Statement of Work

LEED-Related Building Commissioning Services for 1900 Sixteenth Street at the Millennium Bridge in Denver, Colorado

Prepared for:

Trammell Crow Denver Development
1225 17th Street, Suite 3050
Denver, Colorado 80202

Commons 19, LLC (Owner)
1215 Fourth Avenue, Suite 2400
Seattle, Washington 98161

Prepared by:

Architectural Energy Corporation
2540 Frontier Avenue, Suite 201
Boulder, Colorado 80301

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Background

Commons 19, LLC and Trammell Crow Denver Development are managing the design and construction of a new, approximately 622,000 square foot mixed-use development at 1900 Sixteenth Street in lower downtown Denver. The development, known as 1900 Sixteenth Street at the Millennium Bridge, consists of Tower A, Tower B, Tower C, distributed retail and a large structured parking podium. The project will be phased with Tower A and the below grade and partial above grade parking structures representing Phase 1A, and additional above grade parking. Tower B will be constructed as part of the Phase 2 development schedule. Phase 3 will consist of 80-100 housing units built above the parking structure. However, the entire 1900 Sixteenth Street development will be designed together through the Schematic Design Phase, and then each phase taken through the Construction Documents Phase individually, beginning with Phase 1. The scope of this proposal addresses only Phase 1 design and construction.

Commons 19, LLC and Trammel Crow Denver Development, and the design team, led by David Owen Tryba Architects, are committed to creating an energy and environmentally responsive design solution. An overall sustainable design has been established based on the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED®) sustainable rating system – a LEED-C&S (Core & Shell) Gold rating.

Commons 19, LLC and Trammell Crow Denver Development, on behalf of the Project Development Team, has requested building commissioning services from Architectural Energy Corporation as part of the requirements for LEED Certification as well as best practices for achieving a constructed and operating building that meets the design intent and owner's expectations. The expected results of commissioning the facility are to ensure that all commissioned building systems are properly designed, constructed and functioning properly upon occupancy, and that the Owner's operation and maintenance staff have adequate documentation and training to effectively and efficiently operate the facility.

1.0 Introduction

Architectural Energy Corporation is pleased to submit the following Statement of Work and fee proposal for providing LEED-related building commissioning services on the new 1900 Sixteenth Street mixed-use development. The statement of work presents the goal, objectives, activities, deliverables, and budget for providing LEED-related building commissioning services.

The current scope of work is limited to Fundamental Building Systems Commissioning (LEED Energy and Atmosphere Prerequisite 1) as defined in the LEED New Construction rating system Reference Guide. Enhanced Commissioning (LEED Energy and Atmosphere Credit 3), as defined in the LEED New Construction rating system Reference Guide, will also be included as part of the basic services.

AEC is proposing a comprehensive building commissioning approach for the approximately 420,000 square foot Tower A office building, and associated structured parking. Commissioning activities are proposed to be provided during the Design, Construction, Acceptance, and Warranty Phases of the building delivery process. The commissioning effort described herein has been specifically designed to meet the criteria of the LEED-C&S rating system for the "Prerequisite" commissioning requirements and the additional credit or "Enhanced" commissioning requirements.

2.0 Project Description and Commissioning Scope

2.1 Project Description

Tower A is a seventeen (17) floor approximately 420,000 square foot office building that is part of a larger mixed-use development. It will sit on one level of below grade structured parking. An entrance lobby, retail and service areas occupy the ground floor.

Schematic Design of Tower A has been completed, and design development has begun. Preliminary design and specification of the primary building systems have been completed. Thus, the general character and quantity of equipment to be commissioned under the core and shell construction process are known, and are addressed in Architectural Energy Corporation’s commissioning services proposal.

2.2 Commissioning Scope

The scope of LEED-related commissioning, as defined in the LEED-NC Reference Manual (LEED-C&S references the LEED-NC Reference Manual for commissioning requirements), involves at a minimum the mechanical HVAC systems, automated lighting controls and domestic hot water systems. Consequently, AEC has assumed that the following building systems / equipment will be commissioned under this project:

- All Core and Shell HVAC mechanical systems.
  - Variable volume air handler.

  - Central boilers and associated piping, pumps and controls
  - Central cooling plant
  - Central condenser water loop
  - Retail heat pumps
  - Fans, pumps, fan-powered VAV boxes
  - Building automation system
  - Miscellaneous HVAC equipment (unit heaters, fans, etc.)
  - Test Adjust and Balance verification

- All Core and Shell Automated lighting control systems
  - Occupancy sensors
  - Daylight sensors (for exterior lighting control)
  - Central lighting control system
  - Daylight interaction of electric lighting and daylight design elements

- Domestic hot water system

- Renewable energy system (i.e. building-integrated photovoltaics) if implemented into the design

3.0 LEED-Related Building Commissioning Activities

The following statement of work identifies the commissioning services proposed by Architectural Energy Corporation for this project. The scope of services for the fundamental commissioning process fulfills the LEED prerequisite commissioning requirements.

3.1 Commissioning Goal and Objectives

The overall goal of the commissioning effort is to verify and document that those building systems selected for commissioning -- as defined and agreed to by the owner, design team and commissioning authority -- meet the design intent and owner's requirements for functionality and performance.

Specific commissioning objectives for the project are as follows:

- Fulfill the LEED Prerequisite commissioning requirement.
- Verify and document that the equipment is installed and started per manufacturer's recommendations and to industry accepted minimum standards.
- Verify and document that equipment and systems receive complete operational checkout by the installing contractors.
- Verify and document equipment and system performance.
- Verify the completeness of operations and maintenance materials.
- Verify that the facility's operations personnel are adequately trained on the operation and maintenance of building equipment.

3.2 Fundamental Building Systems Commissioning -- LEED Prerequisite

Architectural Energy Corporation, in cooperation with the design and construction team, will perform the following activities to achieve the project goal and objectives:

- **Documentation of Design Intent and Basis of Design**

  A clear design intent is critical to the commissioning process. Design Intent defines the benchmark for system performance. The Design Intent Report is a detailed explanation of the information developed for the owner's program, focused on those systems included in the scope of work for commissioning. It will clearly define the functional and indoor environmental quality requirements. The Basis of Design Report details the design teams response to the performance criteria in owner's program and design intent. It will include the heating, ventilation, and air-conditioning requirements for each occupancy type, with references to applicable codes and standards, and other design criteria used as the "basis of design" for other building systems to be commissioned. AEC will request these documents from the owner and design team and will review them for completeness and for future reference as they are integral to the project delivery process, or as required, assist the Design Team to create the necessary deign intent and basis of design reports.

- **Commissioning Specifications**

  Commissioning specifications for the targeted building systems will be prepared by the design team, with assistance from AEC, or can be provided by AEC if needed. The proposed specifications will be reviewed for completeness and adequacy relative to defining the commissioning requirements of the general contractor and all installing subcontractors. The commissioning specifications describe the scope and requirements for commissioning, as well as the roles and responsibilities of the general contractor, installing subcontractors, owner personnel, Design Team, and the AEC Commissioning Team.

- **Prepare Commissioning Plan**

  AEC will prepare a Commissioning Plan. The Commissioning Plan describes the implementation of the commissioning process and provides a framework for integration of commissioning activities into the construction and acceptance process. The Commissioning Plan also provides an agenda for organizing and focusing the commissioning scoping meeting. The Commissioning Plan expands to incorporate more information as the design, construction, and acceptance and warranty phases of the facility are completed. The Commissioning Plan will be updated during the construction and warranty phases.

- **Commissioning Scoping Meeting**

  AEC will hold a scoping meeting which will bring together all members of the design and construction team that will be involved in the commissioning process.

Each building energy system to be commissioned is addressed, including its intended operation, commissioning requirements, and completion and start-up schedules. During the scoping meeting, all parties agree on the scope of work, tasks, schedules, deliverables, and responsibilities for implementation of the Commissioning Plan.

- **Pre-Functional Inspection Checklists**

  A Pre-Functional Inspection Checklist will be developed by AEC and be completed by the appropriate sub-contractor for all major equipment and systems being commissioned. The checklist confirms the as-built status of the equipment or system and ensures that the systems are complete and operational, so that the functional performance testing can be scheduled. Manufacturer's start-up checklists and other technical documentation guidelines will be used as the basis for all pre-functional checklists. AEC reviews and verifies the completed Pre-Functional Inspection Checklists before beginning the functional performance testing. This activity will be coordinated with the design mechanical and electrical engineers' punch list activities.

- **Conduct Construction Observation**

  Onsite observations are conducted to verify compliance with manufacturer's installation and start-up instructions and recommendations, compliance with the design intent, and meeting the requirements for efficient operation and maintenance. Construction observation is not for the express purpose of ensuring compliance with codes and standards. Regularly scheduled meetings are held for site coordination, reporting on construction and commissioning progress, and resolution of any identified issues or deficiencies. Construction observation activities will be coordinated with the architect's on-site construction administrative representatives, and with the owner's operation and maintenance staff to facilitate their participation in the commissioning process and familiarize them to the building systems that they will ultimately be required to operate and maintain.

- **Functional Performance Testing**

  Functional performance testing verifies the intended operation of individual components and system interactions under various conditions and modes of operation. Functional Performance Testing Plans will be prepared by AEC so that the complete sequence of operations is included in the test procedures.

  Under the supervision of AEC commissioning staff, the installing subcontractor performs the hardware and/or software manipulations required for the testing. AEC commissioning staff witness and record the results of functional performance testing. If a building component or system substantially fails the functional performance testing, the installing subcontractor is responsible for making the necessary system adjustments or alterations. The failed component or system will then be re-tested for conformance. It is critical that final start-up

procedures, tune-up testing, air and water balancing, and control software de-bugging be complete before any functional performance testing is undertaken.

Testing, adjusting and balancing (TAB) observation will also be performed to verify TAB methods and procedures on both air-side and water-side systems. Commissioning will include verification of the balancing as a prerequisite to functional performance testing. The verification procedure will spot check air and water flow rates at locations selected by the commissioning engineer. The TAB contractor will complete the measurements and provide the equipment.

- **Issues Log**

  The results from pre-functional checklists, functional performance testing, and short-term diagnostic monitoring will be documented in an Issues Log Report by AEC. The report includes all details of the components or systems found to be non-compliant with the drawings and specifications. The report also details the adjustments or alterations required to correct the system operation, and identifies who is responsible for making the corrective changes. The Issues Log Report is a living document that will be regularly updated to reflect the progress on many components and systems.

- **Complete Seasonal Testing**

  Seasonal variation in operations or control strategies may require additional testing during the opposite season to verify performance of the HVAC system and controls, or other building systems with seasonal operating characteristics, and other building systems with a seasonal operating schedule, such as irrigation, automated natural ventilation, etc. During the warranty period, seasonal testing and other deferred testing is completed by AEC as required to fully test all sequences of operation.

- **Operations and Maintenance Training**

  AEC will schedule the training sessions and insure that the material covered is appropriate and informative. AEC will coordinate the training sessions with the entire commissioning team (contractors, designers, facility staff, etc.) Minutes and training logs will be generated by AEC to provide proper documentation of the training efforts. As required and appropriate, the O&M training sessions will be videotaped for future use by new O&M staff. The operation and maintenance manuals compiled by the installing contractors will be reviewed for completeness and for adherence to the requirements of the specifications. The agenda for staff training programs proposed by the contractors will also be reviewed. Materials may be added, or requested from the contractors, to stress and enhance the importance of system interactions, troubleshooting, and long-term preventative maintenance and operation.

- **Commissioning Report**

  A final Commissioning Report will be compiled by AEC which summarizes all of the tasks, findings, conclusions, and recommendations of the commissioning process. The Commissioning Report serves to "benchmark" the building and is useful in a continuous commissioning process which is recommended for the long-term performance of the building.

  The commissioning report includes the following information:

  - An evaluation of the operating condition of the systems at the time of functional test completion.
  - Issues (Deficiencies) that were discovered and the measures taken to correct them.
  - Functional test procedures and results.
  - A summary of all commissioning field activities as they progressed, and a description and a proposed schedule of required deferred testing.
  - LEED Documentation: Documentation will address and certify the LEED section on "Energy and Atmosphere" Prerequisite 1.0 titled "Fundamental Building Systems Commissioning."

3.3 Enhanced Commissioning -- LEED Additional Credit (Optional Scope)

The LEED enhanced commissioning credit requirement addresses commissioning activities during the design and post-occupancy phases. Architectural Energy Corporation, in cooperation with the design and construction team, will perform the following activities to achieve the intent of the Enhanced commissioning credit should this optional scope of work be approved and authorized by Trammell Crow Denver Deveolpment:

- **Design Review of Construction Documents**

  The construction documents review is undertaken to ensure that commissioning is adequately specified within the construction documents for those building systems to be commissioned, and that the targeted building systems are likely to meet the design goals (intent) relative to functionality, energy performance, maintainability and indoor environmental quality.

  The intent and timing of this review is to identify and resolve any issues that may adversely impact the installation, operation and performance of the equipment and building systems to be commissioned before the construction documents are completed and used for construction purposes.

- **Submittal Review**

  The contractor's standard submittals that are applicable to the commissioning scope will be reviewed by AEC to ensure that the equipment or system provided

will meet the specifications and design intent, as they relate to their energy or environmentally responsive characteristics.

- **Develop Re-Commissioning Manual**

  A Re-Commissioning Manual will be prepared by AEC and will include all information required to effectively maintain the building at optimal performance. The Re-Commissioning Manual will include, at a minimum, the following information:

  - Final version of the Owner's project requirements and basis of design.
  - As-built sequences of operations for all equipment as provided by the design professionals and contractors, including time-of-day schedules and schedule frequency, and detailed point listings with ranges and initial setpoints.
  - Ongoing operation instructions for all energy- and water-saving features and strategies.
  - Functional performance test results, blank test forms, and recommended schedule for ongoing benchmarking.
  - Seasonal operational guidelines.
  - Recommendations for recalibration frequency of sensors and actuators by type and use.
  - Single line diagrams of each commissioned system.
  - Troubleshooting table for ongoing achievement of the owner's project requirements.
  - Guidelines for continuous maintenance of the owner's project requirements (operational requirements) and basis of design (basis of operation).

- **Conduct End-of-Warranty or Post-Occupancy Review**

  The Architectural Energy Corporation Commissioning Team will return to the site before the end of the warranty period to review the current building operation with the facility maintenance staff. The review will also include any outstanding issues from original or seasonal testing. The AEC commissioning staff will interview facility staff to identify concerns with building operation and provide suggestions for improvements. In addition, AEC will help identify issues that relate to the original warranty and assist staff in developing reports or documentation to remedy any problems.

4.0 Architectural Energy Corporation's Qualifications

Architectural Energy Corporation is a leading energy engineering firm assisting its clients to achieve and to maintain peak building performance over the life of their buildings. This mission is accomplished through a comprehensive and innovative suite of professional services and products which address sustainable design and analysis; commissioning and diagnostic testing; utility and energy service company engineering services; energy information systems, services and data acquisition equipment; internet services; hardware and software product development; performance evaluation; and market transformation services.

Founded in 1982 by Michael J. Holtz, FAIA and Donald J. Frey, PE, and expanded in 2004 through a merger with Eley and Associates, Charles Eley, FAIA, PE, Architectural Energy Corporation maintains an interdisciplinary staff of over 90 mechanical, electrical, architectural and energy engineers; architects; computer scientists; mathematicians; physicists; technicians; and research support staff to undertake complex and diverse projects related to energy, buildings and the environment. AEC has offices in Boulder, Colorado; San Francisco, California; Chicago, Illinois; and Nashville, Tennessee. The professional services staff is divided into a number of business area teams.

AEC is a member in good standing of the U.S. Green Building Council, and the Building Commissioning Association which promotes building commissioning practices that maintain high professional standards and fulfill building owners' expectations. Staff members also maintain active membership roles with various professional organizations, including American Society of Heating Refrigerating and Air-Conditioning Engineers (ASHRAE), the Association of Energy Engineers, the American Institute of Architects, and the Building Operator’s Association of Colorado. AEC has participated in, including sponsoring, the National Conference on Building Commissioning for all of its twelve year history.