be provided and installed by Seller as required by NFPA 2001.

All door, windows, vents, or opening of any kind that could allow for air flow in or out of the hazard area must be placed on self-closing, so that upon detection of an issue they can close, any openings that cannot be closed must be accounted for with extra agent as outlined in NFPA-2001. All HVAC units are to be shut down at the same time, and all duct work leading from the space to the outside to be closed with airtight dampers, in the event the system cannot be shut-down or the ducts and vents not shut, additional agent must be provided to comply with NFPA-2001.

The water density for the design of the pre-action sprinkler system shall be determined by Seller based on the battery technology being used, guidance of NFPA 855.

The pre-action valve is to be UL listed and FM approved for use. It is recommended to use a Double interlock Pre-action valve be used, to reduce the risk of false alarms, accidental water flow into the pipe, and water leaks from piping. Systems to be either Electric-Electric activation, that uses one of the following activations and detection methods, cross zoned smoke detectors, cross zoned heat detectors, or a min of two (2) concentration levels for automatic air sampling systems, levels to be determined by designing engineer/Seller in compliance with NFPA and FM requirements based off testing from UL 9540A. Systems can be Electric-Pneumatic activation, where the electronic follows the requirements outlined above. All Pre-action systems to be provided with electronic accelerator.

Where the AHJ, Fire Dept or other code enforcement do not allow for the use of double interlock valves to be used a single interlock system can be used, with either pilot line or electric actuation can be used, with electronic being recommended. All single interlock valves to be provided with an electronic accelerator.

The pre-action sprinkler system piping shall be supervised using nitrogen bottles, or a nitrogen generator that complies with the requirements of NFPA-13 and is FM approved. The loss of pressure in the piping shall be alarmed on the local control panel and main fire alarm control panel in the control room. All valves and components to be housed in a controlled dedicated area/room, it is to be heated to protect from freezing, be protected from physical damage from items such as cars, trucks, lifts, etc. All information required by the local fire dept, including drawings, specifications, life safety plans and other required details by the AHJ and Fire Dept that are coordinated by the installing Seller and the fire dept and AHJ. Valves and valve room to be remotely located away from the battery units to a min distance outlined in the UL 9540A testing, NFPA-855, and local requirements, to protect the valves and components from damage from a unit on fire, such as explosion and fire damage that could compromise a system.

4.14.1.3 Fire Detection and Alarm Systems

Designing Engineer/Seller, and installing Seller shall design, furnish and install a fire detection and alarm system throughout the Project, including detection systems associated with the clean agent systems for each battery area, and the other rooms and areas identified in this Technical Specification. All fire detection and alarm system equipment shall be UL listed/ FM approved and shall comply with NFPA 70 and NFPA 72. Detector locations shall be subject to Authority Having Jurisdiction approval.

Installing Seller shall be responsible for the design, furnishing, installing, programing, and testing of a complete intelligent, addressable, supervised, manual and automatic, non-coded, and state-of-the-art fire detection and alarm system. System shall include all electrical relays, interface modules, control transformers, fire protection and detection conduit and tubing, and other miscellaneous electrical equipment and instrumentation, including all local devices as required to ensure proper operation of the fire protection systems, as specified herein and as required by the applicable codes and standards. Detection system shall also provide for the detection of carbon monoxide (CO), hydrogen (H_2) gasses, and other combustible or explosive gasses based on the UL 9540A testing, that may be released in all battery rooms/areas.

Fire Detection and alarm system shall consist of the following:

- Fire detection and alarm systems associated with the required fire suppression systems in the battery areas and all other building areas, rooms, and enclosures.
- Monitoring and supervision of clean agent systems.
- Manual pull stations throughout building and enclosures, including along paths of egress and at all entrances and exits from energy storage containers
- Audible and visual alarms throughout building and enclosures.
- Red strobe beacons outside each battery room or enclosure for indication, located above any paths of entrance or exit to the space that fire has been detected in the room/enclosure.

Seller shall be responsible for providing duct smoke detectors installed in the building/enclosure HVAC systems. All alarms from the duct smoke detectors shall be brought to the Fire Alarm System Control Panel.

Seller shall be responsible to provide local audible and visible alarms and manual pull stations.

Seller shall furnish and install automatic and manual fire detection systems, alarm and signaling systems, including but not limited to: air sampling type smoke detectors (VESDA or equal), spot type smoke detectors, pull stations, horns, strobes, etc. Seller shall be responsible for the installation and connection of all detection devices. The number of detectors to be provided for fire detection in a certain area or room and the corresponding location of these detectors shall be determined by Seller and based upon the manufacturer's recommendations and NFPA 72 requirements.

All detection, tripping and isolation circuits shall be electrically supervised for continuity. Discontinuities shall be indicated by a “trouble” indicator and alarm at the respective local control panel and at the Main Fire Alarm Control Panel. Pathways shall be Class A with a pathway survivability of Level 0.

Each battery room/area shall be provided with two zones (Zones 1 and 2) of air sampling type smoke detection, VESDA or equal, with each zone providing full coverage of the battery room/area being protected. This detection system shall control the release of the clean agent system into the battery room. Rooms and areas that do not have batteries shall be provided with spot type smoke detectors.

The air sampling smoke detectors shall provide programmability of four smoke density alarm thresholds within the systems sensitivity measurement range. Setting of time delays for each of the four alarm thresholds shall also be programmable. Relay outputs shall be provided for remote indication of alarm conditions on the local system panel.

Alarm levels shall be:

- Alert
- Pre-Alarm
- Fire 1
- Fire 2

System shall be designed for resistance to unwanted alarms while still achieving maximum sensitivity.

A time delay of 30 seconds for room evacuation shall be provided prior to the release of the clean agent into large battery rooms. The time delay shall be adjusted downward for smaller battery enclosures. The time delay shall start at the time that the system has alarmed and received all permissions for clean agent discharge.

Activation of the clean agent extinguishing system for each battery room/area shall be via crossed-zoned smoke detection: room aspirating smoke detection systems (both Zone 1 and Zone 2 at Fire 1 alarm level). This shall also release water into the pre-action sprinkler system piping.

Fire alarm control panels shall be wall mounted type, requiring access from the front only. Panels shall be provided with internal battery backup power.

Panel shall provide for HVAC system shutdown for the room being served based on the following:

- Duct smoke detector detects smoke.
- Spot smoke detector detects smoke.
- Aspirating smoke detector reaches Fire 1 alarm level (either zone).

4.14.1.4 <u>Portable Fire Extinguishers</u>

Seller shall furnish, locate, and install portable fire extinguishers in the building and enclosures in accordance with NFPA 10, and as required by the local Authorities Having Jurisdiction. Quantities, type, and sizes of extinguishers shall be determined by Seller in accordance with NFPA 10 requirements.

Portable hand-held fire extinguishers shall be provided at required locations.

4.14.1.5 Testing

All testing shall be performed in accordance with the applicable NFPA code/standard and related electrical specifications, local requirements, and the additional requirements as contained herein.

All testing shall be properly documented in accordance with the applicable NFPA codes/standards, verifying proper testing and test results, and will be submitted to Owner and the Authority Having Jurisdiction for approval.

The piping distribution systems for the clean agent systems shall be inspected and tested to determine that they are in compliance with the design and installation documents. As a minimum, the inspection and testing shall be as identified in NFPA 2001 for Installation Acceptance.

Pressure and flow testing, and enclosure integrity testing for clean agent systems shall be performed as required by NFPA 2001.

All fire detection systems shall be fully tested after installation in accordance with NFPA 70, NFPA 72, and NFPA 2001, such that alarms are received on the Fire Alarm Control Panel and transmitted to the remote monitoring location. As a minimum, each switch, control, alarm, etc., shall be operated or caused to alarm to verify proper function and operation. Actual operation of valves and detectors should be used to initiate alarms, signals, and trips (no simulated signals).

4.14.1.6 Operation and Maintenance of Fire Protection Systems

Fire suppression and fire detection systems shall be operated and maintained in accordance with the requirements of this Technical Specification and the appropriate NFPA standard. Water based fire suppression systems shall be maintained in accordance with NFPA 25.

4.14.2 Project Security

Seller shall provide a security system for the Project. The security system around the perimeter shall include a 7-foot-high chain link fence with 1-foot top guard (total 8-foot high) of three strands of nine-gage barbed wire. The perimeter fence shall include two locked gates: one with a width of 20 feet for vehicles and one pedestrian entrance with a width of four feet. During construction, Seller shall utilize temporary fencing as necessary to maintain security and prevent the movement of livestock. The entire site shall be enclosed with a permanent fence in accordance with Owner design standards.

Perimeter signage shall be provided by Owner and installed by Seller in accordance with Owner standards. Signage shall be installed every 65 feet along the perimeter fence and on all gates. Signage shall be installed five feet above ground level.

Signage that will be provided by Owner will include the following:

Warning! Hazardous Voltage Inside Keep Out

English SI# 7999852

Spanish SI# 7999854

No Trespassing

SI# 8252306

Mounting Hardware

SI# 7999092

Seller shall be responsible for security during construction.

Seller shall contract with AVTEC SYSTEMS INTEGRATOR, A DIVISION OF CACHE VALLEY ELECTRIC, (Security Sub-Contractor), to provide and install the necessary security equipment. Contact:

Avtec – System Integrator
Michael Petric
(801) 908-4191
michael.petric@cve.com

This equipment may include, but is not limited to:

- LED Spot or LED flood lights.
- Security cameras located such that they are capable of adequate identification of intruders covering the perimeter of the Site. Cameras shall be placed at a height that permits line-of-sight access to the property.
- Cameras with a control and detection system that assists in the detection and identification of intruders.
- Network - Digital Video Recorders used to record video that could be used for evidence in the event of theft or vandalism.
- Seller shall negotiate with third party vendor to identify the scope of work that will be performed by Seller, to ensure that a complete and operational security system as described by third party vendor is provided. Third party vendor shall provide to Seller the security system design, which will indicate the location of cameras, DVRs, security lighting and any security communications equipment, based on third party vendor's overall System design. The work that may be provided by third party may include the furnishing and installation of wiring, cabling, labor, tools, equipment, and ancillary materials required for a complete and operational security system. At minimum, it is expected the Security Sub-Seller will provide the following equipment: cameras, network DVRs, and any specialized security communications equipment.
- Seller shall be responsible for the furnishing and installation of all necessary conduits, 120-V_{ac} power extensions for all Security related equipment.

- Seller shall provide a free-standing weather-proof enclosure with adequate space required for Security Control Equipment as specified by the third party.
- Installation of telephone lines, and/or cellular modem(s), and/or local area network for the interconnectivity of all related Security System Equipment.
- Seller shall provide fiber optic cable for Security System Communications. Fiber optic cable shall consist of a minimum of six fiber strands between each required camera location.
- The system shall be complete, tested, and fully operational. Prior to construction, Seller shall provide the following:
    - Descriptive statement and single-line block diagram to show how all related equipment will interface and operate as a complete system.
    - Product data: manufacturer's technical data sheets on each product to be used.
    - Drawings, including plans, elevations, equipment mounting heights, and dimensions required to show devices' locations and demonstrate accessibility compliance in accordance with referenced documents.
    - Detailed schematic wiring diagrams for all system devices; wiring information shall include cable type, conductor routings, quantities, and connection details at devices.
    - Manufacturer's user's manuals for operations, administration, installation, and maintenance.

4.14.2.1 Security System Installation

All system components and appurtenances shall be installed in accordance with the manufacturer's specifications, referenced practices, guidelines, and applicable codes. All necessary interconnections, services, and adjustments shall be furnished as required for a complete and operable system as specified. Control signal, communications, and data transmission line grounding shall be installed as necessary to preclude ground loops, noise, and surges from adversely affecting system operation.

All security system wiring shall be installed in dedicated conduit throughout. Cable shall not be pulled into conduits or placed in raceways, compartments, outlet boxes, junction boxes, or similar fittings with other wiring. All low-voltage wiring outside the control console, cabinets, and similar enclosures shall be plenum rated where required by code.

All wiring conductors connected to terminal strips shall be individually numbered and each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with the name and number of the device as identified and shown on the drawings.

4.14.2.2 Security System Components

Security system components may consist of LED spot or LED flood lights, cameras, alarms, network video recorders, communication lines, and all wiring required for all the components. The security system shall be sufficient to monitor and deter any theft or vandalism onsite. The security component supplier shall provide detailed specifications of each component.

Seller shall coordinate with Owner's SCADA design/instrumentation and control engineer to ensure sufficient bandwidth is available on the network to accommodate the proposed security system. Owner may elect to reduce the equipment needs based on the location of the Site and subsequent security requirements.

Surveillance cameras and pan/tilt/zoom (P/T/Z) drives shall meet the following minimum requirements. Surveillance cameras and P/T/Z drives shall be provided by Seller. Alternative solutions providing higher upgradeability and compatibility with future products are acceptable at no additional cost, subject to Owner's approval.

The P/T/Z unit shall meet the following design and performance specifications:

- The unit shall be microprocessor controlled with network / IP based programming via standard WEB based interface.
- Each pan/tilt drive unit shall operate as an independent unit with exclusive programming and setup data contained on each unit's nonvolatile memory.
- The unit shall be capable of 360-degree continuous pan rotation with a vertical unobstructed tilt of +36 to -85 degrees.
    - Manual Control Speeds of: 0.1 degree to 40 degree per second (Pan), and 0.1 degree to 30 degree per second (Tilt)
    - Preset Speeds of: 100 degree per second (Pan) and 30 degree per second (Tilt)
- The unit shall pan and tilt under manual control.
- The unit shall be capable of 16 learned tours and 256 configurable preset locations for Alarm Call-up configuration.

The camera shall meet the following specifications:

- The sensor type shall be 1/2-.8-inch Type Exmor CMOS Sensor.
- The camera shall provide a minimum of 1080p (1920x1080) resolution, at 30 images per second (ips).
- Camera shall provide a minimum of two simultaneous video streams: Dual H.264 or H.264 and Scalable MJPEG.
- Camera shall allow for control and monitoring of video via IPv4 and IPv6 Networks.

The motorized lens shall meet the following design and performance specifications:

- The camera shall provide 16:9 Aspect Ratio and shall provide a 30X optical zoom and 12X Digital Zoom.
- The lens shall provide horizontal angle of view of 59.5 degrees (wide) to 2.1 degrees (telephoto).
- The lens shall feature an automatic focus with manual override.
- A step-down power transformer shall be provided for each camera. Transformers shall be rated 120/24 V_{AC} and shall have an adequate volt-ampere rating for the load at 40 degrees C ambient air temperature. Individual Fuse Distribution shall be provided.

The camera and lens housings shall be weatherproof and part of an Integrated Optics Cartridge (IOC). The IOC shall accommodate specified camera and lens combinations. IOC shall be dry nitrogen filled to 10 psig, to protect Camera Sensor / Lens optics from condensation and corrosion.

Camera assembly shall be provided with integrated IR Illumination. IR Illumination Transmitters shall be integrated to the Pan / Tilt Assembly Housing so as to provide IR Illumination for areas being viewed by the camera.

- IR Illumination shall be provided for distances up to and including 330 feet from each camera location.

Video Wiring System

Description: 100-ohm, four-pair UTP, covered with a black PVC jacket.

- Comply with ICEA S-90-661 for mechanical properties.
- Comply with TIA/EIA-568-B.1 for performance specifications.
- Comply with TIA/EIA-568-B.2, Category 6.
- Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
    - Communications, Direct Burial Rated: Type F/UTP, complying with NFPA 262.
    - General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher. All terminations shall use TIA/EIA 568B wire termination color coding.

Power and/or Auxiliary Input/Output cable shall be multi-conductor twisted shielded cables selected for use with the specific equipment to be controlled for installation in concealed conduit system. Cables shall have outer jacket of PVC and shall be suitable for direct burial installation.

All cables and conductors that serve as control, sensor, low voltage power, or data conductors shall have surge protection circuits installed at each end that meet the IEEE C37.90.1 surge withstand capability test. Fuses shall not be used for surge protection.

If fiber is to be used for the communication backbone and copper is to be used for each camera connection, then Fiber to copper convertors are to be provided for each camera location. Theses convertors need to be capable or at least 1GB connectivity.

Network Video Recorder and Multiplexor

The network video recorder (NVR) and multiplexer shall be provided as one integrated unit. The NVR shall be provided by Seller.

The NVR shall provide for live and playback viewing while the system continues to record new images. It shall be capable of time division, multiplexing multiple cameras and storing their digitized and compressed images on integral hard disk drives, and search and retrieval either locally at the unit or from a remote work station using a graphical user interface. It shall have Ethernet connectivity.

The NVR shall record video on an internal hard disk drive(s). It shall support multiple internal and external hard disk drives of minimum one (1) Terabyte, or large enough to store up to one month of the camera recordings (whichever is greater). Minimum redundancy level RAID 5 is required with a hot swappable drive.

The NVR shall support archiving of images on an external archiving device. It shall support recording on portable / removable storage media.

The NVR viewing software shall provide the following displays as a minimum in live and playback mode: full-screen, sequencing, quad, 9-way, or 12-way. It shall allow the user to rearrange cameras in any multi-screen display, in both live and playback modes. The display options shall include but not limited to:

- Camera tilting
- Title display, per monitor
- Time and date, per monitor

4.14.2.3 Security Software

Seller shall provide a minimum of two software and database management licenses. Seller shall provide two copies of the software on CDs for backup and a complete user manual. Software shall be Windows compatible. Seller shall provide free software upgrades during the warranty period of the system as a minimum. In addition, camera licensing is required with one (1) license per camera.

4.15 Cybersecurity Requirements

General Security Criteria

1. Please confirm you have and maintain security controls to protect the Company's networks, systems, software, Confidential Information, and Data no less rigorous than those set forth in the latest published version of ISO/IEC 27001 – Information Security Management Systems–Requirements and ISO/IEC 27002 – Code of Practice for International Security Management.

2. If providing a web portal or web service, please confirm that web services use HTTPS/TLS version 1.2 or later for all content.

3. Please confirm you encrypt all Company data while at rest as well as when in transit over the network.

4. Please confirm that all Company-related file transfers are encrypted while at rest as well as when in transit over the network.

5. For responses above, please confirm all encryption uses NIST-approved algorithms and key lengths.

6. Please confirm you support federated single-sign-on (SSO) authentication for any Company accounts, whether via web interface or mobile application. You must have the ability to support Azure Active Directory.

7. If you do not support federated single-sign-on (SSO) authentication, please confirm that Accounts provided by you support multi-factor authentication compliant with NIST SP 800 63-3 Authentication Assurance Level 2. Provide documentation that supports compliance and describe supported authentication mechanisms.

8. Please confirm, by provision of supporting documentation, that email sent while under the Contract to the Company by you or by any service: Originates from a domain(s) with a published Domain-based Message Authentication, Reporting and Conformance (DMARC) policy of "reject" and with a published Sender Policy Framework (SPF) policy consisting of valid senders and a "fail" directive (-all). If the optional DMARC "pct" directive is used, "pct" must be set to "100".

9. Please confirm, by provision of supporting documentation, that email sent while under the Contract to the Company by you or by any service passes a Domain-based Message Authentication, Reporting and Conformance (DMARC) authentication check.

10. Please confirm, by provision of supporting documentation, that email sent while under the Contract to the Company by you or by any service is signed by a DomainKeys Identified Mail (DKIM) 2048 bit key.

11. Please confirm, by provision of supporting documentation, that email sent while under the Contract to the Company by you or by any service supports Transport Layer Security (TLS).

12. Please describe your process to disclose known vulnerabilities to the Company related to products or services provided as they pertain to the proposed service.

13. Please describe methods supplied to the Company to verify software integrity and authenticity for any software or patches provided by you as they pertain to the proposed service.

14. Please describe your process for security event monitoring and notification/alert/response plans, including response to security incidents affecting the Company.

15. Please confirm you will notify the Company of a security incident as soon as practicable, but no later than 48 hours after discovery.

16. Please confirm you will coordinate responses to security incidents with the Company that pose a security risk to the Company.

17. Please confirm that all rights to any data provided by the Company shall remain exclusive property of the Company.

18. Please confirm you will not share data with third parties for unrelated commercial purposes, such as advertising or advertising-related purposes.

19. If remote access of any type will be required as part of the service, please fully describe your requirements for remote access.

20. If remote access of any type will be required as part of the service, confirm your ability to conform to Company requirements for intermediate host methods for remote access, such as Citrix or Virtual Desktop,

21. If remote access of any type will be required as part of the service, and if a virtual private network is required, please confirm your ability to terminate in a demilitarized zone network (DMZ). Note that direct virtual private network connectivity to Company corporate networks is always prohibited.

22. If remote access of any type will be required as part of the service, confirm that you will notify the Company when remote or on-site access is no longer needed by your representatives, where applicable.

23. Please list facilities proposed in bid located outside the continental United States.

24. Please list any support staff used during the term of this contract located outside the continental United States.

25. Please confirm you will disclose third parties upon which you depend to deliver the Company offering (such as third-party software, implementation, hosting, for example).

26. Please describe your methods to securely ship and deliver products to the Company as they pertain to the proposed service.

For Hosted or Cloud Services:

27. If your service is comprised in whole or in part of a cloud-based or hosted services solution, please confirm you currently undergo, or are willing to undergo, annual Statement on Standards for Attestation Engagements (SSAE) Service Organization Control (SOC) 2 Type 2 audits ("Audit") for your enterprise or covering the scope of services for the term of the contract with the Company, as appropriate. Note that a datacenter audit alone will not be sufficient. You may include an audit for datacenter/colocation provider for informational purposes.

28. If your service is comprised in whole or in part of a cloud-based or hosted services solution, please confirm that your administrative access complies with NIST SP 800 63-3 Digital Identity at Authentication Assurance Level 2 or higher, where compromise of one factor does

not contribute to compromise of the other factor. Provide compliance documentation and describe supported authentication mechanisms.

4.16 Drainage Systems

Sanitary drainage, roof (storm) drainage, and floor and equipment drainage systems shall be provided, as required, to service all project buildings. All systems shall be gravity drainage systems with all pipe uniformly sloped in the direction of flow. Minimum slopes for all drainage systems shall conform to the requirements of the applicable Plumbing Code.

All plumbing fixtures and washing facilities shall be drained to the sanitary system. Floor drains in toilets, washrooms, and showers, if included, shall also be drained to the sanitary system. All such drains shall be routed independently from all other drainage systems to the Project Sewage Treatment Facility or to the local sanitary sewer system. Connection to the local sewage line is Seller's responsibility.

All plumbing fixtures and sanitary drainage related floor drains shall be trapped and vented to the outside in compliance with the applicable plumbing code.

All roof drains shall be provided with dome strainers, integral expansion joints, flashing collars, and underdeck clamps. All horizontal roof drainage piping shall be insulated and jacketed to prevent sweating.

Floor and equipment drains shall be connected to a common drainage system. Drainage from areas wherein chemicals can enter the drainage system shall be neutralized before combining with ordinary floor and equipment drains. Drainage from areas containing oil shall be processed through oil separators prior to discharge.

Equipment drains shall be sized on the basis of the largest drainage rate from equipment to be drained. Equipment drains shall be provided for all equipment with continuous drips or subject to frequent flushing. Equipment drains shall also be located at each fire protection system alarm valve station.

All station floor drains shall be a minimum of 4 inches in size. All areas containing concentrations of oil shall be provided with dikes, trenches, and/or drains sized to contain the maximum anticipated spill.

Any section of drainage system which cannot be drained by gravity to its disposal facilities shall be provided with pumps. Pumps for the sanitary drainage system shall be duplex sewage ejectors of the non-clog type, submersible, vertical submerged type or pneumatic type. Sewage pumps shall be installed in cast iron basins. Pumps for the roof and floor and equipment drain systems shall be duplex sump pumps of the vertical, submersible type installed in concrete pits or cast-iron basins.

4.17 Toxic Materials

If a significant amount of a toxic substance can be emitted from the equipment during a failure, fire or emergency/protective operation, an alarm system to alert personnel shall be included in the equipment. The toxic nature of the substances as well as treatment for exposure to it shall be included in the Operation and Maintenance (O&M) manual. Sellers shall provide battery safety data sheets and test data with the bid.

Coordination and approval from the local fire protection agency is required prior to acceptance by Owner.

4.18 Spare Parts and Equipment

Seller shall evaluate its design with regard to failure rates, effects and BESS reliability. Seller shall provide a recommended spare parts list, including prices and availability, as part of his proposal. Spare parts that are readily available from stock and available within sufficient time to meet the required availability shall be considered off-the-shelf items and not required as spare parts in stock at the site. These parts shall be listed and so noted on the spare parts list. Seller shall also identify spare parts that Seller recommends should be stocked locally to ensure prompt repair due to any failure that can be reasonably expected, considering the length of time required to obtain replacement parts. Owner will determine the need for and purchase separately all spare parts.

All spare parts for equipment covered by this Technical Specification shall comply in all aspects with the requirements of this Technical Specification. This includes documentation identical in kind and format to that required for the original equipment or material. Each of the spare parts shall be fully identified by reference to the spares list, part number, cost, and manufacturer drawing number.

If Seller, his suppliers, or sub suppliers cease manufacture of any of the spare parts, or if for any reason any spare part will become unavailable at any time during the Design Life of the facility, as specified in Table 1, Seller shall notify Owner in writing at least 180 days prior to the unavailability of such spare parts. Seller shall provide Owner the opportunity to purchase sufficient stock of spare parts to support the system for its expected life.

The initial complement of equipment shall include a supply of chemicals as may be needed to neutralize small electrolyte spills.

Seller shall provide, receive, store locally, distribute and restock spare parts, materials, test equipment, instruments, tools, and consumables required for start-up and operation of the systems and equipment within its scope until Substantial Completion.

4.19 Project Access

4.19.1 Construction Access

Seller shall abide by all load limits established by the applicable state department of transportation.

Seller shall be responsible for providing, operating, and maintaining equipment, services, and personnel with traffic control and protective devices, meeting the requirements of the *Manual of Uniform Traffic Code Devices* as required, allowing traffic flow on haul routes and onsite access roads in a safe manner. Seller shall be responsible for any costs to comply.

Seller is responsible for construction of temporary access around areas of excavation and other construction activity, if necessary and as required.

4.19.2 Site Access

The Site access road shall be designed and installed by Seller. This design shall be based on sufficient soils and subsurface investigation by a qualified professional engineer licensed in the jurisdiction of the project to ensure that the constructed road will meet its intended purpose. The Design Life of the access road shall be 30 years (assuming annual maintenance). The Site access road shall be a gravel compacted road (unless local regulations specify otherwise) sufficient to satisfy the loading requirements of the equipment vendors and to provide all-weather access for operation and maintenance of the BESS. Site access roadway design shall comply with local permit requirements and be appropriately graded for drainage.

Temporary construction roads and staging areas not connected to permanent roads (if any) shall be restored by Seller in accordance with permit requirements.

4.19.3 Onsite Roads

Seller shall provide a minimum setback of 20 feet between the perimeter fence line and any equipment or as directed by local authorities if more distance is required. This setback space may be used as a perimeter road.

For interior service roads as necessary, Seller shall allow a minimum road width of 10 feet between BESS containers and PCS/MVT equipment. Road surfacing shall meet local fire and emergency vehicle access requirements.

Roads shall have a minimum 75-foot inside radius, unless otherwise instructed by state or local requirements. A smaller turning radius may be approved with written approval from Owner.

4.20 Signage and Labeling

Permanent naming placards should be placed on all equipment, including inverters, combiner boxes, transformers etc. Naming on placards and/or tags shall match drawing naming convention. Security signage shall be in accordance with Owner requirements and meet current Industry Standards.

All cables shall be labelled to meet applicable codes and standards. All cables shall have a label affixed to the outer jacket with a Brady or equivalent cable marker at each termination of a type accepted by Owner before installation. Labelling will match the point to point drawings. Seller is required to place arc flash labels on all inverters, combiner boxes, and other equipment requiring such. A method for ensuring labeling is complete must be included in Seller's QC Inspection Point Program.

4.21 Surge and Lightning Protection

Seller shall provide a lightning risk assessment performed to Industry Standards by a certified lightning protection professional, as outlined in Section 4.21.2 External Lightning Protection System (LPS). The results of this assessment shall be the basis for determining the requirements and extent of the facility LPS and a surge protection system that provides protection of the batteries, DC power circuit, PCS, measurement control and communications systems, and other major electrical equipment including transformers.

4.21.1 Surge Protection

A staged, comprehensive surge protection system, inclusive of Types 1, 2, and 3 surge protective devices (SPDs), shall be incorporated as determined by the lightning risk assessment (A-3.7.1 Electrical Engineering) or as required by the PCS manufacturers in all relevant pieces of electrical equipment. Protection shall be provided within the inverter on both the DC and AC sides as required by inverter manufacturer. Additionally, surge protection shall be provided in combiner boxes, and measurement control and communication systems as determined by the lightning risk assessment study. Type 3 surge protection installed within that equipment shall be mounted on DIN rails and must have finger safe replaceable modules that can be exchanged without the use of tools. SPDs shall be applied on all power circuits (AC and DC) and all communications and control circuits in a coordinated, staged manner. The operating status of the power SPDs shall include visual indication and shall be able to be remotely monitored by a set of integral contacts.

In addition to the performance requirements indicated above, all SPDs shall be compliant to the respective domestic or international standards, including, but not limited to, the following standards and guidelines:

- UL Standard 1449 3rd edition.
- IEEE Guideline C62.41.1-2002
- IEEE Guideline C62.41.2-2002
- IEEE Standard C62.42-2005
- IEEE Standard C62.45-2002
- IEEE Standard 1100-2005

4.21.1.1 SPDs Applied on AC Power Circuits

SPDs applied on AC systems must meet all the requirements listed above in this general section and must be specifically designed for and compliant to UL 1449 3rd edition. SPDs must be selected for the system voltage where they are to be applied. SPDs are to have a short-circuit current rating (SCCR) higher than the short circuit availability where they are installed, therefore not requiring external fusing. SCCR of 200,000 A is ideal.

4.21.1.2 SPDs for Measurement, Control, Instrumentation, and Communications Circuits

All critical non-power circuits are to be protected with appropriate DIN rail-mounted pluggable surge protection for the system they are applied. Surge protection bases are to permit signal continuity even if the SPD module is removed from the base.

4.21.2 External Lightning Protection System (LPS)

Based on the findings of the lightning risk assessment and/or the discretion of Owner, an external LPS may be required to be installed. If so, Seller shall provide an LPS to protect the overall Project from direct lightning strikes to any portion of it, including, but not limited to, inverters, outside cabinets, and buildings housing electrical equipment. The LPS shall consist of air terminals of proper height and spacing (using the rolling sphere method), properly rated and properly designed and placed down-conductors to assure safety of personnel during discharges, and a properly designed and installed ground system.

The systems shall be designed in accordance with the latest globally recognized standards for such designs, which are IEC 62305-1 and IEC 62305-3, or NFPA 780.

Grounding systems shall be in compliance with IEEE Standard 142-2007, IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems.

Designs are to be provided by a recognized expert LPS design firm, supplier, or professional engineer licensed in the state of the project and are to be submitted to Owner. All components of the LPS shall be in compliance with the selected system design standard chosen.

4.22 Design Package

4.22.1 Engineering Design Package

Based on the review of the Project Site and infrastructure, Seller shall design (or have designed by consulting engineers) a Project (including all layout, civil, electrical, and structural components) that will meet the required performance and that is capable of being operated in a safe, normal, reliable, and continuous manner as required by the Contract at all operating conditions and modes specified above. The system design shall comply with all applicable laws and regulations and applicable permits. Studies prepared by Seller's third-party consultants shall be provided to Owner for review.

The Engineering Design Package shall include all items:

- Studies related to the Project, such as the geotechnical engineering report and the lightning protection study.
- Schematic and preliminary designs.
- Design calculations.
- All drawings including mechanical, fire protection, HVAC, electrical, structural, civil, and construction drawings Site plans, schematic single lines, index and detail drawings.
- Project schedule.
- Product and manufacturer description information.
- Bill of Materials.
- Equipment details, descriptions, and specifications.
- Instrumentation and electrical lists, including preliminary circuit schedules.
- Layout and arrangement of equipment.

The Engineering Design Package shall be provided prior to commencement of construction.

4.22.2 Maintainability

Maintenance features shall be provided to optimize maintenance work. This shall include adequate space inside Project enclosures, adequate space around and inside DC racks removable panels in electromechanical enclosures, and positioning of equipment access to allow removal of equipment, and other features that facilitate material handling. Required maintenance activities during normal operations and how it impacts system SOC and performance must be appropriately considered.

4.22.3 Operability and Safety

The Project shall be designed for primary operation via its own autonomous control. The secondary operation shall be via remote dispatch centers and the Project shall also have the capability to operate via local panels for normal startup, operation, shutdown, and emergency shutdown capability for all BESS related equipment. BESS, balance of plant equipment, power conversion, instrumentation, controls and monitoring devices shall be designed for ease of operation and maintenance. Attention shall be given to adequate lighting, access, and ventilation of operational spaces.

The BESS and supporting equipment shall be operable from remote dispatch centers under all normal conditions including automatic startup and shutdowns as a load following mode of operation.

Where redundant equipment is supplied, the idle device shall be capable of immediately backing up the operating device. The switchover shall be accomplished automatically through a system local panel, or the BESS SCADA system.

"Single point of failure contingency" shall be incorporated into the Project design such that the loss of any single process device, instrument or switch shall not interrupt BESS availability to the grid. For example, all circuit breaker position switches shall employ two sets of contacts where those contacts are used for operational interlocks.

The target Minimum Availability of the BESS is stated in Table 5 and should meet or exceed this amount during periods of expected tasking. This includes expected maintenance outages. Seller shall provide their calculation of the BESS availability and the fraction of the power and energy available during various types of service.

5.0 BESS FACILITY INFORMATION

The major equipment items shall include a battery, four-quadrant bi-directional PCS, MV step-up transformer, and local and remote control/monitoring equipment. Additional equipment shall include battery monitoring system, harmonic filters, HVAC system, fire suppression system, auxiliary cooling systems, wiring, connectors, protective devices, grounding, junction boxes, enclosures, instrumentation, foundations, temporary supplemental power supply connections, and all other items needed for a fully functional, utility interactive BESS, installed to meet the requirements set forth in this Technical Specification.

The BESS shall be designed to produce low-cost power capacity, with low-cost energy storage as a significant secondary factor. Costs include initial cost as well as overall BESS efficiency, cell life, disposal and replacement cost, maintenance costs and other contributors to life-cycle energy cost. The BESS shall also be designed to have high reliability, Design Life as listed in Table 1, and designed for unattended operation with 24-hour remote monitoring and control by Operator in addition to Owner's SCADA system.

The failure of any single system component, except the main step-up transformer, should not affect the performance requirements described in Section 5.1. Seller shall provide a system with all necessary component redundancy, diversity and margins to ensure rapid return to service in the event of any major component failure.

5.1 BESS Technical Objectives

The BESS shall be "Utility Grade." This means that all equipment shall be expected to last through the Design Life with only typical routine maintenance and planned consumable goods. The energy storage modules will change in chemistry and can be addressed with a mix of replacement and augmentation.

5.1.1 Project Objectives

The overall objective of this Project is to meet the use cases called out in section 2.0 and optimize the priority of the system operation for revenue and grid requirements as shown in Table 1 below.

TABLE 1: BESS PROPOSED BASE CASE PERFORMANCE REQUIREMENTS

Rated Continuous Discharge Power (MW)	Project Specific
Duration (hr)	4.0
Power Factor range (leading to lagging)	+/- 0.9
Output Voltage Range (pu)	0.95 pu – 1.05 p
Output Frequency Range (Hz)	60 /59.0 Hz – 60.5Hz
Rated Continuous Charge Power (MW)	Project Specific
Maximum Charge Power (MW)	Project Specific
Expected number of daily full charge / discharge cycles	0-3 daily
Maximum Inactive Period	4 weeks
Battery Modules Minimum Component Life (years)	15
PCS Minimum Design Life (years)	20
BESS Minimum Design Life (years)	20
Minimum Availability (%)	95%

5.2 BESS Availability

For all BTA bids, as a part of their RFP bid response, Seller is required to provide Appendix A-10 Plant Performance Guarantee/Warranties. Seller shall design, engineer, and furnish equipment with the objective of producing a BESS system that will meet or exceed stated guaranteed energy availability performance, measured at the point of interconnection, based on expected equipment availability and degradation consistent with Seller's bid and these specifications.

5.2.1 BESS Definitions

For the purposes of calculating outages, the BESS is defined as all equipment within Seller's scope of supply and shall apply under all operating scenarios. The following definitions shall be used for describing the availability and reliability of the BESS:

- Accountable BESS outages are outages caused or necessitated by the BESS equipment that result in reduced capacity or loss of essential function of the BESS system. These outages may be initiated by failure of components, loss of battery capacity, the operation of protective devices, alarms or by manual action. Such outages include:
  - "Forced Outage" means NERC Event Types U1, U2 and U3, as described in the Appendix E-2 PPA, Exhibit J, and specifically excludes any Maintenance Outage or Planned Outage.
  - "Maintenance Outage" means NERC Event Type MO, as described in the Appendix E-2 PPA Exhibit J, and specifically includes any outage involving ten percent (10%) of the Net Output of the Facility that is not a Forced Outage or a Planned Outage.
  - "Planned Outage" means NERC Event Type PO, as described in the Appendix E-2 PPA Exhibit J, and specifically excludes any Maintenance Outage or Forced Outage.

- Accountable BESS outage duration is the elapsed time of accountable BESS outages from the instant the BESS experiences reduced capacity or is out of service to the instant it is returned to service or full capacity. If the BESS is out of service but determined by Owner to be available for service even if Owner elects not to return the equipment to service, such time will be discounted from the outage duration.

- Availability is the percentage of real time, measured cumulatively from the data historian, that the BESS is available during the availability guarantee period. The availability guarantee period for the project shall be proposed by the Seller in their submission of Appendix A-10 Plant Performance Guarantee/Warranties. Availability shall be calculated as follows:
  - [1-(Σ accountable BESS outage durations in hours/ guarantee period in hours)] x 100

- The capacity of the BESS is the maximum alternating current (AC) power transfer level expressed in both MW and megawatt hours (MWh) at the point of interconnection. The BESS shall be in an accountable outage if either the maximum required output (MW) or the required duration at maximum output (MWh) cannot be met.

5.2.2 Acceptance

Title and ownership shall pass to Owner upon written acceptance of the BESS system for operation. Maintenance responsibility shall remain with Seller until the system meets the criteria of the availability guarantee period set forth in Section 5.2.3 - Availability Guarantee. Final acceptance of the BESS will not be granted until all provisions of the Technical Specification have been met, the availability guarantee period has been successfully completed, all training is complete, and all required documentation has been received.

5.2.3 Availability Guarantee

Seller is required to provide the completed Appendix A-10 Plant Performance Guarantee/Warranties as a part of the RFP response, which may include an availability guarantee. The availability guarantee period for the Project, during which the performance of the Project will be observed to determine fulfillment of the above requirements, will start at Substantial Completion and it will continue for a period proposed by Seller in their submittal of Appendix A-10 Plant Performance Guarantee/Warranties. For the purposes of calculating outages, the Project is defined as all equipment within Seller's scope of supply.

Seller shall install the necessary communication equipment to monitor the Project remotely and respond to alarms and outages. Outage reports will be provided by Seller and verified by Owner.

During the availability guarantee period, operation records will be collected of the number and duration of outages and the total energy delivered. Such records will be obtained from the information gathered and stored by the Project control system supplied by Seller as described elsewhere in these Technical Specifications.

Seller shall prepare a response plan for maintenance and repair of the Project during the availability guarantee period. The response plan shall address the method of detection of required maintenance or repair as well as the method of accomplishing such actions. If subcontractors are used, the plan shall list specific subcontractors Seller proposes and the level of training provided to them.

If actual availability is below the specified level proposed in Seller's submittal of Appendix A-10 Plant Performance Guarantee/Warranties, Seller shall, at no cost to Owner, analyze the situation and provide corrections and modifications to meet the availability requirements in addition to liquidated damages. The availability guarantee period shall then continue until the later of 1) [18] consecutive months of operation at or above the availability requirement or 2) the term of the availability guarantee, as defined in Section 5.1 - BESS Technical Objectives, is achieved. Seller's commitment to provide the maintenance services and repair or replacement of parts during the availability guarantee period shall not be restricted by the terms and conditions of original manufacturer's warrantees on individual components of the Project.

Seller shall test performance according to Section 8.5, Acceptance and Performance Testing. Seller has verified the required availability of the BESS, all defective and spare parts have been replaced, all training is complete and all final documentation including as-built drawings has been received.

5.3 BESS Performance Guarantee

Seller is required to provide the completed Appendix A-10 Plant Performance Guarantee/Warranties as a part of the RFP response. Seller shall state in their proposal, the specific factors used in determining the performance guarantee, including the number and type of events assumed in estimating module life. Seller shall also provide a description of how the performance and life of individual modules relates to the performance and life of the entire battery.

In addition, Seller shall provide a detailed description of any environmental or planned maintenance requirements on which the performance guarantee is based. Information provided shall include the frequency of such planned maintenance actions and estimated person-hours to complete each task. Alternatively, Seller may retain planned maintenance responsibility for the battery portion of the BESS until the capacity guarantee has been met.

Seller shall also furnish a curve or table and data showing how certain required parameters impact the number of discharges or the total energy delivered and the degradation rate. The table shall demonstrate that the installed capacity and energy proposed by Seller are available throughout the entire BESS life cycle. The initial installed capacity and energy, and annual performance degradation rates shall be provided.

Owner expects to perform a rated capacity discharge test once per year to determine compliance with this requirement. This test will be conducted at rated frequency and voltage at the point of interconnection within the specified normal range.

5.4 BESS Life Expectancy Warranty

The guaranteed life expectancy shall be based on the system studies performed by Seller and the outage information and operating descriptions contained in this Technical Specification. Seller shall warrant that the BESS will perform in accordance with the guaranteed life expectancy represented in Table 1. Minimum equipment and EPC warranties are as follows:

Scope of Supply	Minimum Term	Warrantee
Batteries		Time and materials
Inverters	10 years	Time and materials
Transformers		
EPC		
Balance of System	5 years	

All equipment warranties shall be negotiated so that they can be assigned to Owner upon project acceptance.

5.4.1 Degradation

A report detailing the annual expected BESS degradation will be required to show system capacity over the lifetime of the BESS site. This report will include:

- Battery module capacity
- Charge and discharge limits
- Battery module expected degradation based on use case
- Proposed augmentation needed to maintain POI power level (to be performed at Owner's discretion)

In addition, an annual report will describe commercial operation year performance prior as described in Section 5.6.

5.4.2 Augmentation

It is typical for augmentation to be assessed at relevant time intervals based on battery degradation to keep battery performance above Owner set minimum capacity for the lifetime of the project. For this RFP, Owner does not require Seller to include costs for augmentation in Seller's RFP response. However, it is required for Seller to provide the battery degradation parameters for Owner to assess.

5.5 BESS Power and Energy Ratings

The BESS shall be nominally rated based on project specifics at a power factor determined by the requirements of the utility, with four quadrant (full power circle) operation, AC power output and 4 hours duration or as required to meet the operating scenarios as described in this specification. The requirements for VAR support shall be as described below. This power shall be measured at the Revenue Metering Point on the high side of the step-up transformer and as well as on the low side of the step-up transformer for Owner's monitoring purposes. Losses and power consumed by all required BESS auxiliary systems, including the HVAC, shall be subtracted from the gross power measured to determine the net power delivered.

The rated capacity at the end of useful life shall apply to the normal voltage and frequency operating range as specified in Section 3.4 - Electrical Design Parameters. In addition, the BESS shall be capable of providing adequate energy to prevent load shedding under N-1 conditions on Owner's system and operating scenarios described in Section 5.6 - BESS Operation.

5.5.1 Overload Capability

Seller shall provide, a curve showing the inherent overload capability (if any) of the proposed BESS as a function of time. It is not a requirement to design specific overload capability into the BESS.

5.6 BESS Operation

For all BTA bids, as a part of their RFP bid response, Seller is required to provide a completed Appendix K General Services Contract-Operations & Maintenance Services for Project.

Whether Seller is awarded the O&M contract or not, the BESS will require 24-hour control and oversite. All equipment warranties shall be negotiated so that they can be assigned to Owner upon project acceptance.

The BESS shall be capable of operating in a completely automatic mode, as selected by Owner's system operations or through a local system interface and shall be capable of four quadrant (full power circle) operation to provide for peak power limiting operations, potential hybrid renewable energy plant smoothing, charge/discharge operations, VAR support, and other operating support, as described in this Technical Specification. The BESS controls shall also allow for manual (local and remote) setting of all operating states and modes.

The BESS shall be designed to provide continuous control of real and reactive power over its entire operating range. The BESS shall appear to the power system to be a continuous control device and one that does not exhibit a step change in its net output characteristic during start-up or as it varies over its operating range. However, nothing in this section shall prohibit the use of mechanically or electronically switched devices for VAR support.

Seller shall specify, for the type of battery proposed, the method used to determine the point where further discharge is no longer practical or safe and the battery must be recharged before further use. Examples of common methodology are discharge cutoff voltage or the maximum amp-hour capacity that can be reliably discharged. Throughout this Technical Specification, the term discharge limit shall be used to mean Seller specified methodology.

The BESS operating functions shall be programmed in a higher-level programming language and made available to Owner so that software modifications can be made or new functions can be added if the need arises at some point in the future. Any required supporting software such as compilers and linkers shall also be made available to Owner.

The operating functions described below will be limited and confirmed with the battery vendor by the charge and discharge limit to prevent damage to the battery. Termination of any operating scenario by the discharge limit, without reaching rated capacity discharge, will be deemed a failure for the purposes of calculating availability.

A detailed annual report shall be provided by the Seller on the anniversary of commercial date of operations including the degradation of the BESS for the commercial date prior. This report shall be used for commercial and warrantee purposes during the operational phase.

The following sections discuss common inverter control functions that shall be implemented in the BESS as part of the local and remote automatic BESS controls.

5.6.1 Real Power Controls

- Direct Charge/Discharge Storage - This is a basic function that can be used to discharge or recharge the BESS to a specified state of charge (SOC) and at a specified rate.
- No-Grid-Charging Mode – System should accommodate programming times and conditions under which grid charging will not be active.
- RPS: Real Power Smoothing - This is a real power control mode function for the BESS that could monitor the potential hybrid renewable energy plant real time power output for fluctuations. Although this functionality is a lesser priority, the BESS should be capable of responding to smooth out the renewable systems fluctuations and mitigate any power quality issues due to renewable systems output variability. The BESS response shall be capable of smoothing the net power output from the combined renewable systems and BESS while also preserving the BESS available stored energy.

5.6.2 Reactive Power Controls

If reactive power is for the Facility, it will be based on the point of interconnection agreement and the BESS services agreement identified by PacifiCorp Transmission. Below are examples of what may be required under this section:

- Direct Voltage Control – In this function the BESS shall output VARs to control the POI voltage to a specified setpoint voltage and a specified droop, and with a specified maximum and minimum kVAR range which shall not be exceeded. The BESS shall be normally operated with voltage control enabled.
- Watt-Var Function – In this function the BESS shall actively control its reactive power output as a function of the real power output. The reactive power output follows a user defined Watt-Var or P-Q curve. The Watt-Var curve is a piece-wise linear user defined curve entered as X,Y point pairs where the x-axis is the power output and the y-axis is the corresponding VAR output.
- Function CV: Constant VARs – This function allows the BESS to produce a constant VAR output at a specified level.
- Fixed Power Factor Function – This function allows the BESS to produce or absorb power with a user entered constant power factor. The power factor range is +/- 0.00 to 1.00.
- Watt Power Factor Function – In this function the BESS actively controls the BESS power factor as a function of the real power output of the BESS. This function utilizes a piece-wise linear curve defined by X, Y point pairs, to determine the power factor of the BESS output at any BESS real power output.

5.6.3 Miscellaneous and Support Functions

- Scheduling Function – This function is used to perform the real and reactive control functions via a time-based schedule and/or a load-based schedule. The Schedule function can define when different X-Y curves become active and what the ramp rate will be when transitioning between scheduled functions. When more than one function is active for Real Power or Reactive Power control then the schedule shall define a priority order for the functions.
- Event Logging and Reporting Function – this function shall be used to record any protection events triggered by the inverters including but not limited to i.e. over current, over voltage, over temperature, sequence of event reporting (SER), etc.
- Status Monitoring Function – this function shall include voltages, SOC, Inverter Status, Usable Energy, BESS rack and module temperature, Present Operating Mode, Inverter Active and Reactive Power output, power factor, present line frequency, Connect/Disconnect Status, Operating Time, Connected Time, and possibly other BESS information.
- Function Connect/Disconnect – This function shall be implemented by two sets of commands, one being a virtual command and the other being a physical command. The virtual Disconnect command sets the real and reactive output of the BESS to zero. A physical Disconnect provides galvanic isolation between the inverter and the grid. Additional details regarding Shutdown, Disconnect, and Operate modes are provided in the Sections 5.6.7, 5.6.8, and 5.6.9 below.
- LHVRT Function – This function shall be used to specify the low and high voltage ride through characteristics of the BESS. This function will be used to specify the trip, suspend and normal operation ride through voltage characteristics as per IEEE P1547, protection coordination studies, and Owner policies.

- LHFRT Function – This function shall be used to specify the low and high frequency ride through characteristics of the BESS. This function will be used to specify the trip, suspend and normal operation ride through frequency characteristics as per IEEE P1547, protection coordination studies, and Owner policies.
- Local/Remote Mode Function – This function when in Local Mode shall block commands by offsite sources to enable safe local maintenance and diagnostics and provide a means for secure on-site management. This function shall also allow the return to remote control.
- Automatic/Manual Mode – This function shall enable and disable the BESS from performing any of the automated control functions for real and reactive power. When switching from automatic to manual mode the BESS real and reactive outputs shall ramp down to zero at a specified ramp rate.

5.6.4 VAR Support

The BESS may be required to provide VAR support for voltage regulation under steady state and contingency operating conditions as described below. The BESS shall be capable of up to full rated output, when operating within the normal sustained voltage and frequency ranges specified in Section 3.3, Electrical Design Parameters, or as determined by Seller's system studies. The voltage regulator controls shall not be affected by changes in system frequency. The voltage regulator controls shall include Owner selectable setpoint and droop characteristic and shall be capable of setting by Owner's SCADA system or by a local control interface.

Nothing in this section shall be construed as limiting the ability of the BESS to operate in other modes as described in these Technical Specifications. The VAR output of the BESS may be limited based on remaining inverter capacity used for real power output unless supplemented as described above. The final VAR requirements will be provided to the successful Seller at a later date.

5.6.5 Charging

Seller shall specify charging requirements.

Seller shall design the charging system to ramp up from zero to the maximum capacity at an Owner selectable ramp rate as described elsewhere in these Technical Specifications to avoid shocking the system and allow generation to follow load easily. Seller shall provide a curve showing how demand from Owner's system varies with time throughout the charging cycle. The BESS control system shall allow Owner's dispatcher to initiate remotely Seller-specified/programmed charge cycle. The maximum demand required by the charging cycle shall be Owner selectable but shall not exceed Seller specified charge rate. Seller shall provide data showing how the recharge period varies as maximum demand decreases.

Seller shall also specify restrictions, if any, on operation of the BESS during any portion of the charge cycle. Seller shall provide a curve or table and data showing the state of charge of the battery as a function of time.

Automatic or programmed charge cycles shall be implemented to prevent SOC going below the battery vendor specified SOC limits whenever possible.

5.6.5.1 Charge Rate

There will be times when the BESS may be directed use overload charging capability (if any) exceeding the normal maximum charging rate for a short duration. Seller shall provide, a curve showing the inherent overload capability (if any) of the proposed BESS as a function of time. It is not a requirement to design specific overload capability into the BESS. Overload charging will not be allowed if the batteries are charged above the Seller specified maximum charge level. When the BESS is nearing the Seller specified maximum charge level, the BESS charging shall ramp down linearly to zero at an Owner selectable ramp rate.

Seller shall provide adequate energy storage capacity and level of charge to accommodate the number of charge/discharge occurrences and total energy requirements described elsewhere in this Technical Specification.

5.6.6 Shutdown

The shutdown state shall be defined as battery DC contactor/breakers and PCS AC breaker open; non-critical power supplies de-energized; control system power may remain energized. This mode includes both normal shutdown and system trips requiring reset.

The control system shall initiate shutdown under the following conditions and remain in the shutdown state until a reset signal, either local or remote, is initiated:

- Emergency trip operation.
- AC circuit breaker trips (either main or PCS breaker) that isolate the BESS.
- Door interlock - initiate shutdown when the door to the PCS is opened. A “defeat” feature shall allow for maintenance. Interlocks shall be self-resetting.
- Smoke/fire alarm.
- Fire Suppression operation.
- Control logic trouble.
- DC ground fault - field adjustable setting.
- Failure to restart from disconnect state after automatic restart attempts.
- Remote disable (no reset required).

5.6.7 Disconnect

The disconnect state shall be defined as balance of plant (BOP) DC contactors/breakers and battery DC contactors/breakers and PCS AC breaker open; non-critical power and control system power energized.

Some faults or failures are expected to be transient in nature. The control system shall open contactors upon fault occurrence and may be manually started-up after an operational Seller determined manual reset or operational procedures agreed upon with the Owner. The control system shall go to the disconnect state under the following conditions:

- Synchronization Error - The PCS is unable to synchronize with the utility grid.
- Grid transient conditions (i.e., line switching or reclosure action).
- Utility voltage out of emergency operating range as defined in this Technical Specification.

- Utility line frequency out of emergency operating range as defined in this Technical Specification (field adjustable in 0.1 Hertz increments).
- Over-temperature on the battery, PCS, controls or other equipment.
- Excess explosive gas level.
- Owner and grid operator requested outages.

5.6.8 Start Operate

The Operate state shall be defined as all contactors/breakers closed and power available to flow to or from the BESS, PCS and transformer system to the utility system. Normal operation shall include all operating scenarios as described herein and discharge and charge modes. It also may include additional modes and sequences deemed necessary by Seller.

The BESS shall operate normally and automatically, with no faults detected or critical alarms as defined in Section 7.0.

5.6.9 Specific Operational Requirements

The BESS must not be damaged if there is no power available from Owner for a period of up to 168 hours with the BESS discharged to its lower operational limit. If the system proposed by Seller cannot meet this requirement, or if there are advantages to Owner to specify a shorter duration, Seller shall specify the maximum period that can be sustained without damage. The design shall include provisions for connecting a mobile generator to charge the batteries if the 168-hour requirement cannot be met.

Seller will indicate any required rest (neither charging nor discharging of the BESS) periods, their duration and what event they must follow or precede.

The BESS shall have appropriate functionality to accept an emergency disconnect input. Once the emergency disconnect is activated, the BESS project must immediately cease operation.

During manual operation of the BESS project, the system must indicate which, if any, autonomous functions are disabled.

Owner may impose rest intervals, such as charging off-peak and discharging on-peak. If no other tasking is done, this will create a rest period between each half cycle. This shall not adversely affect BESS performance and shall be included in capacity calculations. Provide the maximum rest period allowed (days, weeks, months).

If another condition requires special action for a string or the battery bank, describe this condition, how often it occurs, what event triggers the need for it, what it takes to correct it, whether the string/BESS remains available during this period to be approved by the Owner on a case-by-case basis. Examples are some type of reconditioning (holding at 100 percent DOD) or charge equalization (holding at 100 percent SOC).

The cells within a battery shall either be self-balancing, or their periodic balancing be handled automatically by battery module management electronics. Similarly, the modules within a string shall either be self-balancing or periodic balancing handled automatically by string/bank management electronics.

The BESS SCADA system shall store historic performance data metrics which describe the quality of system performance for each function over the last 168 hours minimum. Seller to ensure interface with Owner to offload reports at an agreed interval. Historical performance data metrics shall be stored for long term (2 years at minimum) for performance analysis and warranties.

The design must include prudent provisions for technology improvement. Battery modules shall allow for upgrade or replacement with higher performance cells to the extent practical. Where such changes are made to a battery module, all modules in that battery string must also be upgraded before the upgraded modules are placed into service.

5.6.10 Large Generation Interconnection Agreement Requirements

This section is intended to supplement but not replace any interconnection requirements determined by the Transmission Provider through the large generation interconnection process.

The main bus of the Project switchgear is to be connected to the POI. Protective relaying will need to comply with previously determined design from the Cluster Study.

The BESS project shall at all times monitor voltage at POI. If POI voltage deviates from the trigger voltage, the BESS project shall respond instantaneously with appropriate reactive power to ensure POI voltage is within the limits.

The BESS monitoring system shall always monitor system SOC and provide a mechanism to regulate SOC to ensure recovery of SOC after discharge events.

Design, procurement, installation and testing of the communications with the Owner's facilities shall be the responsibility of the seller in accordance with Owner's standards.

The BESS control system shall be configured to adhere to the communication systems requirements outlined by Owner and as further outlined in the Integrated Automation Equipment in section 6.1 of this document.

5.7 BESS Electrical Systems

Seller's scope of supply will end at the POI as defined in the Interconnection Agreement and as defined in the Points List. The electrical auxiliary power system shall be sized so that in no case it limits unit output power relative to the specified nominal capacities detailed in Table 1. Any revisions to the existing electrical power system installation (e.g., protective relaying) shall be designed for Owner coordination, safe operation and maintenance.

Load flow, dynamic stability, harmonic interaction, short circuit, voltage droop, coordination, grounding system safety and other studies shall be performed to properly determine equipment capacity, performance, withstand requirements, transformer impedances, etc. Seller shall submit design criteria, harmonic profile, short circuit characteristics, and calculations associated with these studies to Owner for review. Owner will provide data on existing Owner equipment and electric grid as necessary and will be available to facilitate Seller's performance of these studies.

Electrical systems shall not inhibit the BESS from complying with Frequency Ride Through (FRT)/ Voltage Ride Through (VRT) requirements per Owner's requirements listed in the Technical Specification.

Areas of the BESS enclosures subject to explosive concentrations of gases due to faulty systems, failure of ventilation, etc., shall be classified as hazardous locations in accordance with the latest NFPA criteria. Accordingly, electrical equipment in those areas shall be provided with the appropriate enclosures for the installed locations.

Electrical system design shall be performed under the supervision of a professional engineer. Specifications and drawings shall be sealed if required for submittal to regulatory agencies.

Electrical systems shall be equipped with protective relaying to trip circuit breakers for de-energizing and isolation of equipment in the event of electrical faults. Seller supplied relaying protection will include primary and back-up relaying and overlapping zones of protection. Seller protection relaying is to be coordinated with Owner's existing relaying. Areas of Seller supplied relaying will include, but not be limited to, MPTs, MV system, and DC/UPS systems. Protection relaying shall comply with Owner's requirements.

5.7.1 BESS AC System

The BESS AC system shall be connected to the main step-up transformer and connected to Seller switchgear as required.

The high side of the main step-up transformer bus connection shall be considered the BESS point of connection insofar as determining rated power, efficiency, VAR supply/consumption, harmonics and similar electrical parameters

Seller shall design the BESS for the maximum overall (charge/discharge) efficiency, including parasitic loads.

The BESS shall be designed for "0" MVAR exchange at the point of the BESS interconnection when operating in standby mode.

The BESS low side main circuit breaker must be open, or inverters blocked before closing the MV breaker(s) or switch(es). The BESS low side main circuit breaker or PCS shall be used for synchronization of the BESS to the MV collection system.

Seller shall design and install underground conduit, power cable and wiring from the BESS equipment to the main step-up transformer, MV switchgear, and instrument transformers.

Seller's protection system shall be capable of interrupting maximum fault currents (as determined by equipment and system studies) in any portion of Seller's scope of supply.

Seller shall, in close coordination with Owner, design, engineer, furnish and install all appropriate hardware (relay protection, SCADA, BESS controls, metering, etc.) and software.

5.8 BESS Enclosure

If a building is proposed, Seller shall design, engineer, and provide the building suitable for use to house the BESS and all indoor components. Seller shall provide on-site inspection, coordination with required building inspectors, and design review of the building required to accommodate the BESS commensurate with the BESS Design Life represented in Table 1, including but not limited to seismic events, wind loads or other controlling criteria.

The BESS building or enclosure, including PCS and Control Room shall be designed with the appropriate insulation to meet local building codes and ensure an energy efficient operation of the HVAC and/or ventilation system.

Limited geotechnical data is available for the Project location and included as a part of the specification. This data is provided for information only and may be used for bidding purposes. Seller shall provide all assumptions used as the basis for their bid.

The building or enclosure design shall consider materials on the basis of being maintenance free with a maximum durability and minimum cost for replacement and repair. Structural systems shall be engineered for ductile modes of failure to the extent possible.

5.8.1 Building Design

See Section 4.11.2 for Environmental loads that shall apply to the building.

- Structural Framing: Design primary and secondary structural members and exterior covering materials for applicable loads in accordance with the Metal Building Manufacturers Association's (MBMA) "Design Practice Manual"

- Structural Steel: For design of structural steel members, comply with the requirements of the American Institute of Steel Construction's (AISC) "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings" for design requirements and allowable stresses.

- Light Gauge Steel: For design of light gauge steel members, comply with requirements of the American Iron and Steel Institute's (AISC) "Specifications for the Design of Cold Formed Steel Structural Members" and "Design of Light Gauge Steel Diaphragms" for design requirements and allowable stresses.

- Welded Connections: Comply with requirements of the American Welding Society's (AWS) "Standard Code for Arc and Gas Welding in Building Construction" for Welding procedures.

Basic Design Loads: Include live load, wind load and seismic load, in addition to the dead load. All loads shall be based on the site-specific conditions and latest IBC, state and local codes.

- Live Load with Snow Load shall be based be in accordance with IBC and the state local code.

- Wind Load: Wind load shall be based be in accordance with IBC and the state local code.

- Seismic Load: Seismic load applied shall be in accordance with IBC and the state local code,

- Auxiliary Loads: Include dynamic live loads such as those generated by suspended ceilings, sprinkler systems, electrical or mechanical systems or any suspended HVAC units, and exterior frames and doors.

Design: Each member shall be designed to withstand stresses resulting from the combination of loads that produce the maximum allowable stresses in that member as prescribed in MBMA's "Design Practices Manual".

5.8.2 Shipping Container or Metal Enclosure

If containers are proposed, it shall be in accordance with the International Standard ISO 1496-1 or similar standards.

5.9 Other BESS Facility Design Requirements

5.9.1 Hydrogen Mitigation

If applicable for the battery chemistry proposed, Seller shall calculate the maximum hydrogen emission rates for the battery and design a fully redundant forced-air ventilation/fan system accordingly to satisfy all codes and standards. These calculations shall be included in the proposal and shall include the safety margins used.

Seller shall provide and install hydrogen detectors and configure their control logic such that the hydrogen detection system alarms at one percent hydrogen concentration. Additional alarms and logic shall be provided to stop battery charging if the hydrogen concentration exceeds a safe level.

Any enclosures into which hydrogen may propagate during normal or abnormal operations shall be protected against accumulation of a flammable or explosive mixture of hydrogen and air, and against ignition by an external spark of any such mixture that may nevertheless occur.

If flooded electrolyte cells are used, Seller shall install flash arresters on the cells.

5.9.2 Emission Mitigation

As relevant to the type of cell proposed, Seller shall design the BESS and produce calculations which demonstrate that the cells, method of charging, HVAC and overall system design are such as to comply with the OSHA requirements for any and all emissions that may be present under all conditions, for example: thermal runaway.

5.9.3 Electrolyte Spill Containment

The BESS design shall mitigate electrolyte spills that are credible for the types of cells used. The design shall include features that contain electrolyte spills (to be emptied by contracted chemical disposal company in the event of a spill) and prevent discharge to local sewers or the surrounding site soils. The design shall address containment of water from the fire protection system, as applicable. Seller shall provide a Spill Prevention Control and Countermeasures plan and provide secondary containment where required.

The O&M manual shall address procedures to cleanup electrolyte spills, as applicable.

5.9.4 Painting / Logos

Seller shall paint the entire exterior of the building or enclosure with a finish coat in a color approved by Owner. The paint shall be suitable for application to the exterior material of the building or enclosure and the environmental conditions applicable to the site. Owner may supply image(s) of company logo for display on buildings or enclosures, after painting. Upon completion of painting, remove surplus material, rubbish, and debris resulting from this Work and leave the building and enclosures and Site in a neat, clean and acceptable condition.

All builders' hardware shall be suitable for the required functions. Hardware shall be of a durable grade consistent with the life expectancy of the facility and appropriate Federal specifications. Exit and fire door hardware shall conform to UL specifications. Installation of exits shall conform to NFPA No. 80.

6.0 SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA)

The BESS SCADA system will supervise and monitor BESS operations. The BESS SCADA System shall be compatible with the Owner's historian database and applicable protocols. The BESS SCADA system shall incorporate an RTU to send data to the Owner's historian.

SCADA pricing should include hardware and software (including all software subscriptions for first year of the project) for the Design Life of the Project. The monitoring system shall provide energy generation data, historical data, meteorological data, and all other applicable data to record operational history. The system shall be configured to sample data at a rate of once per second, with 1-to-10-minute average intervals and shall be configured to update the server at least once every 15 minutes. The system shall be configured to sample and store the 1-to-10-minute averaged interval data for a period of 24 months based on Owner preferences.

The monitoring system shall be capable of issuing alarms and notices to instantly alert the proper personnel in a timely manner, both locally and via Owner SCADA system, to potential system problems and outages. The monitoring system shall specify a module-level monitoring system capable of detecting that an abnormal module condition exists or may exist. Abnormal module conditions shall include all types of module failures that are commonly known to occur for the type of module used. At a minimum, the module monitoring system shall identify three alarm states as follows:

- The monitoring/alarm system or procedures shall alert Owner when the number of failed or inadequately performing modules or other Seller determined conditions indicates that preventative maintenance should be performed to keep the BESS at the specified performance levels. Maintenance required to correct problems identified may be performed at the earliest convenience.

- The monitoring/alarm system or procedures shall alert Owner when the number of failed or inadequately performing modules or other Seller determined conditions indicate that the BESS is in imminent danger of failing to meet specified performance levels or potential safety hazards exist. Maintenance should be scheduled as soon as possible.

- The monitoring/alarm system or procedures shall alert Owner when the BESS can no longer meet the specified performance criteria or safety hazards exist. Immediate corrective action is required to return the BESS to specified performance levels or correct safety hazards.

Seller shall include, in the Operation and Maintenance Manual, the recommended corrective action and maintenance procedures for each alarm level or observed condition provided. In all cases, the monitoring/alarm system or procedures will record data on the number and general location of failed cells, to expedite maintenance and module replacement. This recorded data shall be stored in non-volatile memory. Seller shall design the system so that the data can be retrieved remotely from Owners Transmission Provider Grid Operations either through the SCADA system or through other suitable means. Such monitoring/alarm system shall be part of the control system and alarmed to Owner's SCADA system. Additionally, the design of the system shall include an alarm journal of recorded alarms during a time period specified by owner/operator to pull historical alarms, filter by level, and sequence of events/alarms

The metering and monitoring system shall comply with the accuracy requirements and general standards set forth in IEC 61724 which shall have an accuracy of better than two percent of the reading.

All electronics shall be enclosed in a NEMA 4 enclosure or in a control room within the building. This system may be housed in the same enclosure as the security equipment. The data shall be collected at hardwired locations and transmitted. Seller shall test the installed communications system to demonstrate its ability to meet the requirements of its intended use. Testing shall be done when the final system interconnections have been made.

Seller shall furnish and install all materials and equipment necessary to complete the SCADA installation. The monitoring system shall be configured for automatic reporting of generation statistics required by Owner. The data shall be collected at the hardware locations and transmitted via a SCADA system to be provided and installed by Seller. Points to be monitored by the SCADA system shall include, at a minimum:

- Inverters
  - AC voltage
  - DC voltage
  - AC current
  - DC current
  - kiloWatts (kW)
  - kiloVARs (kVAR)
  - kiloWatt-hours (kWh)
- Metering
  - Monitor and store date from the Project meter on an interval between 5 and 20 seconds
- Transformers
- Video security and surveillance monitoring buildings or shelters
- Project switchgear

All monitored project electrical generation equipment (e.g., inverters, transformers, switchgear) shall be monitored to capture real time AC and DC electrical characteristics, including:

- Voltage
- Current
- Power
- Frequency
- Power factor

All monitored project electrical generation equipment (e.g., inverters, transformers, switchgear) shall be monitored to capture all diagnostic information, including:

- Temperatures
- Alarms

- Status indicators
- Fault states
- Communication Status

6.1 Integrated Automation Equipment

A proven and established instrumentation and control system shall be provided for the BESS. The Owner's control systems will supervise and monitor the BESS SCADA system while the BESS SCADA and Controller will act as the master.

6.1.1 Network Devices

6.1.1.1 Network Servers

Seller shall supply and install an Owner-approved and commercially-proven hardware and software package from vendors to implement the BESS SCADA System. The BESS SCADA System shall include one or more servers providing data gathering, operator interface, alarming, historian and other functions necessary to fully monitor and automate the BESS. The BESS SCADA System shall include hardware and software maintenance, including all software updates and subscriptions, for a minimum of 20 years. The BESS SCADA System shall be configured to sample data at a rate of once per second, with 1-to-10-minute average intervals and shall be configured to update the server at least once every 15 minutes. The BESS SCADA System shall be configured to sample and store the 1-to-10-minute averaged interval data for a minimum of 24 months. No EOL hardware to be used at time of installation.

The BESS SCADA System shall include a networked GPS synchronized clock capable of providing time synchronization signal to other devices in the BESS SCADA System using IRIG-B via coaxial cable.

All hardware and software shall support and implement standard, open protocols and datasets as specified in the MESA-ESS and MESA-DEVICE standards. No proprietary protocols shall be utilized. The BESS SCADA System shall retrieve data from all capable devices within the BESS and interconnect substation. The BESS SCADA System shall be capable of interfacing with Owner's external historian database protocol systems with full MESA-ESS Level 3 compliance.

All servers and functionality shall be implemented with redundant hardware and software in a hot standby architecture. Virtualized systems may be utilized to provide redundancy.

All hardware shall support redundant hot-swappable power supplies, hot-swappable solid-state drives, and RAID. All software shall be installed on a commercially available operating system with regularly provided security and reliability updates.

6.1.1.2 Routers, Switches, and Modems

Seller shall supply network hardware as necessary to connect all servers, relays, meters, and other equipment capable of communicating with the BESS SCADA System and Owner's corporate SCADA via external networks. All hardware shall be implemented using ruggedized industrial models unless housed in climate-controlled cabinets.

Seller shall supply one or more network switches as necessary to the BESS SCADA System network. Switches shall meet or exceed IEEE 1613 (Class 2). Switches shall support modern security functionality, including VLAN, SNMPv3, RSTP, MAC-based port security, traffic prioritization, port mirroring, PTP time synchronization and pass through, user-based accounts, and dual power supplies.

Seller shall supply one or more network routers as necessary to connect the BESS SCADA System network to Owner's existing SCADA system via external networks. Router shall meet or exceed IEEE 1613 (Class 2). Router shall support stateful firewall with NAT, IPSec Virtual Private Networking, AES256, RADIUS centralized password management, multi-level passwords, SSH/SSL encryption, MAC-based port security, VLAN and SNMPv3, external user access logging for auditing purposes.

Seller shall supply modems as necessary to support the requirements of Owner and/or telecom utility to connect Owner's external network. Seller shall work with Owner to determine the number of internet connections needed and minimum bandwidth requirements. Seller shall work with Owner to determine a list of acceptable internet providers.

6.1.1.3 Operator Workstations

Seller shall supply two operator workstations. Each workstation shall consist of one monitor, keyboard, mouse, and PC for display of the operator interface. All components of the workstation shall be utility grade off the shelf components and capable of operating in the BESS environment. Each workstation shall include all software necessary to access the BESS SCADA System and all functionality of the installed equipment with licensing for a minimum of five years.

Remote operation workstation shall be included for the remote operations of the BESS site. This can be achieved via remote access VPN tunneling or SSL.

6.1.2 Control and Monitoring Network

6.1.2.1 Supervisory Control

Seller shall supply BESS controllers compliant with the communication methods, protocols and datasets provided in the MESA-ESS and MESA-Device standards. Any operational function of the BESS shall be capable of being controlled through the BESS SCADA System HMI via either local or remote operator workstations. Function parameters of any operating function shall be capable of being modified remotely or locally.

The control system shall be configurable and capable of hardware, firmware or software upgrades to provide additional operating functions in the future, if needed. Seller shall provide 10 percent additional or spare hardware capacity to add to or reconfigure the modes of operation via software applications, replacement firmware, expansion of the operating system memory or additional input/output and/or logic.

The control system shall have the necessary hardware and software such that it is compliant with the latest Owner standards and NERC CIP reliability standards for control system security requirements.

6.1.2.2 Integration Panels

Seller shall supply one or more integration panels within the BESS to install the PLCs, RTUs and other devices necessary to provide the required functionality of the BESS SCADA System. Each integration panel shall match the design of other panels as specified in this document, including power source, fuses, terminal blocks and other equipment necessary to the function of the BESS SCADA System. In the event that there is loss of Auxiliary power, UPS shall be included in the design and installation inside the panels containing essential control and network hardware.

The integration panels shall provide operators with the ability to cut out active alarms via panel mounted test switches. The integration panel shall allow operators to connect to the facility network via standard Ethernet port for control or diagnostic purposes.

6.1.2.3 Interoperability

The BESS System shall communicate with Owner's corporate SCADA system via the communication methods, protocols and datasets provided in the MESA-ESS standard. Parameters to be communicated to Owner will include, but not be limited to: SOC, actual and contractual Up Reserve and Down Reserve capability when the BESS is responding under its frequency response, status of frequency response, power output in MW, energy output in MWh, available energy capacity in MWH, circuit breaker status, physical availability in percentage, voltage at Revenue Metering Point, and other telemetered information that Owner may require for system operations.

In the event of loss of communication between Owner and the BESS SCADA System, a provision must be made for the BESS systems to institute Owner's desired behavior in such circumstance, including but not limited to maintaining the previously communicated operating behavior, accepting a curtailment command from a local terminal, or a safe and linear shutdown.

6.1.3 Local Control

The BESS local controls and indication requirements shall be designed in close coordination and with an approval from Owner. The BESS shall include a local control panel or console within the BESS control room. The local control panel may consist of manual control switches, with redundant control actions initiated by digital signals through a local control console. Emergency trip push buttons shall be manually operated and not require action from the digital control, as described elsewhere in these Technical Specifications. As a minimum, the following operator controls shall be located on the local control panel:

- Trip/reset for the MV circuit breakers connected to the main step-up transformer.
- Trip/reset for the PCS circuit breaker.
- Trip/reset for the DC circuit breaker/contactor.
- PCS on/off.
- BMS on/off
- Reset toggle or push-button. When reset is initiated, the control system shall resume control and proceed to the appropriate operating mode.
- Reset cut-out selector switch to disable remote or local reset signals.
- A selector switch to manually set the operating state (i.e., shutdown, disconnect and operate) and to have the control systems set the operating state automatically.
- A selector switch to manually set the operating mode (i.e., VAR control, discharge and charge) and to have the control system set the operating mode automatically.
- An emergency trip pushbutton shall be located near the control panel and be suitably protected to prevent accidental operation.

6.1.3.1 Remote Control

All functionality available through the Local Control Units shall be available via the BESS SCADA System for remote operation via Owner's SCADA connection and remote operations center.

6.1.3.2 Application-Specific Control Panels

Where appropriate, additional control panels shall be provided to control specific functionality and applications of BESS equipment. All functionality available at these panels shall be available remotely via the BESS SCADA System.

6.1.4 Integrated Automation Controls

The BESS SCADA System shall consist of established manufacturers' components such as balance of plant instruments, equipment and integral controls, process input/output equipment and companion PID "loop" controllers, equipment specific controllers, communication processors and various other necessary devices. The integrated BESS SCADA System electronic components taken together shall form the interconnecting means and functions required to; control, monitor, alarm protect, interlock, diagnose, maintain, and safely operate BESS facilities installed under an assigned project scope of work.

The installed BESS SCADA System equipment shall perform the requirements of supervisory and discrete control, equipment protection and process interlocking, component diagnostic, upset analysis, maintenance guidance, and alarm/data logging or archiving functions. Seller selected BESS SCADA System hardware and software provided shall meet all desired modes and conditions of operation, assuring a safe, environmentally compliant, and economic operation of distributed energy storage capabilities described in the scope of work.

BESS related systems startup, manual operation, shutdown, response to upsets, and other operating conditions shall be performed by: 1) intervention by an operator in any specific BESS local control point: or 2) remotely from a central or dispatch center via HMI operator positions with necessary software for that BESS facility. Once desired and stable functional BESS mode has been achieved, autonomous and selected supervisory modes shall automatically maintain, within tolerance, that selected mode until override, or manual intervention by the central or dispatch operators is enabled.

Supervisory, monitoring and mode management required BESS functions shall be gained by means of both local and/or remote operator HMI interface workstations. Functions and logic of control, protection, and interlock of BESS components and support systems shall be distributed to independent-microprocessor based controllers or unit programmable controllers as feasible to minimize a single point of failure.

Likewise, interface and networking equipment between the BESS SCADA System and the separate process control and instrumentation packages of individual equipment shall be redundant for both communication functions and control power source. The intent of the Project is that the BESS SCADA System as a Supervisory and Control System HMI be designed and implemented for intuitive and understandable human interactions, high reliability, including critical system redundant BESS and PV control and sensing elements for specific BESS systems, to enable the desired degree of safe and automated operation.

HMI interaction and autonomous control of some independent auxiliary BESS systems may be as self-contained as practical. These independent systems may be controlled through integrated distributed controllers with local control panels incorporating a self-contained HMI. Alerts, alarms and process data along with auxiliary system diagnostic information shall be sent to the BESS System. Independent auxiliary BESS system controls shall be developed upon a common architecture, with data communications protocol compatible with the BESS SCADA System. Simplicity of operator interaction and ease of maintenance should be the design criteria.

The fundamental BESS SCADA System control logic and related functions shall be segregated to the extent that failure of one or more modes of operation does not result in the failure of other functions. The BESS SCADA System controller shall be designed with regard for redundancy in critical "control loop" functions so that no single component fault will cause the failure of process-controlled equipment in any one system or cause the BESS diagnostics and protection systems to malfunction.

BESS SCADA System indication, control and alarm element redundancy shall be provided for all events or upsets in critical "control loop" functions that may directly cause a self-protection system to activate. Redundancy in the BESS SCADA System controller architecture shall be configured such that selected standby process equipment shall alarm and start automatically upon failure of the primary system. Specific standby components shall have self-initiated automatic start capability field wired to function in parallel with fundamental BESS SCADA System control logic.

6.1.4.1 Control of Fire-Suppression Systems

Fire panel shall communicate with Owner's SCADA via a standard protocol as listed in this Technical Specification. The minimum remote monitoring requirements shall be as follows:

- System State
- Fire/Smoke Detector Status
- Fire System Trouble
- Countdown to discharge
- Discharge Completed
- Manual Release Request
- Abort
- Alarms/Warnings

6.1.4.2 Control of HVAC Systems

HVAC system shall communicate with Owner's SCADA via a standard protocol as listed in specifications. The minimum remote monitoring requirements shall be as follows:

- System State
- Area Temperatures
- Manual Control
- Alarms/Warnings

6.1.4.3 Control of Electrical Systems

BESS auxiliary electrical power shall communicate with Owner's SCADA via a standard protocol as listed elsewhere in this Technical Specification. The minimum remote monitoring requirements shall be as follows:

- Availability of normal and backup power sources.

6.2 Instrumentation

All metering, sensors, transducers and test points in the BESS shall be easily and safely accessible for calibration, maintenance and troubleshooting by Owner. Seller shall provide and install current and voltage test switches for each protective relay and for each set of metering within a CT circuit.

Seller shall provide a complete metering system for the BESS, including any required current and voltage transformers, to measure all required parameters at the Revenue Metering Point. The metering system shall be utility grade, revenue class accuracy in all components. The metering system shall be capable of measuring all required quantities, including but not limited to, BESS MVA in/out, BESS MW in/out, MWh in/out, MVAR in/out, MVARh in/out, voltage, frequency and harmonic content. Bi-directional quantities shall be measured and recorded independently. Metering of net quantities is not acceptable.

Seller shall furnish and install a complete metering system, including any required current and voltage transformers, for the AC station service. The metering system shall be utility grade, revenue class accuracy in all components. The metering system shall measure all BESS AC auxiliary station service loads, whether served from the primary or back-up AC station service system.

As a minimum, the BESS shall include instrumentation to measure and report locally and to Owner's SCADA, as applicable to the system proposed, the following:

- Battery voltage and current at sufficient points to monitor the condition of the battery.
- Cell temperature at sufficient points to represent the battery temperature.
- Charging system trouble alarms.
- Battery ground faults, including fault location.
- Temperatures in PCS, battery rooms or other critical cabinetry.
- Hydrogen detectors.
- Smoke detection.
- Fire suppression equipment.
- Battery leakage current-to-ground.
- Other sensors and equipment, as needed to provide for monitoring and alarms as determined by Seller.

As a minimum, the following meters shall be installed on the BESS local control panel and/or be displayed on the local control console. Meters shall be digital displays and shall be no less than 1.0-inch high. These metering signals shall also be supplied to Owner's SCADA system.

- Battery voltage overall and in each string
- Battery current overall and in each string
- PCS DC power overall and from each PCS
- PCS AC power (real, MW) overall and from each PCS
- BESS net AC power (real, MW)
- BESS net AC power (apparent, MVA)
- BESS net AC power (reactive, megaVARs)
- PCS Transformer High Side Voltage (each phase)
- BESS net AC Amperes (each phase)

As a minimum, the following indicator lights or similar displays shall be installed on the local control panel or console.

- PCS breakers status
- Status of all contactors and motor-operated disconnect switches (if applicable)

At a minimum, the following alarm functions shall have indicator lights or similar displays on the local control panel or console, as applicable:

- PCS breaker trouble alarms (to be determined)
- Grid voltage present
- Battery, PCS or other equipment over temperature
- Battery ground fault (DC ground current exceeds trip level)
- Smoke/Fire detection
- Fire Suppression Activation
- Excess hydrogen level detected
- Synchronization Error Shutdown
- Control logic trouble
- Blown fuse
- Building door(s) and/or gate open
- Battery under voltage
- Module under voltage
- String under voltage

At a minimum, alarms from the battery monitoring/alarm system, if automatic, shall be displayed locally at the control panel or console and Owner's SCADA system.

The BESS control and instrumentation systems shall include provisions for determining and storing in non-volatile memory, the sequence of abnormal events, trips and/or alarms that cause the BESS to go to a disconnect or shut down state. In addition, the BESS shall include a dynamic system monitor or fault recorder to record the BESS output and waveform, and other Seller and specified parameters, for all events where the BESS is required to operate as described elsewhere in these Technical Specifications. Waveform recording shall be triggered automatically by Seller and Owner specified means and shall record a sufficient amount of pre-event data to analyze the event.

The BESS shall transmit all the above meter quantities and alarm/status indicators to Owner's SCADA system as described elsewhere in these Technical Specifications. Seller shall provide all transducers, interposing relays, or other equipment required to interface to Owner's SCADA system. Seller shall engineer and install wiring from the BESS equipment to the interface enclosure located in the control room. Such wiring shall be placed in conduits or wireway and shall be designed for ease of installation of future wiring by Owner.

6.3 BESS + Wind or Solar Controls

The control panel or console shall also include meters, indicators and display, as described in Section 7.2 - Instrumentation.

The control system shall include the capability to adjust all the ±VAR supply criteria and discharge power levels for automatic operation. Seller shall include the capability to adjust voltage/current/time profiles for battery charging and battery end-of-discharge voltage, and/or program temperature corrections/adjustments to such parameters.

The control system shall provide for the automatic operation of fans, HVAC, automatic watering system and similar ancillary equipment.

As applicable to the design/layout of the BESS and Wind/PV plant (Wind or PV plant), there shall be one or more Emergency Trip push-button(s) strategically located within the battery compartment(s). The push-button(s) shall be suitably protected to prevent accidental operation. Operation of the push-button(s) shall turn off the PCS and open the DC contactor. There shall be a similar push-button(s) in the immediate proximity of the PCS that, when operated, shall turn off the PCS and open the PCS DC contactor and AC breaker.

If deemed convenient for maintenance, Seller may duplicate relevant control panel or console functions on the PCS.

Only balanced three-phase control of the BESS and Wind/PV systems is intended under this Technical Specification. It is not the intent to utilize the BESS and Wind/PV systems to correct for system unbalances. However, the BESS and Wind/PV systems shall be designed to operate in the presence of all unbalances that may exist on Owner's POI.

The BESS and PV control system shall be designed to provide for automatic, unattended operation of the BESS and PV systems. However, the control system design also shall provide for local manual operation and remote operation or dispatch of the BESS and Wind/PV systems from Owner's SCADA system.

All local and remote control and monitoring system components shall be housed in the separate control room in the BESS building or enclosure. The control room shall be insulated to meet local, State and national building codes and shall be furnished with redundant HVAC units.

The control system shall be designed such that the failure of any single component of the control system will allow the BESS and Wind/PV system to continue to operate at full capacity.

The control system shall be of digital design, shall be fully redundant using a hot standby design. The design shall be such as to prevent externally supplied, control panel or local signals from causing the BESS and Wind/PV systems to operate in an unsafe manner or in a manner that may damage the BESS, Wind/PV system, its equipment, or the connected utility system equipment. The BESS and PV systems shall include provisions for an orderly and safe shutdown, even in the absence of utility power.

One purpose of the BESS and Wind/PV systems is to assist Owner in responding to abnormal utility system conditions. Therefore, Seller shall design the control system, including its power supplies and connections to sensors, to be immune from utility voltage and/or frequency excursions, transients and similar events. The control system shall meet or exceed the surge withstand capability requirements of IEEE C37.90.

The control system also shall provide for setting the operating mode from a local control panel and by signals from Owner's SCADA system. Initiation and continued operation in any of the modes shall be as allowed by the state of charge of the battery, as well as the set operating state (i.e., shutdown, disconnect and operate).

All software provided by Seller shall recognize and automatically adjust for daylight savings time. The BESS and Wind/PV control system shall be designed to allow for software upgrades without taking the BESS and/or Wind/PV systems out of service.

7.0 TESTING AND START-UP

7.1 General

Seller shall furnish all supervision, technical personnel, labor, normal and special test instruments, tools, equipment, spare parts and consumables and materials required to perform the electrical, instrumentation and mechanical checkout and testing of components and equipment to verify the initial operation of the systems and equipment in Seller's scope.

Seller shall perform and successfully complete Commissioning Tests on systems and equipment in Seller's scope of supply to demonstrate the safety, operability and reliability of the systems and equipment within specified design limits according to the contract, engineering drawings, documents and specifications. All normal and necessary tests shall be conducted using written test procedures.

For each test scope, the Seller shall provide a manual describing the test to perform and criteria for success or failure. This shall require Owner review and approval. The Seller shall be required to provide a certificate for successful completion of each test scope.

Seller shall coordinate with Owner for all tests where the BESS is to be connected to Owner's power system. No such tests shall be performed unless permission by Owner has been granted. The tests must be performed in a fashion to minimize unanticipated disturbances on the power system. These tests may have to be performed during the night or low load periods for certain types of tests.

7.2 Tests

Seller shall be responsible for preparing test plans and testing the equipment and systems within their scope. The tests shall include, but are not limited to:

- Grounding System Testing
- Megger Tests
- High Pot Tests (or VLF)
- Functional Tests of all Controls, Protection Relays and Interlocks
- Functional tests of all Safety Devices and Alarms
- AC/DC Motor Tests
- Battery and UPS Test
- PCS Test
- Switchgear Test
- Control Circuit Checkout
- Instrument and Loop Calibration
- Fire protection test
- All manufacturer recommended equipment tests

Additional required procedures include, but are not limited to:

- Start-up Program Organizational Procedure
- Safety Tagging Procedure
- Confined Space Entry Procedure

7.3 Factory Testing of the Battery Modules

Seller shall test and submit test data for the modules designated for use on this project. At a minimum, the following tests shall be performed.

- Energy and Power Capacity
- Heat Generated
- Efficiencies
- Maximum hydrogen release rates
- As applicable, maximum noxious and toxic material release rates

Seller shall provide a test plan for all required module tests. Test data for production lots other than those being supplied for this project are not acceptable.

7.4 Factory Testing of the PCS

Seller shall develop and submit a factory test plan. As a minimum, sufficient tests shall be conducted to demonstrate that all controls, protective functions and instrumentation perform as designed and follows this specification. Successful tests performed on scale models or analog simulators will be deemed to meet the intent of this paragraph. The tests shall demonstrate that the PCS is capable of synchronizing with - and operating in parallel with - the utility connection.

Factory testing shall include a burn-in test. For this test, the PCS shall be operated at a site ambient temperature of 120^{o} F for eight hours. Alternately, the burn-in test may be performed separately on each component or subassembly of the PCS.

7.5 Acceptance and Performance Testing

Prior to BESS final commissioning, a Control System Acceptance Test developed by Seller and mutually agreed upon by Owner and the control system integrator will be performed by Seller. Software and simulated BESS conditions will mimic the performance functions with data logging of the results using scaled values. To the maximum degree possible the verification can be done during the factory validation test of the control system. On site verification should still be performed. Seller and Owner are expected to participate and will require a four-week notice or shorter if agreed on by both parties before the testing is performed.

Seller shall be responsible for demonstrating that all systems in Seller's scope of work meet the design requirements in accordance with the required performance functions.

Following commissioning and startup, the Provisional Acceptance Tests listed in Table 9 shall be conducted at the Worksite to demonstrate compliance with the required performance guarantees.

All measurement instruments and systems used in Provisional Acceptance Tests and Final Acceptance Tests shall be calibrated prior to beginning the tests and shall have calibration certificates demonstrating calibration.

TABLE 2: PROVISIONAL PERFORMANCE TESTS

TEST	COMMENTS
BESS Ramp rate tests	The test sequence consists of a ramp from zero output (MW and MVAR) to full MW discharge, then ramp to full MW charging, then ramp back to zero output. The real power MW ramps will be in conjunction with reactive output (MVAR) adjustments to avoid voltage violations on the system
SCADA tests	Verify indication of all metering, alarms and controls for BESS, control building, and connected systems.
Voltage regulation testing	Test the Facility to hold the MV bus voltage as Owner system permits and within the operating conditions of the Existing Facility.
Curtailment interface tests	With the Facility online, verify the response to various real-power set points and ensure the Facility decreases to appropriate levels.
Annunciator tests	Verify proper indication of annunciated alarms and conditions, including reset and acknowledgment of alarms.
RTU tests	Testing to verify the interface between Owners' Facility and the BESS.
BESS Acceptance tests Startup/shut down, including emergency shut down Instrumentation/control systems functions and diagnostics Power in/Power out tests (including a full discharge test and a discharge test of each string summed to the total discharge capability) Ramp power in and out Demonstration of response to variable power commands at various states of charge Verify lead/lag controller/droop response to System frequency changes Verify receipt/response to Owner's Automatic Generation Control signals Verification of analog BESS signals (i.e. status parameters) to Owner	

7.5.1 Function Verification

After the BESS has been installed, Seller will perform comprehensive testing on the entire system to verify compliance with all requirements of this Technical Specification. Owner may, at Owner's discretion, witness these tests.

Special attention shall be given to demonstration of utility interface with Owner's protection and SCADA/EMS control signals, circuits and functions. Testing shall include, as a minimum, measurement of harmonic content and power factor at full and partial power levels for both charge and discharge.

Operation of all control, protective relaying, and instrumentation circuits shall be demonstrated by direct test if feasible or by simulating operating states for all parameters that cannot be directly tested. Automatic, local, and remote operation will be demonstrated.

Seller shall perform any required modifications and repairs identified by the testing, prior to acceptance by Owner.

7.5.2 Performance Verification

The BESS performance verification shall include tests as determined by Seller to verify that the performance criteria specified in these Technical Specifications can be met or exceeded. Accordingly, Seller shall provide a total system performance verification plan to ensure correct BESS response to system disturbances and operating scenarios described in this Technical Specification. The tests shall include, but not be limited to a constant discharge at the rated power and energy requirements listed in Table 5, or to maximum discharge limit.

The total system performance verification plan shall be submitted to Owner for review and approval 60 days prior to BESS performance tests.

Each discharge cycle, as determined by Seller, shall be followed by Seller specified normal charge cycle.

Ramp up/down tests shall be performed to demonstrate the BESS meets the specifications for the different operating modes.

These tests shall demonstrate that the BESS capabilities, efficiencies, response, and features are as proposed by Seller.

Owner will not accept the BESS until all acceptance tests have been successfully completed and all provisions of the contract have been met.

7.5.3 Actual Operating Experience

It may not be possible due to system constraints to test all facets of the BESS function as part of the performance verification tests specified above. The actual operating experience of the BESS and PV system through the availability guarantee period shall be deemed an extension of the performance verification tests.

Actual operating experience will be documented through Seller furnished sequence of event recorders, digital fault recorders and other system monitoring equipment capable of identifying system disturbances and associated BESS performance. Additional information may be provided by monitoring equipment installed by Owner at other locations.

Documented failure or malfunctions of any BESS component during the availability guarantee period shall be deemed as a failure of the system commissioning test. Seller shall, at no cost to Owner, make the necessary repairs, replacements, modification or adjustment to prevent the same failure or malfunction from occurring again. The replacement of certain BESS components in response to a system failure may necessitate, at the discretion of Owner, the duplication of certain performance verification tests which shall be performed at Seller's expense.

7.5.4 Other Compliance Tests

Seller is responsible for obtaining before and after BESS installation measurements to ensure the Project complies with this Technical Specification in the following areas. Owner reserves the right to perform (or request others to perform), at Owner's expense, identical compliance test measurements for the following:

- Broadband frequency signal strength and noise voltage
- Harmonic voltages and currents
- Audible noise measurements

7.6 Commissioning and Startup

Seller shall provide a commissioning and startup plan for the Project.

Seller shall coordinate with Owner to develop an acceptable commissioning plan that includes a checkout and startup procedure. This work will assure: that systems are activated in a manner that is safe for personnel as well as for the equipment, that Seller work is complete and according to the contract documents, and that the systems perform as required by the contract documents and are ready to be turned over to Owner. As the construction and installation of the systems nears completion, Seller and Owner shall prepare punch lists and conduct system walk-downs, sub-system and system checkouts, startups, testing, and turnovers.

The final approved Acceptance Test and Commissioning Procedures shall, at minimum, include the following:

- Safety plan during startup and commissioning.
- Review of all QA/QC testing on the DC and AC sides of inverters.
- Detailed procedure for Project startup, including switching sequencing.
- Confirm testing and energizing inverters in conformance with manufacturer's recommended procedures; note operating voltages; and confirm inverter is performing as expected.
- Testing the system control and monitoring system to verify that it is performing correctly.
- Testing the communication system for offsite monitoring.
- Testing the Project metering and protective relaying to verify they meet utility requirements.
- Detailed procedure for interface and initialization with the grid and completion of all Transmission Provider forms to be provided prior to construction.
- Documentation of successful startup and commissioning procedure.

- Written notification submitted by Seller to Owner that the completion of Acceptance Testing and Commissioning has occurred.

7.7 Synchronization Procedures and Requirements

All testing shall be done in accordance with the LGIA and all the requirements to achieve electrical and mechanical completion of the Project.

7.8 Mechanical and Electrical Completion

Seller shall achieve Backfeed and assure that the Project has been synchronized with the Owner Interconnection Facility (in accordance with Transmission Provider's requirements) before conducting the Capability Verification, Guarantee Design Conditions, and Guaranteed Performance Tests.

Mechanical Completion means:

1. Equipment for the Project has been installed, including with the required connections and controls to discharge and charge the BESS into the system and produce electrical power.
2. All remaining electrical systems have been checked out and are ready for operation.
3. All electrical continuity and ground fault tests and all mechanical tests and calibrations have been completed.
4. All instrumentation is operational and has been calibrated in accordance with manufacturers' standards and guidelines and, where possible, loop checked.

7.9 Power Capacity Test

Prior to starting the energy capacity test, a power capacity test shall be performed. This test shall be performed after several days of continuous, regular use, and is to consist of a measure of the BESS' instantaneous power output capability under normal conditions. The test report shall consist of the following:

- Any agreed upon deviations to the test procedures.
- Instrument calibration sheets/certificates.
- Test data (manual and from the data acquisition system).
- Corrected test data
- Field notes
- Calculations
- Post-test uncertainty analysis
- Conclusions

Detailed test procedure shall be proposed and submitted by Seller for review and approval by Owner.

7.10 Energy Capacity Test

Seller shall submit its proposed plan to comply with the testing procedures 60 days prior to the date that Seller anticipates the commencement of the test. The objective of the Project Energy Capacity Test Procedure is to demonstrate to Owner that the Project has achieved the Energy Performance Guarantee (in MW_{AC}) under project test conditions. The submittal by Seller regarding the Energy Capacity Test Procedure shall, at a minimum, include a listing of test instrumentation, calibration procedures, test duration, type of data collected and collection frequency, test data collection procedures, and test reporting.

Seller shall be authorized in writing by Owner to begin the Energy Capacity Test Procedure, which will be to establish the full power rating of the Project. If the rating falls below the guaranteed output, Seller shall take measures to bring the Project up to the required rating.

If Seller shall complete corrective measures to bring the power rating up to an acceptable level, then retesting may occur following notification to Owner in writing.

Seller shall submit preliminary results of the Energy Capacity Testing within 24 hours of the conclusion of the test. Upon Owner's acceptance of the preliminary test results, Seller shall submit to Owner a detailed test report within 5 business days of the completion of the Energy Capacity Test. The test report shall consist of the following:

- Any agreed upon deviations to the test procedures.
- Instrument calibration sheets/certificates.
- Test data (manual and from the data acquisition system).
- Corrected test data
- Field notes
- Calculations
- Post-test uncertainty analysis
- Conclusions

Detailed test procedure shall be proposed and submitted by Seller for review and approval by Owner.

8.0 MAINTENANCE

8.1 General

Operations and Maintenance requirements will be in compliance with the O&M contract and Seller must meet the technical specifications and requirements of the equipment manufacturers. All equipment and construction documentation to be compiled into O&M manuals. Seller to provide O&M procedures to properly guide the Owner for safe operations of the site.

The Project shall be designed so that regular planned maintenance may be carried out by either Seller (under a separate contract) or by the Owner or by Others. Full Operations and Maintenance manuals for all equipment, the fully integrated facility and site tasks are required by the Seller.

8.2 Period of Performance

O&M period of performance shall be proposed. Minimum period is during construction up to transfer of ownership under BTA. O&M by Seller can extend after transfer of ownership under a separate contract.

8.3 Maintenance Prior to Acceptance

Prior to Final Completion of the Project Seller shall be responsible for maintenance of all components of the Project.

8.4 Maintenance Procedures

O&M procedure periods shall be identified to be consistent with manufacturer specified intervals. The BESS is intended to be unstaffed on a day-to-day bas. Expected O&M intervals for all equipment shall be provided.

All equipment planned maintenance for the period of the O&M Contract shall be identified prior to Commercial Operations date and presented in an O&M Plan, in accordance with Vendor's maintenance requirements.

9.0 TRAINING AND TOOLS

9.1 General

Seller shall provide training for the Project as specified below. Seller shall determine the content and duration for each training session. The suggested class durations in this Technical Specification are meant to illustrate the level of training expected. Performance evaluation testing of all trainees (i.e., a written test) is required for all classes. Seller's minimum requirements for Training are:

- Submit training plan
- Plan shall be reviewed and approved by Owner
- Lesson Plan for each topic shall be provided
    - Learning Objectives
    - Instructor Qualifications
    - Class room training objectives w/safety
    - Field training objectives w/ safety
    - Evaluation: Either test learning or demonstration
- Record keeping
    - Program
    - Each participant
- Certification of Training Completion

9.2 Operator Training

Seller shall provide the necessary training in proper operation of the Project and related equipment. This training shall be conducted after completion of the Project performance verification testing, but before system commissioning. It is anticipated that this session will last one to two days and the Seller will provide an outline and syllabus prior to the session. This session will be limited to a maximum of 20 people. Emphasis shall be placed on safety and hands-on operating experience interspersed with the critical background as necessary, including switching procedures and emergency response training.

9.3 Maintenance Training

Seller shall provide necessary training in maintenance of the Project and related equipment, if maintenance by Owner option is chosen. The maintenance training shall be scheduled after successful completion of the availability guarantee period. It is anticipated that this session will last one to two days and the Seller will provide an outline and syllabus prior to the session. This session will be limited to a maximum of 20 people. The maintenance training shall include, but not be limited to:

- Safety and grounding procedures
- periodicity of inspections and maintenance
- normal maintenance methods
- repairs and replacement
- diagnostic procedures
- equipment calibration
- re-energization
- special tests
- spare parts
- special tools

9.4 Training Schedule

Training schedule shall be agreed upon prior Commercial Operational Date

9.5 Tools and Equipment

Seller shall provide all "special tools and equipment" for maintenance and operation which are not normally or readily available. Seller shall submit a complete list of tools and equipment needed for erection/installation and maintenance and a list of special tools and equipment that will be provided, including prices. Special tools and equipment shall become the property of Owner at the completion of the BESS and PV installation. Owner reserves the right to purchase additional quantities of tools if desired.

9.6 O&M Documentation

Seller shall supply Owner with all manuals and/or handbooks (in printable electronic format) that provide, either in a single manual or handbook or collectively, complete operating and maintenance instructions (including inventories of spare parts and tools and parts lists with ordering instructions) for each major piece of equipment and system of the Project. O&M suggested schedule shall be coordinated among major equipment.

9.7 Turnover Documents Including O&M Manuals

Seller shall provide Owner with three paper copies and one editable electronic copy of all manuals.

Hard copy manuals shall be on standard 8-1/2" x 11" paper. Drawings and schedules which are to be bound into the manual shall also be 8-1/2" x 11" or 11" x 17" folded. Each manual shall be assembled and bound in heavy-duty post binders designed for rough usage. Light duty and ring binders are not acceptable. Binder capacity shall not exceed four inches, nor shall material included exceed the designed binder capacity. If the material to be furnished exceeds this capacity rating, multiple volumes shall be furnished. Binders shall be sized to the material to be contained, and capacity should not be more than approximately one-half inch greater than the thickness of material within the binder. All documents, illustrations, specifications, equipment data sheets, drawings, operating and maintenance instructions shall be in the English language. Use of the English system of units on documents is preferred; if the metric system of units is used, the drawing, data sheet, specification or illustration shall clearly indicate that the metric system of units is used. Each manual shall include a Table of Contents, front cover, side label and laminated index tabs and shall be of a consistent format.

The electronic copy of the manuals shall be organized in folders consistent with tabs in the paper manuals. Electronic copies of installation, operation and maintenance manuals shall be organized from the most general information in the top directory to the most specific information in the lowest level folder. The top-level folders shall include a document containing a directory of the subfolders describing the contents of each and every subfolder. Electronic copies of Installation, Operation and Maintenance manuals shall be organized by project, system, subsystem, equipment and components. Manufacturers' or vendors' electronic manuals shall be delivered as individual files. Seller shall not merge or combine manufacturer and vendor provided files containing manuals.

The manuals to be provided shall include:

9.7.1 Design Manuals

Design manuals shall contain the following items:

- Drawing List, Drawing and Specification Identification System, Units of Measurement and Formats
- System List and Equipment Numbering System
- List of applicable drawings
- System design requirements
- System and equipment descriptions
- Equipment lists itemizing type, performance and technical requirements.
- Overall performance data

9.7.2 <u>Start Up, Operation and Shutdown Manual</u> for the BESS, including comprehensive and complete procedures for checkout, startup and testing of the Project and will include as a minimum the following items:

- BESS start-up and shutdown procedures
- Startup schedule
- Startup organization chart

- Administrative procedures
- Data sheets
- Test procedures for all tests required for Mechanical and Electrical Completion and Final Acceptance.
- Turnover sequences and procedures
- Safety clearance procedure
- Work responsibility matrix

9.7.3 Installation, Operation, and Maintenance Manuals for the Equipment, including information typically supplied for equipment and/or systems such as the following items:

- System or equipment startup and shutdown procedures
- Description / design criteria of each item of equipment
- Nameplate information and shop order numbers for each item of equipment and components thereof
- Operating procedures and instructions for commissioning, startup, normal operation, shut down, standby and emergency conditions and special safety precautions for individual items of equipment or systems
- List of any start-up prerequisites
- Normal range of system variables
- Operating limits and hazards for all equipment and systems including alarm and trip set points for all devices
- Testing and checking requirements
- Effect of loss of normal power
- Tolerance of electrical supply frequency variation
- Final performance and design data sheets, specifications and performance curves for all equipment including test data and test curves
- Preventive maintenance schedule and maintenance instructions for equipment including standard and special safety precautions and special conditions that trigger non-scheduled maintenance
- Dismantling and assembly procedures for equipment with associated tests and checks prior to returning equipment to service
- Detailed assembly drawings to complement assembly procedures mentioned above including parts lists and numbers for replacement ordering
- Cleaning procedures, including frequency, equipment, resources needed, water source, etc.
- Specifications for any gases, chemicals, solvents or lubricants
- Drawing showing space provided for equipment maintenance for equipment and any fixed facilities for maintenance
- Methods for trouble-shooting

- List of maintenance tools furnished with equipment
- Installation instructions, drawings and details
- Vendor drawings as appropriate
- Installation, storage and handling requirements.

The above requirements are a minimum; however, requirements which are clearly not applicable to specific items or components may be deleted, however, any additional information which is necessary for proper operation and care of the equipment shall be included.

10.0 CODES AND STANDARDS

Codes and Standards will comply with the following codes and standards at a minimum.

- Aluminum Association ("AA")
- American Association of State Highway and Transportation Officials ("AASHTO")
- American Concrete Institute ("ACI")
- American Institute of Steel Construction ("AISC")
- Association of Iron and Steel Engineers ("AISE")
- American National Standards Institute ("ANSI")
- American Society of Civil Engineers ("ASCE")
- American Society of Heating, Refrigeration, and Air Conditioning Engineers ("ASHRAE")
- American Society of Mechanical Engineers ("ASME")
- American Society of Nondestructive Testing ("ASNT")
- American Society of Testing and Materials ("ASTM")
- American Water Works Association ("AWWA")
- American Welding Society ("AWS")
- Applicable state requirements, including State Department of Transportation and Environmental Protection
- Avian Power Line Interaction Committee ("APLIC")
- Code of Federal Regulations ("CFR")
- Concrete Reinforcing Steel Institute ("CRSI")
- Crane Manufacturer Association of America ("CMAA")
- United States Environmental Protection Agency ("EPA")
- Federal Aviation Agency, Department of Transportation ("FAA")
- Federal Energy Regulatory Commission ("FERC").
- Federal Highway Administration ("FHWA")
- IAPMO Uniform Plumbing Code

- Illuminating Engineering Society (“IES”)
- Institute of Electrical and Electronic Engineers (“IEEE”)
- Instrumentation Society of America (“ISA”)
- Insulated Cable Engineering Association (“ICEA”)
- International Building Code (“IBC”)
- International Code Council (“ICC”)
- International Electrotechnical Commission (“IEC”)
- Modular Energy Storage Architecture (“MESA”)
- National Electric Code (“NEC”)
- National Electrical Contractors Association (“NECA”)
- National Electric Safety Code (“NESC”)
- National Electrical Manufacturers Association (“NEMA”)
- National Electrical Testing Association (“NETA”)
- National Fire Protection Association (“NFPA”)
- National Safety Council (“NSC”)
- North American Electric Reliability Corporation (NERC)
- Occupational Safety and Health Administration (“OSHA”)
- Post-Tensioning Institute (“PTI”)
- Scientific Apparatus Makers Association (“SAMA”)
- Sheet Metal and Air Conditioning Contractors National Association (“SMACNA”)
- Society for Protective Coatings (“SPC”)
- Telecommunications Industry Association/Electronic Industries Association (“TIA/EIA”)
- Underwriter’s Laboratories (“UL”)
- Uniform Building Code (“UBC”)

11.0 REFERENCE OWNER’S STANDARDS

Appendix “A-7” contains the following Owner standards that apply to this Technical Specification:

- RFP Appendix A-7.01: Attachment 1A Project Document Formatting and Requirements.
- RFP Appendix A-7.02: Attachment 1B – Project Document Deliverables
- RFP Appendix A-7.03: Computer Aided Design (PacifiCorp Energy) General AutoCAD/Drafting Standards (Specification DCAP876).

- RFP Appendix A-7.04.1: EBU PX-S01/S01A Substation Equipment—Power Transformer, All Ratings and Substation Equipment—Transformer-Specific Requirements
- RFP Appendix A-7.04.2: EBU PX-S02 Substation Equipment—Collector Substation Main Power Transformer
- RFP Appendix A-7.04.3: ZS-102 Two-Winding Distribution Transformer Inverter Step-Up Liquid-Immersed (Pad Mounted, Compartmental Type)
- RFP Appendix A-7.05: EBU SI-S04 Electrical Equipment—Insulating Oil
- RFP Appendix A-7.06: EBU SI-S02 Wind, Ice, and Seismic Withstand
- RFP Appendix A-7.07: EBU SI-S03 Contaminated Environment Protection
- RFP Appendix A-7.08: SP-TRF-INST Transformer, Oil-Filled Reactor and 3phase Regulator Installation Procedure
- RFP Appendix A-7.09: TD 051 Sign, Danger
- RFP Appendix A-7.10.1: 6B.5—Fence Application and Construction
- RFP Appendix A-7.10.2: Section 02810 Chain Link Fencing and Gates
- RFP Appendix A-7.10.3: Section 02815 Cantilever Slide Gate
- RFP Appendix A-7.11: 6B.6—Substation Grounding
- RFP Appendix A-7.12: GEN-ENG-RELAY-0001 Protective Relaying Standard
- RFP Appendix A-7.13: GEN-ENG-RELAY-0002 Arc Flash Hazard Standard
- RFP Appendix A-7.14: GEN-ENG-RELAY-0003 Relay Current Transformer (CT) and Potential Transformer (PT) Insulation Integrity Test
- RFP Appendix A-7.15: GEN-ENG-RELAY-1003 Thermal Plant Protective Relay Maintenance and Testing – PRC-005
- RFP Appendix A-7.16: Relay Testing and Commissioning Checklist
- RFP Appendix A-7.17: GPCP-EQPMNT-INST Generation Protection And Control Equipment Installation Procedure
- RFP Appendix A-7.18: GPCP-CT-INST Current Transformer Installation Procedure
- RFP Appendix A-7.19: PCF-CT-INST Current Transformer Installation Form
- RFP Appendix A-7.20: SG-001 Substation High-Voltage Warning Signs
- RFP Appendix A-7.21: EXHIBIT X Specification for Substation Equipment Installation, Testing and Commissioning
- RFP Appendix A-7.22.1: SV 251 Bird and Animal Protection for Miscellaneous Equipment
- RFP Appendix A-7.22.2: SV 001 Bird and Animal Protection – General Information
- RFP Appendix A-7.22.3: SV 002 Bird and Animal Protection – General Installation Instructions
- RFP Appendix A-7.23: Volume 8 Consultant Drafting Procedures and Standards (For Engineering Drawings)

RFP Appendix A-4.1 - Contractor Safety Plan Requirements

1.1 Safety Plan Requirements

1.1.1 This Section sets forth an outline for the *minimum* contents and requirements of the Safety Plan to be prepared by Seller.

1.1.2 Safety Plan outline:

(1) **General:**

(a) Purpose and scope of safety program

(b) Project Site description

(c) Project Site map

(d) Roles and responsibilities / key personnel / contact information

(2) **Project Site rules:**

(a) Project Site / employee orientation

(b) Project Site- and task-specific training

(c) Stretching program

(d) Firearms / weapons

(e) Motor vehicle operation qualifications and requirements

(f) Heavy equipment operation qualifications and requirements

(g) Substance abuse program

(h) Removal of employees

(i) Subcontractor management

(j) Badging requirements

(k) Tours / third-party visits

(l) Disruption avoidance plan

(m) Incident notification procedures

(3) **Emergency procedures:**

(a) Safety stand-down procedures

(b) Explosion procedures

(c) Severe weather procedures

(d) Bomb threat procedures

(e) Utility emergency procedures

(f) Civil disturbance procedures

(g) Tower rescue procedures

(h) Snake / insect bite and dangerous animals

(i) Spill control and prevention plan

(j) Evacuation procedures

(k) Emergency route map

(l) Emergency contacts and first responder list

(4) **Health and safety programs:**

(a) Job safety and environmental analysis ("**JSEA**") program / pre-task planning

(b) Toolbox talks

(c) Personal protective equipment ("**PPE**") requirements

(d) Fire prevention and suppress procedures

(e) Fall protection program

(f) Material Handling and Storage

(g) Welding and Cutting

(h) Walking / working surfaces

(i) Stairways and Ladders

(j) Scaffold standards

(k) Tower climbing program

(l) Crane and erection safety program

(m) Crane walking procedures

(n) Excavation and trenching program

(o) Hazard communication / hazardous materials program

(p) Electrical safety

(q) Lockout / tagout ("**LOTO**") program

(r) Motor vehicle and traffic safety program

(s) Respiratory protection program

(t) Concrete safety program

(u) Confined space entry program

(v) Inspection / audit program

(w) Incident / injury reporting and investigation program

(x) Hand and power tool safety program

(y) First aid / CPR / medical response program

(z) Bloodborne pathogens

(aa) Permitted work requirements

(bb) Blasting requirements

(cc) Competency requirements

(dd) Hunting safety

(ee) Environmental program

(ff) Working on or near exposed energized parts

(gg) Deenergizing lines and equipment for employee protection

(5) **Required checklists and forms:**

(a) Accident / injury / incident report forms

(b) Site orientation training verification form – employee

(c) Site orientation training verification form – visitor

(d) Stretch and bend sign-in form

(e) Safety audit checklist

(f) Site inspection forms

(g) Critical lift planning forms and checklists

(h) Excavation inspection form

(i) Competency evaluation forms

(j) JSEA form

(k) Toolbox talk form

(l) Rigging inspection forms

(m) Hazardous materials inventory form

(n) Heavy equipment inspection forms (daily, monthly)

(o) Heavy equipment operator certification form

(p) Respirator compliance checklist

(q) Respirator fit test certification form

(r) Form of LOTO permit and extraction form

(s) Form of hot work permit

(t) Form of dig permit

(u) Form of blasting permit

(v) Form of confined space entry permit

1.1.3 Other Safety Plan requirements:

(1) The Safety Plan shall be specific to the Project and the Project Site.

(2) Seller is responsible for creating an energization and de-energization plan for safe operation. The Seller shall coordinate with all applicable parties to coordinate the energization plan. Site safety plans shall detail the process, roles, and responsibilities related to the energization procedure.

(3) Energization and de-energization plans shall be submitted to the Owner for review no less than 30 Business Days before the energization date. The Seller shall hold a meeting with all applicable parties before energization to walk through the energization/de-energization plans.

(4) The Safety Plan shall be sufficient in scope and detail to convey the means and methods that will be employed by Seller to perform all aspects of the Work.

(5) Seller shall be responsible to establish coordination with locally available hospitals and medical facilities to ensure that they will be supporting the project site for nay emergency needs. These details should be part of the site safety plan.

(6) All rigging shall be rated; inspected daily and monthly; and load tested in accordance with the Applicable Standards or other more rigorous requirements set forth in the Safety Plan. The manufacturer-rated capacities shall be legible and permanently affixed. Inspection reports shall be maintained at the Project Site and available for review by Owner. Copies of testing certificates and calibration records for all tooling shall be maintained at the Project Site and available for review by Owner.

(7) Seller shall conduct daily job hazard analysis meetings for each task to be performed in order to identify and mitigate potential hazards prior to beginning Work. Each such meeting shall be specific to the task and shall be conducted at the respective work area. A job hazard analysis form shall be completed daily for each such meeting.

(8) Seller shall conduct site safety orientation (approximately 2-3 hours) for all personnel working on the Project Site, including, but not limited to, Owner, Turbine Supplier, subcontractors, office personnel, and visitors, prior to their being released to work on the Project Site. In addition, there shall be a delivery driver orientation given to all delivery drivers that will visit the site. Personnel who have not attended the site safety orientation and environmental awareness training shall have escorted access around the project site.

(9) Seller shall indicate the minimum ratio of full-time safety representatives to total workers on Site, and provide at least two (2) full-time safety representatives at all times till the final completion of the project. In periods of low activity, these two HSE representatives will be on site on a standby basis. Seller will provide additional safety staff based on the number of employees on site. Seller shall, in all cases where the Seller, or Subcontractor(s) perform any Work during extended or weekend hours, have an HSE representative on-Site till such Work is completed.

(10) HSE representative should have a degree in Health and Safety or equivalent safety experience. Shall be fully dedicated to health and safety with at least half of their time being in the field to ensure adherence with the site safety plan is maintained. Shall have working knowledge of OSHA regulations as well as other applicable agencies related to safe work practices.

(11) Seller shall provide the Owner the weekly hours, number of orientations and incidents for the week on a weekly reporting schedule.

(12) Seller shall conduct daily safety plan of the day meeting at the beginning of each shift including a stretch program, which will occur at the office compound prior to dispatching to site work locations. This meeting can be completed in break-out groups by trade at the respective hob sites. Seller shall conduct a weekly all hands site safety meeting that includes all employees of each Seller for the entire site.

(13) Seller shall document weekly site health and safety inspections with all the corrective actions. Seller shall implement a documented audit program per quarter.

(14) Seller shall establish a Health and Safety Committee consisting of the EPC/BOP Seller and Subcontractor's employees other than management personnel. The committee shall meet at least once per week and document meeting minutes and actions.

(15) Seller shall establish a weekly Site Safety Managers Meeting with published meeting minutes and actions. This meeting shall include the health and safety representatives from each Seller on site.

(16) Seller shall report incidents to Owner's Site Safety Representative as soon as practically possible either verbally or electronically. Seller shall perform follow-up written incident investigations that will include recommended corrective actions within forty-eight (48) hours from incident occurrence and submit the investigation report to the Owner. Final reports are due to the Owner no later than ten (10) days after the incident.

(17) Seller shall liaise and coordinate with local emergency services, including coordination with local "life flight" to identify landing sites available for helicopter emergency evacuation of personnel. Seller will develop a written Emergency Management Plan (EMP) which shall include at a minimum injury response, environmental and weather risks. Two safety evacuation drills shall be conducted, one during early works and another prior to the completion of five (5) wind turbines. A report of these drills shall be submitted to Owner which shall include, at a minimum, a timeline of events and any areas that may need improvement.

(18) Seller shall perform all necessary emergency response drills, to be performed at least quarterly, including coordination with local emergency response officials and hospitals and incorporating the dispatch of ambulance and life flight to the Project Site.

(19) Seller shall immediately report all near misses, accidents, thefts, injuries (including first aid), and safety incidents to Owner's site manager and health and safety representative(s). A written incident report shall be submitted to Owner within 48 hours of each incident.

(20) Seller shall provide all necessary safeguards to ensure safety and security of, at a minimum, the Project Site, equipment, and personnel at the Project Site.

(21) Seller shall ensure medical and first aid. Review all Federal and State regulations for first aid kit and AED inspection and/or registrations. All sites shall have AEDs and personnel trained in their operation.

(22) Seller shall provide drug and alcohol testing for all injuries requiring more than first aid; if drug or alcohol use is reasonably suspected; in the event of equipment damage . Drug and alcohol testing shall be performed as soon after the event as reasonably possible.

(23) Training records shall be retained by the Seller for the duration of construction.

(24) Seller shall provide training for the following but not limited to, site evacuation and emergency awareness training, fall prevention awareness training, mobile equipment training, energy isolation training, confined space training, forklift training and reporting requirements.

(25) Seller shall conduct environmental Orientation shall be of an appropriate length (approximately 1 hour). This orientation shall include at the minimum, overview of the environmental regulatory obligations, including relevant site egals, review of the flora, fauna and archaeological restrictions and housekeeping and recycling requirements.

(26) Seller shall meet all safety program requirements of Owner, including Appendix A Contractor Health Safety and Environmental Requirements, and all changes to applicable law and Owner policies.

RFP Appendix A-4.2 - Contractor Health, Safety and Environmental Requirements

Contractor: ___________________________________

Applicability

The health, safety and environmental requirements below apply to all contractors performing work at all PacifiCorp worksites. The contractor named above (hereinafter, Contractor) shall also ensure compliance with these requirements by all of its subcontractors of every tier. Any, and all training required in order for Contractor's personnel and the personnel of Contractor's subcontractors to comply with these requirements shall be received by those personnel prior their performance of applicable work. All such training shall be at Contractor's expense.

Security

Contractor shall be responsible for the security of all contractor-furnished material and equipment, as well as any PacifiCorp-furnished material and equipment received by Contractor.

The PacifiCorp project manager or other on-site PacifiCorp project supervisory personnel (hereinafter, PacifiCorp Supervisor) may require identification of persons entering or leaving PacifiCorp sites or project sites. PacifiCorp may also require searches of vehicles entering or leaving its sites or project sites. PacifiCorp-owned project materials may only be removed from project sites with prior express written approval from the PacifiCorp Supervisor.

Contractor shall each day provide the PacifiCorp Supervisor the number of contractor personnel working on the project and when, where, and what work will occur.

Personal Protective Equipment Requirements

On all PacifiCorp work sites including pre-bid meetings and job walks.
Contractor shall ensure that their employees are provided with and wear;

- Non-Metallic Hard Hat satisfying ANSI Z89.1-2003 Class E
- Safety Glasses with Side Shields, satisfying ANSI Z87.1 -2003
- Safety Footwear, satisfying ANSI Z-41/ASTM F2413 with a class 75 rating
- Synthetic clothing should not be worn on any PacifiCorp worksite where energized work may be performed

When work is to be performed by Contractor on Electrical Equipment that is or may become energized, at 50 volts or greater, or within the area of a Sub-Station, Contractors employees shall wear, at a minimum:

- Long sleeve FR Shirts with an ATPV of 8.0 cal/cm2 for shirt fabrics), with sleeves rolled down and buttoned. Note: Shirts or clothing with a higher ATPV may be required for work on some equipment at those sites where indicated by signage. Consult with PacifiCorp Supervisor to determine applicability of higher levels of protection.

When setting or removing meters from energized meter bases Contractors employees shall utilize;

- Face Shields that satisfy ANSI Z87.1 -2003

Tools, Equipment and Safety Supplies

Except as specifically noted elsewhere in the contract, Contractor shall provide all tools, equipment and supplies, including safety supplies, to perform the work in a safe and appropriate manner.

Safety, Health and Environmental Accident and Damage Prevention

Prior to starting any work, Contractor shall inspect the project site to ensure Contractor fully recognizes and understands all health, safety, and environmental site conditions. Contractor shall also, prior to starting work, review and understand all health, safety, and environmental laws, regulations, permit conditions, and requirements applicable to performance of Contractor's project work.

Prior to start of any work, Contractor shall ensure that each of its employees and its subcontractors are fully informed concerning all applicable safety, health, environmental and security regulations and project requirements, as well as all pertinent health, safety or environmental site conditions.

Contractor shall ensure, through health, safety & environmental discussions each day that all workers present are fully informed concerning all applicable safety, health, environmental and security regulations and project requirements, as well as all pertinent health, safety or environmental site conditions or potential injurious exposures. Contractor shall ensure all workers at each of Contractor's PacifiCorp work locations each day participate in these discussions on the health and safety aspects and potential environmental impacts of the day's work. Such meetings or discussions shall be repeated any time there are changes in the work group or work conditions resulting in new hazards or new potential exposures. These meetings shall be documented on a contractor provided form. Example *Tailboard forms* are attached for your reference. These documents shall be retained with project documentation and available to the PacifiCorp Supervisor.

Contractor shall conduct operations in such a manner as to prevent or control the risk of bodily harm to persons, environmental damage or releases, and/or damage to property. Unsafe, unhealthful and environmentally threatening conditions shall be addressed immediately. Records shall be generated of all such conditions and all steps undertaken to mitigate them.

Contractor shall ensure that when working on or in the area of energized, unguarded electrical equipment, or equipment that may become energized at 50 volts or above, that such work is performed by Qualified Persons. When work that is typically completed by non-high voltage electrical contractor is being performed they shall provide a Qualified Person to act as a safety watch and be responsible to monitor all work of non-qualified workers, on a continuous basis, stop any work that could create a hazard, and ensure all safety rules are observed. The qualified person shall ensure that a job briefing is conducted with the persons under his care before each job

Contractor shall ensure compliance with all applicable requirements set forth in OSHA, DOSH, DOT, EPA or any other applicable Federal, state and/or local regulations. Such responsibility shall apply to both its operations and those of its subcontractors. When a PacifiCorp Supervisor notices infractions of safety, health or environmental requirements and notifies Contractor, Contractor shall immediately correct the condition and record the actions taken to make such corrections.

In the event Contractor fails to promptly correct any noted infraction of safety, health, or environmental requirements, or if there is a safety or environmental incident, a PacifiCorp Supervisor may order a suspension of the work via the *Health, Safety or Environmental Incident Notice*. When satisfactory corrective action is complete, an order to resume work will be issued by a PacifiCorp Supervisor. Contractor shall not be entitled to any extension of time or any claim for damage or excess costs by reason of a notice of infraction, a suspension order, or any corrective action. Failure of PacifiCorp to order discontinuance of Contractor's operations shall not relieve Contractor of its responsibility for the safety of personnel and property.

Contractor is responsible for the manner in which all tools and equipment are stored, handled transported, and used, and for the proper use of safety equipment and devices necessary to safeguard personnel at the site, including those of PacifiCorp and other contractors.

Contractor will furnish its personnel with personal protective equipment, appropriate to the specific work activity, in accordance with applicable regulations and PacifiCorp site rules. All of its personnel shall wear appropriate protective equipment for the tasks undertaken.

All vehicles shall have seats firmly secured and adequate for the number of occupants to be carried. Personnel shall not ride in or upon any moving vehicle, except in a seat or other space specifically designed for human occupancy and in the manner for which it was designed. Seat belts and anchorages meeting the requirements of 49 CFR Part 571 (Department of Transportation, Federal Motor Vehicle Safety Standards) shall be installed in all motor vehicles and shall be used by all occupants at all times when the vehicle is in motion.

Tobacco-Free Workplace Policy

PacifiCorp is a Tobacco-Free Work Place. Tobacco use is prohibited in all PacifiCorp buildings, facilities or property. The policy applies to any person on property subject to the control of PacifiCorp. See the attached Tobacco-Free Workplace Policy.

Site control

Contractor shall furnish and utilize safety devices and equipment as appropriate to secure the jobsite and safeguard its personnel, as well as PacifiCorp and subcontractor personnel and members of the public.

Contractor shall at all times maintain the jobsite in the safest condition reasonably possible. At all times, it shall be Contractor's duty to correct or arrange to give warning of any hazardous condition. Appropriate precautions and security shall be established by Contractor to protect the public from site hazards and to reduce the site's potential as an attractive nuisance.

Barriers, barricade tapes and signs shall identify unsafe conditions. Danger area signs and barricades shall be designated by a predominantly red color. Danger area barricade tape shall be red and shall be lettered with either "DANGER" or "DANGER - DO NOT ENTER."

Caution area signs, barricades, and barricade tape shall be designated by a predominantly yellow color. Caution area barricade tape shall be yellow and shall be lettered with "CAUTION."

Barricades and barricade tape and/or flagging shall have properly completed information signs attached in a conspicuous location at each entry point stating the date, reason for the barricade and the person to contact for additional information. Signs, barricades, or other precautionary material shall be removed immediately upon termination of the hazard.

PacifiCorp uses a protective switching and tagging procedure to ensure systems are safe prior to work being performed on them. Contractor shall familiarize its personnel and the personnel of its subcontractors with the *Switching Terminology* and the *Switching Order Processing Policy* documents, and shall follow all Dispatch and Grid Dispatch procedures appropriate for the work.

In the event of an incident requiring outside assistance, Contractor's personnel shall call 911 (local county dispatch emergency number) in order to receive the appropriate emergency assistance.

All accidents and fires are to be reported to Dispatch and to the PacifiCorp Supervisor. The person that reports the emergency must give his name, state the nature of the emergency and the location of the emergency. The Dispatcher and the PacifiCorp Supervisor will log the event and notify PacifiCorp Risk Management.

In the event of a fire, accident, or evacuation emergency, Contractor must assemble and account for its personnel. Upon completion of an accurate personnel count, Contractor is to report the status of its personnel to the PacifiCorp Supervisor.

Incident Reporting

Contractor shall maintain an accurate record of all cases of property damage and of death, occupational diseases, or injury to its employees or to any third parties that are related to performance of work under the contract. All such incidents shall promptly be reported to the PacifiCorp Supervisor on a *Contractor Incident Report*.

Weekly Reporting

Additionally every Wednesday before 1PM Contractor shall provide either electronically or via fax a copy of the *Contractor Safety Report* of any incidents that have occurred since the previous report. If no incidents have occurred a Copy of the *Contractor Safety Report* shall be submitted denoting no incidents. This is required whenever contractor has any personnel working on any PacifiCorp property. *Contractor Safety Report* is attached for your use.

In the event of an environmental release, Contractor's personnel shall immediately contact the Spill Hotline answering service at (800) 947-7455. In addition, all environmental incidents shall be reported to the PacifiCorp Supervisor.

Hazardous Materials

Contractor's personnel and those of its subcontractors are required at all times to be familiar with and abide by all provisions of the OSHA Hazard Communication Standard and SARA Title III, Emergency Planning and Community Right-to-know Act (EPCRA) rules.

Cleanup

Contractor shall keep the work area, including storage areas used by it, free from accumulation of waste and trash.

Contractor is solely responsible for the transport, storage, security, handling, use, removal, disposal, and all other aspects of materials it brings to, causes to have brought to, or receives at the jobsite. Contractor shall promptly remove all of its unused material (unless desired by Company to be left on site) and all of its generated waste and shall leave none behind at completion of the project. Upon completion of the work, Contractor shall leave the work area in a condition satisfactory to PacifiCorp.

In the event of Contractor's failure, within a reasonable time, to satisfactorily clean the area, PacifiCorp may, after written notice to Contractor, perform the clean-up and removal at Contractor's expense.

Health, Safety and Environmental Violations

All health, safety and environmental violations with respect to work performed by Contractor, or its subcontractors of any tier, must be corrected by Contractor. Contractor shall be solely liable for all costs, including government-imposed penalties, associated with health, safety, and/or environmental violations attributable to Contractor or its subcontractors.

Abnormal or Hidden Hazards

Contractor shall inspect the project site to ascertain all site abnormalities and hidden hazards. Contractor shall make note of these abnormalities and hidden hazards, shall determine methods for addressing them and shall record such determinations. Contractor shall inform its personnel and its subcontractors of the abnormalities and hidden hazards and its determinations in their regard. All notes, records of determinations, etc. with regard to site abnormalities and hidden hazards shall be copied for and provided to the PacifiCorp Supervisor.

Subcontractors

These requirements apply to all subcontractors. It is the responsibility of Contractor to inform all its subcontractors regarding the applicable work rules and security, environmental, health, and safety requirements prior to the start of any subcontracted work, and to train such subcontractors if necessary. PacifiCorp will provide copies of these requirements to subcontractors upon request.

Contractor Acknowledgement

The undersigned Contractor representative hereby acknowledges receipt of these requirements. Contractor represents that it has reviewed and understands these requirements, and will abide by and enforce these requirements with its personnel and those of its subcontractors.

CONTRACTOR

Name: ____

Title: ____

Signature: ____

Date: _______________________

TOBACCO-FREE WORKPLACE POLICY

No individuals, whether employees, contractors, vendors, visitors or guests, are allowed to smoke or use tobacco products on the premises of any PacifiCorp facility or property, whether owned or leased. This prohibition includes offices, field facilities, company vehicles and aircraft, garages, parking lots, lawns and sidewalks. Where approved, the company will identify tobacco-use areas at its power generation and mining facilities for use during authorized break periods.

Note: For represented employees, a collective bargaining agreement may supersede this policy.

REPORTING

Employees are expected to report violations of the company's tobacco-free workplace policy to their supervisor or a human resources representative. Failure to comply with the tobacco-free workplace policy will result in discipline, up to and including termination of employment. Smoking in the workplace is a violation of law in certain states and may carry civil penalties for those who violate such laws.

PROTECTION AGAINST RETALIATION

Retaliation against any person who, in good faith, reports a violation of this policy or participates in an investigation of smoking or the use of tobacco products in the workplace is prohibited. If the company finds retaliation has occurred, individuals who engaged in the retaliatory behavior may be subject to discipline, up to and including termination of employment, regardless of whether the original complaint is substantiated.

These policies supersede and revoke any and all past policies and practices, oral and written representations, or statements regarding terms and conditions of employment concerning the subject matter covered herein. PacifiCorp reserves the right to add to, delete, change or revoke these policies at any time, with or without notice. These policies do not create a contract between PacifiCorp and any employee, nor do they create any entitlement to employment or any benefit provided by PacifiCorp to its employees.

CAUTION! This document may be out of date if printed.

Company Name: Example Only - Do Not Duplicate
TAILBOARD AND RISK ASSESSMENT

Job Description: ______________________ **GPS Coordinates:** ____________

Job Location: ______________________

Facility Point # ______________________

Order Number: ______________________

EMERGENCY PHONE NUMBER:

"NOT GROUNDED NOT DEAD"

Use back of form for additional comments, if needed

JOB PLANNING

YES	NA		YES	NA		YES	NA	
☐	☐	Job plan review	☐	☐	Fall protection	☐	☐	Communication check (radio, other)
☐	☐	Other work groups (contractors)	☐	☐	Confined space, trenching/shoring	☐	☐	Health Hazards / MSDS
☐	☐	APM / RMD (Resource Manual) review	☐	☐	Non-standard construction	☐	☐	Environmental clean-up
☐	☐	Grounding manual review	☐	☐	Proper rigging & pulling equip	☐	☐	Job assignments
☐	☐	PPE (FR clothing, hearing, footwear, eyewear, hard hats, safety vests and other PPE)	☐	☐	Inspection of tools & equipment	☐	☐	Weather, (lightning) terrain & other considerations (slips, trips & falls)

N/A Not applicable

SWITCHING REVIEW

Substation ____________ **Circuit #** ____________ **Voltage(s)** ____________

YES	NA			
			Recloser # ____________	**Compass / switch order #** ____________
☐	☐	**Hold**	**De-energized test?** ☐ **Voltage detector** ☐ **Buzzing**	**Grounding method used?** ____________
☐	☐	**Assurance**	**Open point(s)?** ____________	
☐	☐	**Clearance**	**Clearance point(s)?** ____________	

POTENTIAL HAZARDS & PLANNED CONTROL MEASURES

Points checked "YES" below must include a brief outline of planned control measures

YES	NA	
☐	☐	How is electrical apparatus or equipment being isolated, disabled or modified? ____________
☐	☐	What is the minimum approach distance? ________ Type of cover-up / barrier required? ____________
☐	☐	What is the potential back feed or induction? ____________
☐	☐	What are the hazardous deteriorated facilities? ____________
☐	☐	Traffic control measures put in place? ____________
☐	☐	Vehicle grounding / barricading plan? ____________
☐	☐	Other potential hazards or safety considerations? ____________

RE-TAILBOARD

Note reasons for re-tailboarding, include initials of individual responsible for job planning and anyone new to the crew.

Re-Tailboard: ______________________

______________________ **Initials:** ____ - ____ - ____

Re-Tailboard: ______________________

______________________ **Initials:** ____ - ____ - ____

SIGN OFF

CREW INITIALS: ____ -- --- ____ - -- ____

TAILBOARD CONDUCTED BY: **TIME:** ________ **GF:** ____________ **DATE:** ________

SIGNATURE

____________ **DATE:** ________ **MGR:** ____________ **DATE:** ________

SIGNATURE SIGNATURE

Underground Work

Company Name: Example Only - Do Not Duplicate
TAILBOARD AND RISK ASSESSMENT

Job Description: ______________________ **GPS Coordinates:** ______________

Job Location: ______________________

Order Number: ______________________

Facility Point #: ______________________

"NOT GROUNDED NOT DEAD"

EMERGENCY PHONE NUMBER:

Use back of form for additional comments, if needed

JOB PLANNING

YES	NA		YES	NA		YES	NA	
☐	☐	Job plan review	☐	☐	Confined space & shoring	☐	☐	Environmental clean-up
☐	☐	Other work groups (contractors)	☐	☐	Escape Plan	☐	☐	Proper rigging & pulling equip
☐	☐	Safety Manual	☐	☐	Rescue Plan	☐	☐	Non-standard construction
☐	☐	Grounding Manual review	☐	☐	Air test acceptable	☐	☐	Communication check (radio, other)
☐	☐	Fall protection	☐	☐	Permit /Non-permit	☐	☐	Health Hazards / MSDS
☐	☐	Inspection of tools & equipment	☐	☐	Vehicle grounding / barriers	☐	☐	Job assignments
☐	☐	PPE (FR clothing, hearing, footwear, eyewear, hard hats, safety vests and other PPE)	☐	☐	Gates & fences secure	☐	☐	Weather, (lightning) terrain & other considerations (slips, trips & falls)

N/A -- Not applicable

SWITCHING REVIEW

Substation(s) ______________ **Circuit Number(s)** ______________ **Voltage(s)** ______________

Substation(s) ______________ **Circuit Number(s)** ______________ **Compass / Switch order #** ______________

Recloser Number ______________

YES	NA			
☐	☐	Hold	De-energized test? ☐ Voltage detector ☐ Buzzing	Grounding method used? ______
☐	☐	Assurance	Open point(s) ______	
☐	☐	Clearance	Clearance point(s) ______	

POTENTIAL HAZARDS & PLANNED CONTROL MEASURES

Points checked "YES" below must include a brief outline of planned control measures

YES	NA	
☐	☐	What is the minimum approach distance? ______ Type of cover-up / barrier required? ______
☐	☐	How is electrical apparatus or equipment being isolated, disabled or modified? ______
☐	☐	What is the potential back feed or induction? ______
☐	☐	What are the hazardous deteriorated facilities? ______
☐	☐	Other potential hazards or safety conditions? ______

RE-TAILBOARD

Note reasons for re-tailboarding, include initials of individual responsible for job planning and anyone new to the crew.

Re-Tailboard: ______________________

______________ Initials: ______ - ______ - ______

Re-Tailboard: ______________________

______________ Initials: ______ - ______ - ______

SIGN OFF

CREW INITIALS: ______ --- ______ - -- ______

TAILBOARD CONDUCTED BY: **TIME:** ______ **GF:** ______ **DATE:** ______

SIGNATURE

______________ **DATE:** ______ **MGR:** ______ **DATE:** ______

SIGNATURE SIGNATURE

Rev3 04-29-05

System Operations

Company Name: - Example Only - Do Not Duplicate - _

TAILBOARD AND RISK ASSESSMENT

Order Title: ______________________

Equipment Description: ______________________

Job Location: ______________________

GPS Coordinates: ______________________

EMERGENCY PHONE NUMBER:

"EVERYONE'S INTENTION SHOULD BE PREVENTION"

Use back of form for additional comments, if needed

JOB PLANNING

YES	NA		YES	NA		YES	NA	
		Job plan review			Confined space & shoring			Environmental clean-up
		Other work groups (contractors)			Proper rigging & pulling equip			Gates & fences secure
		Safety Manual			Inspection of tools & equipment			Non-standard construction
		Grounding Manual review			Mobile substation barriers			Communication check (radio, other)
		Fall protection			Chemicals (acid, SF6,PCB's)			Health hazards / MSDS
		PPE review (FR clothing, hearing footwear, eyewear, hard hats and other PPE)			Vermin droppings & other contamination			Job assignments
								Weather, (lighting) terrain & other considerations (slips, trips & falls)

N/A -- Not applicable

SWITCHING REVIEW

YES	NA	
		Hold
		Assurance
		Clearance

Compass / Switch order number? ______________________

De-energized test? ☐ Voltage detector ☐ Buzzing

Grounding method used? ______________________

Clearance point(s)? ______________________

Comments or unusual switching: ______________________

POTENTIAL HAZARDS & PLANNED CONTROL MEASURES

Note: Points checked "YES" below include a brief outline of the planned control measures

YES	NA	
		What is the minimum approach distance? ______________ Type of cover-up / barrier required? ______________
		How is electrical apparatus or equipment being isolated, disabled or modified? ______________
		What are the potential induced currents, voltages and back feed? ______________
		Vehicle grounding / barricading plan? ______________
		Stored energy device, spring, air, capacitor, mechanical, other? ______________
		Other potential hazards or safety considerations? ______________

RE-TAILBOARD

Note reasons for re-tailboarding, include initials of individual responsible for job planning and anyone new to the crew.

Re-Tailboard: ______________________

______________________ Initials: ______ - ______ - ______

Re-Tailboard: ______________________

______________________ Initials: ______ - ______ - ______

SIGN OFF

CREW INITIALS: ______________ --- ______________ -- --- ______________

TAILBOARD CONDUCTED BY:

TIME: ______________ **GF:** ______________ **DATE:** ______________

SIGNATURE

____

SIGNATURE

DATE: ______________ **MGR:** ______________ **DATE:** ______________

SIGNATURE

PACIFIC POWER
A MIDAMERICAN ENERGY HOLDINGS COMPANY

ROCKY MOUNTAIN POWER
A PACIFICORP COMPANY

Contractor Safety Report

Report is due by **1:00 p.m. each Wednesday**. Please complete form and fax to 503-813-7190 or email to ContractorSafetyInfo@pacificorp.com.

Contractor Name:

Report Date:

Company Contact Name and Number:

☐ **There are no new incidents to report.**

Incident 1

☐ Vehicle Incident – Preventable
☐ Vehicle Incident – Non-Preventable
☐ OSHA Recordable Incident
☐ Lost Time Incident
☐ Near Miss
☐ Circuit Interruption

Employee name: **Date of incident:**

Location of incident:

Name, title, phone number of person submitting information:

Description:

Actions taken to ensure incident does not reoccur:

Incident 2

☐ Vehicle Incident – Preventable
☐ Vehicle Incident – Non-Preventable
☐ OSHA Recordable Incident
☐ Lost Time Incident
☐ Near Miss
☐ Circuit Interruption

Employee name: **Date of incident:**

Location of incident:

Name, title, phone number of person submitting information:

Description:

Actions taken to ensure incident does not reoccur:

Use additional sheets for more incidents.

PACIFIC POWER
A DIVISION OF PACIFICORP

ROCKY MOUNTAIN POWER
A DIVISION OF PACIFICORP

Health, Safety or Environmental Incident Notice

(To be issued to Contractor's Representative by the Project Manager)

This serves as formal written notice to Contractor of an observed Health, Safety or Environmental infraction. Repeat and/or additional infractions may result in termination of work in accordance with contractual agreements. Any cost incurred as a result of this notice shall be to Contractor's account.

CONTRACTOR: ____

SITUATION: ____

____

____

____

First verbal notice given to ____
(Name and company of person receiving verbal notice of infraction)

by____on ______________________
(Name of person giving verbal notice) (Date verbal notice FIRST given)

Work suspension ordered? Yes_____No _____

Work suspension released. Date_______________Time _______________

PLANNED CORRECTIVE ACTION (This section is to be completed by Contractor):

____

____

____

____

Expected completion date:_____________________Date completed: ______________________

PERSON GIVING WRITEN NOTICE

Name: ____

Signature: ____

PERSON RECEIVING WRITTEN NOTICE

Name: ____

Signature: ____

Date: ______________________________

cc: Power Delivery Health, Safety & Environment Department
Procurement

Appendix A-8
Real Estate Specifications and Submittals Required for BTA Bids

Real Estate guidelines for RFP submitted projects for which PacifiCorp will be the ultimate operator:

Provide a summary of all land rights agreements (leases, easements, etc.) obtained/to be obtained. For each agreement, provide the following information

- Name of Grantor
- Type of lease (production, access, transmission, etc.)
- Property covered (legal description and acreage)
- Commercial financial terms:
  - Development period payments
  - Operations period payments (including a description of basis of payment methodology: acreage, installed capacity, or production)
  - Additional infrastructure costs (roads, substations, operations buildings, MET towers, transmission lines, etc.)
  - Estimated annual costs
- Confirm the land agreements include the following:
  - Clear and defined alternate payment terms for situations when the operator of the project is a regulated utility, and gross revenue is not applicable
  - Exclusive rights for project construction, operation, maintenance, repair, replacement of project facilities, roads, and infrastructure
  - Grantee insurance requirements can be sufficiently met by program of self-insurance
  - Assignability language in each land right agreement.
  - Agreement contains jury trial waiver provision
  - Requirement for Grantor to execute an Estoppel certificate upon request.
- Provide a discussion of unique lease restrictions, such as first rights of refusal, first rights of offer or supply, favored nations provisions, buffer zones or setbacks, restricted areas within leased property, or other limitations and obligations of the Grantee
- Identify ancillary agreements for crossings, non-disturbance, common-use, encroachments, subordinations, overhangs, etc.