MILLER
ENGINEERING, INC.

Expression of Interest
West Virginia – General Services Division
Central Chiller Plant Ice Farm and Upgrades
CEOI 0211 GSD1900000008

May 15, 2019

Department of Administration
Purchasing Division
2019 Washington Street East
Charleston, WV 25305-0130

304-291-2234 (ext. 107) | 240 Scott Avenue Suite 1 | Morgantown, WV 26508 | www.MillerEng.net
West Virginia | Pennsylvania | Maryland | Ohio | Virginia

MILLER ENGINEERING, INC.

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The Miller Engineering Difference

We are very pleased to submit our response for the WV General Services Central Chiller Plant Ice Farm and Upgrades Project. Since our inception, Miller Engineering has frequently performed services matching the needs and goals expressed in the solicitation, often as the prime consultant. We have a notable history of then implementing our recommendations, from design through construction, and post warranty, with great success. Those projects have often included evaluation of chiller systems, changes to chiller systems resulting in or modifying a plant-type configuration. We are adept at integrating design into existing systems then bidding and performing construction administration on such projects, including separately bid & phased construction. We have evaluated many systems for condition, efficiency, and upgrade potential. For this project, Dr. Ken Means, PE, a 50 year plus HVAC engineer and WVU Engineering Professor, will act as a consultant on the project, working with us in design and acting as a third party peer review at each stage in the project. We are very pleased that Ken has agreed to join us for the project.

We have also teamed with Montum Architecture and CAS Structural for the site, building, or protections portions of the project. Both bring a wealth of practical experience and Carol brings a long history and knowledge base of the Capitol Complex and General Services work to the team. MEI, serving as prime has performed many infrastructure and equipment related projects. This includes many generator projects similar to the need expressed in the EOI. We have some working knowledge of the Central Chiller Plant, having previously implemented two emergency electrical repair projects for the plant: the 4,160V switchgear evaluation and repair and the 12KV transfer switch controller replacement. We believe upgrades and renovations are our forte and our commitment to doing them successfully shows through in each project.

In addition to new construction projects while at WVU, I provided engineering support to the maintenance staff in the form of real-time field assistance, as well as design, bidding, and construction management of modifications to and repairs of the campus mechanical, electrical, plumbing and central utility systems. This work included modifying the campus district chiller plants and adding a new plant. I operated and made improvements to the 3,250 ton district chiller plant at Uniontown Hospital during my tenure there including efficiency upgrades, free winter cooling, and implementing the first digital control of the plant based on load algorithms. Travis Taylor worked for a number of years as a MEP systems designer and project manager for a large electrical contractor and serves as lead engineer at MEI. Our working knowledge of utility infrastructure is based in real world operations as well as engineering design.

We're not your typical MEP firm; we ensure our designs meet very specific, time-tested criteria, including but not limited to being constructible, operable, and maintainable. We want to set up our clients to be self-sufficient, but we work to be available every step of the way.

Our hands-on staff takes great pride in their construction and operations backgrounds, which help us visualize the project as it would be built instead of as just lines on paper. This is particularly important in phased projects where the needs of Owner are critical. We don't set

Clients down and lecture to them about what they're going to get; we listen to them so we can strive to deliver exactly what they want and need. It costs too much time and money (for both our clients and us) to not deliver exceptional service every single time, and we work tirelessly to keep projects on time and on budget. We're proud to say that our change order percentage over the last 10 years is less than 0.1%, and that's not just a statistic; it's a proclamation of our commitment and determination to make sure things are done right the first time, every time.

Miller Engineering has completed several projects for the State of West Virginia in recent years with great success. We believe we have a unique knowledge of the facility including the staff, its operational requirements, and the overall need; which will permit us to hit the ground running on the project. We have experience with the requirements and processes of state procurement, and can deliver a successful project from evaluation and design through bidding, construction, and close-out. I would like to personally thank you for considering Miller Engineering for the Central Chiller Plant Ice Farm and Upgrades Project and wish you luck in the endeavor.

Best regards,

Craig Miller
President/Owner
Miller Engineering, Inc.

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TAB 1 – FIRM PROFILES

MILLER
ENGINEERING, INC.

Firm Profile

MILLER ENGINEERING is a solely held (S) corporation owned by Craig Miller PE, President. The corporation maintains a Certificate of Authority with the WV State PE Board and has carried professional liability insurance since its inception. Neither the firm nor its professional engineers have ever faced disciplinary action in any form from the states in which they are registered.

Our engineered solutions involve a detailed assessment process: investigation, observation, communication with stakeholders, system analysis, building modeling and engagement from our entire team. We approach each and every project with this process and the guiding principle that buildings are designed to be livable and function in their intended purpose.

Over the past 14 years Miller Engineering, Inc. (MEI) has engineered solutions for over $23.2M in MEP system upgrades, repairs and renovations for projects of all scopes and sizes, with clients ranging from private owners to local and state governments. With a strict attention to detail and commitment to delivering a job done well and done right the first time, every time, ***MEI has accumulated a change order percentage of less than 0.1% over the past 8 years.***

Our team has unique skill-sets regarding engineered renovation solutions. Each member of the team has hands-on mechanical system experience including installation, construction, design and maintenance.

Miller Engineering takes pride in being ***different by design****, and that difference shines through in all phases of our work and continued relationships with our clients.*

- Experienced and Licensed Professional Engineers
- Quality, Value-Engineered Project Delivery
- Qualified Construction Representative on Staff
- LEED-AP Certified
- Below Industry Change Order Status
- Building Information Modeling
- Emergency Facility Response

Engineering Design and Consultation

- Mechanical
- Electrical
- Plumbing
- HVAC Design
- Renovation
- New Construction
- Building Information Modeling

Aquatic Facility Design
Public Pools & Areas
ADA Compliance
Indoor & Outdoor (air flow)
Chlorination/Filtration

Construction Administration
Maintenance/Facility Improvement Plans
Contract Administration
Code Observation

Communication System
Intercomm & Public Address
Voice/Data/CATV
Urgent Response

Energy
Power Supply (main & backup)
Green & Renewable Consulting
Systems Utilization & Upgrades
Sustainable Solutions

Facility Utilization
Systems Assessment & Solutions
Adpative Re-use
Planning/Life-Cycle Control
Engineered Replacement

Life Safety Inspection/Design
Fire Protection & Alarm Systems
Access Control
Fire & Electrical Investigation

Industry Experience
Education
Local & State Government
Commercial Development
Healthcare

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West Virginia | Pennsylvania | Maryland | Ohio

Montum Architecture

Montum Architecture, LLC was founded in 2017 to provide architectural design services to clients in West Virginia and western Maryland. Staff includes one licensed architect performing all tasks and duties. This ensures the utmost coordination of building plans and specifications with minimal potential for miscommunication.

Legal Organization

Montum Architecture is a Limited Liability Corporation initially filed in the State of West Virginia. The company is also registered in the State of Maryland as a foreign LCC.

Communication

Tom Pritts will be the primary point of contact for Montum's architectural services. Montum will serve as a sub-consultant to Miller Engineering.

Project Budget

Previous work experience has shown a consistent +/-2% bid-to-budget ratio.

Project Schedule

Montum will monitor and adjust the design tasks in order to complete the design work on the established timetables. They will also work diligently during project construction to maintain the contractual constraints placed as part of the contractor's bid.

Design Software

Montum utilizes Autodesk Revit for all design projects incorporating three-dimensional modeling and parametric reporting.

Firm Profile

CAS Structural Engineering, Inc. – CAS Structural Engineering, Inc. is a West Virginia Certified Disadvantaged Business Enterprise structural engineering firm located in the Charleston, West Virginia area.

Providing structural engineering design and/or analysis on a variety of projects throughout the state of West Virginia, CAS Structural Engineering has experience in excess of 30 years on the following types of building and parking structures:

- Governmental Facilities (including Institutional and Educational Facilities)
- Industrial Facilities
- Commercial Facilities

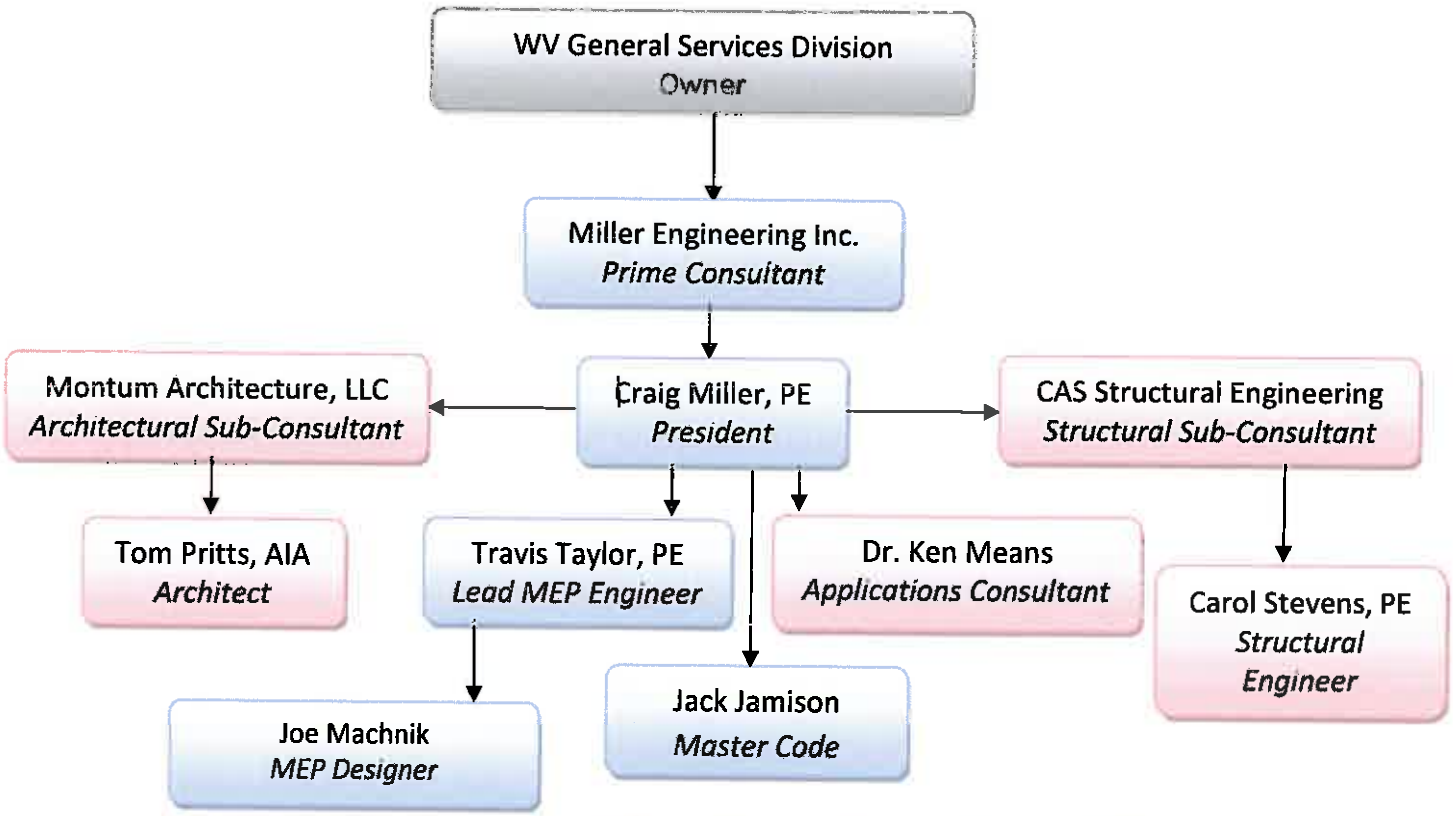
Projects range from new design and construction, additions, renovation, adaptive reuse, repairs and historic preservation (including use of The Secretary of the Interior's Standards for Rehabilitation) to evaluation studies/reports and analysis.

CAS Structural Engineering utilizes AutoCAD for drawing production and Enercalc and RISA 2D and 3D engineering software programs for design and analysis. Structural systems designed and analyzed have included reinforced concrete, masonry, precast concrete, structural steel, light gauge steel and timber.

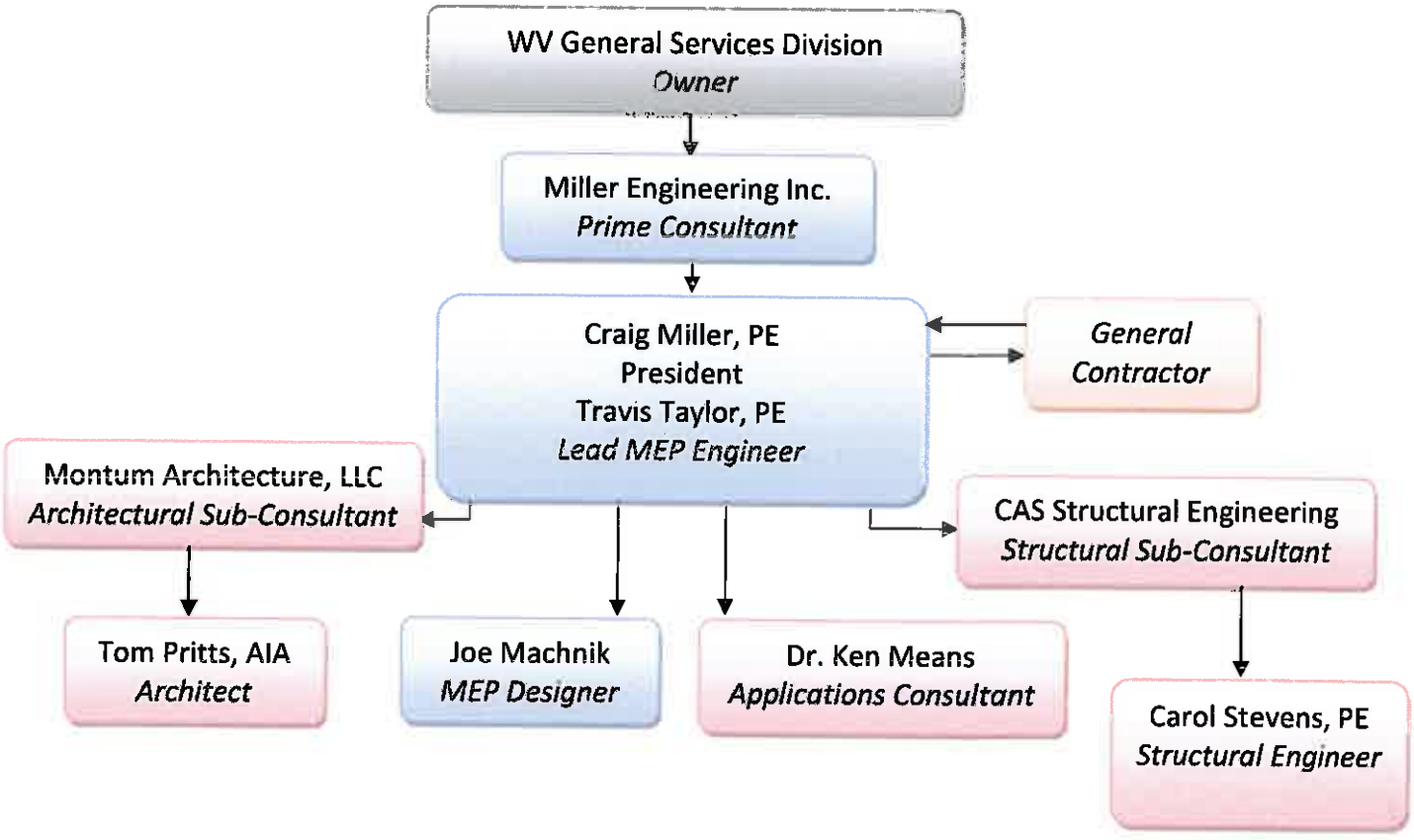
Carol A. Stevens, PE is the firm President and will be the individual responsible for, as well as reviewing, the structural engineering design work on every project. Carol has over 30 years of experience in the building structures field, working both here in West Virginia and in the York, Pennsylvania vicinity. Carol is also certified by the Structural Engineering Certification Board for experience in the field of structural engineering.

CAS Structural Engineering, Inc. maintains a professional liability insurance policy.

Organization Chart – Design



Organization Chart – Construction



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TAB 2 – GOALS

WV Capitol Complex Central Chiller Plant
Section Three – Project Goals

PROJECT GOALS

Miller Engineering has reviewed the project description under Section Three of the Expression of Interest and developed the following outline of project approach concepts, methodologies, core-values, and prior pertinent experience. Note that the project data sheets in section four (4) further describe many of the projects referenced in this section.

GOAL ONE – Chiller Plant Systems Evaluation and Report with Recommendations and Ice Farm Design

CHILLERS AND CHILLER PLANTS

MEI has always focused on renovations as a core of our work. Many of these renovations have had existing chiller systems with single and plant configurations, both air and water cooled, which have required evaluation to assist the Owner in determine where the equipment is in its life cycle and it's potential for continued reliability. For MEI, evaluations of this type are the rule rather than the exception. Our approach includes discussions with the Owner concerning operational issues, review of any available documentation of the HVAC systems, and an on-site evaluation, including a review of the physical condition of equipment, building construction and history, the architectural and structural realities, and a review of the building automation systems.

The evaluation and analysis involves a records review to determine the nature and frequency of service call and repairs, along with interviews of the plant operators and maintenance personnel. We evaluate the physical condition of the chiller using visual, on board instrumentation, and other methods such as load increment amp draw, temperature/pressure relationships, tube sheet eddy current analysis, and vibration analysis. The last can be quite revealing in regards to internal conditions or issues. Additionally, interaction with the chiller manufacturer and review of technical service bulletins provide valuable insight. A review of the operating sequence for varied size, multiple plant chillers is standard.

In addition to the chillers, it is critical to evaluate the pumps, cooling towers, valves, and equipment supporting the plant as both individual components and as part of the larger system. Records review, physical review, and performance testing similar in nature to the chillers is required. Craig's years of operations and maintenance experience play a key part in this part of the evaluation. Once we have a good grasp of the plant's overall condition we use the data collected from field observations and control system is used to benchmark the plant against its original design and startup conditions. The data will include any load data we can develop to relate load to the buildings served. This is done by items such as schedule, temperature/weather conditions, and operator experience. We can model each building served by the plant and integrate them into a unified model of the entire district system to use for further benchmarking, albeit this is a pretty

significant effort. Evaluating the overall plant efficiency with the available data we can develop reveals the big picture related to the plant, along with its components.

We then take all the information we have, and our conclusions and present in a verbal and written report. Such a report will indicate not only the condition and expected life of equipment but also any plant maintenance deficiencies we discover. We try to reinforce the good practices and educate in terms of maintenance type and interval. In some cases, we have developed detailed maintenance plans for facilities to help the Owner maximize the life, efficiency and value of the equipment (see the Appendix for samples of reports and maintenance plan).

By running chiller plant design software simulations early, we can standardize our model to the reality of the district plant and, presuming sufficient information exists, understand the original designer's intent. We then cross check this against the collected data and standards for the time and known rules of thumb; for further validation of the model. Once our confidence in the model is high, we then incorporate the Owner's changes and begin to iterate the model to develop a "what works, what doesn't" matrix for the existing systems and what changes are required to implement the Owner's goals in the most practical manner.

For the Ice Farm Design work, the operational model of the existing plant, annualized by ASHRAE BIN Data, gives us a good tool for maximizing the ice farm system in terms of multiple factors such as efficiency, reduced operational costs, energy cost reduction, and reduced chiller wear. The centrifugal chillers in the plant are generally designed to run at higher loading, so running less chillers at higher load for longer periods of time is good for the chillers, and good for energy costs. The balance between the cost and the capacity of the thermal storage is key to the design. Many years ago, ice farms and ice storage, whether an internal or external melt system, was considered a custom design specialty that only few could accomplish. Like most equipment in the HVAC industry, it is now a pre-engineered component, much like a chiller (albeit with limited capacity and run time) where the design of the component is not specialized; but proper sizing and application is critical. It must be properly sized and integrated into both the piping and most especially the control systems.

The site related design will be handled by the team, as we have performed site preparation design for equipment on many projects through the years as prime consultant. On a day to day basis, and with our project and personal histories, we work and have worked in many heavy utilities infrastructure environments. In this case, we will review all existing information on infrastructure and coordinate that information into our design and into our construction documents. We endeavor to document all existing known infrastructure and relay that to bidders to avoid complications later in the project. A campus environment has a unique set of challenges in this regard and both Travis and Craig understand those as well as the opportunities the existing infrastructure can afford a project. Tom Pritts has several non-typical buildings envelopes for secure facilities, schools, and other government facilities. These include, damage resistant walls, bullet-resistant assemblies, and blast resistant facilities. Protection can take many

forms and Tom and Carol will review the requirements, discuss the Owner concerns, and design a system to meet the project needs. Should we reach a point where the site conditions, regulatory, or the protection requirements exceed our capabilities, we will work with the Owner to determine the best sub-consultant to add to the team to resolve the concerns.

The Chiller Evaluation and Ice farm design lead to a list of items to be addressed either due to equipment issues and requirements, system sizes, or load profile changes. The process of development of this list is iterative and based on practicality, cost, and operations; with all options re-evaluated and revised, new options added or discarded, until the result meets our best recommendations. This detailed list becomes a literal checklist of items to be addressed and form the basis of our report and final estimating. We work with equipment vendors and make detailed equipment selections and do design concept takeoffs either by hand or from our model to incorporate into our estimate. We do not use square footage estimating but as a measure of last resort.

In our recommendations report, we strive to clearly identify and explain our findings in technical accurate and detailed language while keeping it meaningful to the Owner. We work to balance budget realities with first and lifecycle costs; along with operability and maintainability. Where possible, we will relay options, with costs, pros and cons, in tabular form to encourage discussion and support the decision process.

Experience:
We have performed many chiller related projects through the years. Recent work for WV GSD included an evaluation of the second floor of Building 22 for the purpose of installing new and modifying existing systems to accommodate the installation of a new check scanning system. Additionally, MEI evaluated the existing HVAC systems of Building 36 as part of the design for a complete upgrade to the building. In both cases, the written evaluation report included detail recommendations and budgetary estimates. More recent evaluations and projects of this type include projects such as:

- Canaan Lodge Chiller Evaluation, Rental Chiller, and Chiller Replacement
- WV State Building 36 Chiller Evaluation
- Morgantown Ice Rink Chiller Evaluation and Replacement
- South Middle School HVAC Upgrade/DX Replacement with Chillers
- Canaan Ice Rink Chiller Evaluation and Repairs
- Dominion Post HVAC Upgrades
- Pipestem Lodge Piping Replacement

GENERATORS

We approach the design of generator and standby power systems with a detailed look at the total load, but also with considerably more research to really understand the system requirements as a whole. We, as always, start with a discussion of the Owner's goals and concerns, and develop our exploration methodology from that information. MEI looks at the loads the Owner may wish to connect to the generator, along with the transfer device(s) (typically an automatic transfer switch), and the downstream panels and circuits serving the equipment. This is done to gain a full understanding of the requirements for the generator and associated devices as a system.

In this case, the Owner wishes to use the generator as a "prime mover" for the chiller plant, but with the capacity available may they also want to utilize it for other purposes such as backup or emergency power. We have done hospital and data centers which have successfully used this philosophy. Evaluating the loads involves more than just collecting and adding the design amp loads, as motors require significant current above the label amps, albeit for a short time, to start. If powering a chiller, this becomes a critical factor in equipment selection and sizing. These inductive loads, along with other load types such as electronic equipment, UPS chargers, and even lighting can affect the power balance and operation of the generator system under load. To the safest extent possible and in collaboration with the Owner, we verify the label loads of equipment by actually measuring loads using ammeters. Where possible we will compare actual versus theoretical loads for the generator.

Once an understanding of the backup system has been developed, we then determine its overall capacity, limitations, concerns, or code related requirements (life safety, backup, emergency, prime mover, etc.). We use design software to simulate the loading on the generator and the system under different loading scenarios which include adding new or revised loads to the systems. We then evaluate the results according to the Owner's needs and wants, and determine such things as plant size and configuration (one or more generators in a plant), transfer requirements, and downstream distribution changes needed for the project. Other factors in the determination include evaluations of fuel source, system harmonics, and transfer switch configurations for the neutral; which vary with load type. The options for the system, such as load shedding or generator management) are tracked and listed in detail for discussion with the Owner and included in the final written recommendations, along with the budget costs we have been tracking throughout the process.

Experience:
In recent years, and with the increased use of technology, the demand for standby/ backup power has increased substantially. A significant portion of the projects we do have some form of backup power or at least an Owner interest in looking at backup power during design. We have performed these analyses on many facility types in recent years including such projects as:

WV Dept of Agriculture - Ripley Warehouse
The Dominion Post Newspaper
Grant County Bank
Med Express Corporate Headquarters
Blennerhasset Island Prime Generator Evaluation
Advanced Surgical Associates
Preston 911 Center
WV Division of Natural Resources - Elkins Operations Center
Glenville Water Treatment Plant
WV Division of Natural Resources - Wildlife Farm
Potomac Valley Transit Authority

GOAL TWO – Construction Documents Resulting from Evaluation Results

DESIGN AND TECHNICAL DOCUMENTATION

Our approach for the project will be as a technical resource to the Owner in the review and decision-making regarding the report findings. We follow an interactive process of verbal, email, and formal written communications to allow the Owner to drive the decision process. We use the recommendation-based decisions of the Owner as our guidance on the project. Design review meetings, where the progress of the project is reviewed and verification of our assumptions and design path, are crucial to the effort. This involves stakeholders selected by the Owner and includes meeting minutes and post meeting feedback and follow by our team. We develop a list out potential and outstanding issues and concerns on both the technical and stakeholder sign and track them to resolution. We update estimates as project requirements change as we proceed through design. We used this process in the Building 36 design due to the complexity and nature of the renovation.

MEI initiates construction documents as part of the design process. As the documents relay the design intent to the bidders and eventually the performing contractor, we believe documenting the design intent as clearly and concisely as possible is a Day One design goal. We have found this approach tends to identify concerns or issues sooner rather than later and allows us to more efficiently iterate and solidify the design. Our design efforts and drawings center around the Owner's goals and constructability – can it be built the way we show it? At each document submission phase, the product is peer reviewed three times prior to release. Enlarged views, sections, elevations, isometrics are all added as the design progresses. In utilizing building modeling, we can "weave" the systems through the building with higher confidence. Details and schedules are developed and revised throughout the process. We will often note areas of concern or items requiring Owner input on the progress prints to call attention to the situation, we have found this very helpful in meetings.

As project drawings are developed, so are specifications. We have worked as prime consultant on many projects and are quite familiar with developing not just the technical specifications, but the full project manual. Our manuals include all the CSI Divisions required for the project plus supplemental information related to project delivery, conditions, and scope of work. We regularly work with Owners to incorporate their requirements in the "front end" sections of the manual. As the documents near completion, we conduct a final constructability review on the bidding documents and incorporate final Owner comments.

Experience:
As previously stated, renovations are at the core of our work. Renovations involve an evaluation and recommendation phase being followed by design, detailing, and construction documents. We believe this is where the emphasis on understanding the Owner's needs and goals, along with a detailed understanding of the facility, benefit the project. The interactive nature of the evaluation and the documentation prepared result in a smooth transition from Evaluation to implementation. We never assume we have all the answers and there is a great deal of design and detailing work that must be accomplished. The recommendations will be broken down with such items as "mandates" and others as "options" for further evaluation. We review these in detail with the Owner and utilize the Owner's decisions to prepare documents for competitively bidding the renovation. The following projects were all performed using this methodology:

Building 36 HVAC Renovations
WV State Building 25 Piping and 6th Floor Fit Out
Monongalia County Schools - MTEC and Mountainview HVAC Renovations
Alderson Broaddus Withers Hall HVAC Evaluation and Renovations
WV Division of Natural Resources - Elkins Operations Center
Dominion Post Electrical

CONSTRUCTION CONTRACT ADMINISTRATION

MEI does not disappear once the Owner has bidding documents in hand. We will conduct the pre-bid meeting, working with the Owner, and answer bidder questions, vendor substitution requests; creating addenda as needed. We will evaluate the bids and make recommendations for acceptance or rejection of the bids. Once under construction, MEI will make frequent site visits, both formal and informal, to ensure the project work is on track. We call this our "boots on the ground" approach. This is coupled with the normal regimen of meetings and documented project communications. MEI will involve and communicate with the Owner throughout the construction to ensure everyone remains "on the same page". We see this as even more crucial when the Owner retains occupancy of parts of the building during construction, as indicated in the EOI.

Since most of the staff at MEI have construction backgrounds, we understand that delays cost both the contractor and the project money. RFIs from contractors take precedence in the office, and are often answered within 24 hours to ensure the project stays on schedule and to minimize change orders. We will witness many aspects of the installation such as: startup and testing of equipment, testing and balancing, and personnel training. We will require and review all record "red line" drawings and O&M Manuals for accuracy and completeness. We will remain involved to help resolve and enforce any warranty concerns that might arise.

Experience:
As demonstrated during construction of the Building 22 2nd floor HVAC project, which had ongoing issues with the computer room air conditioning units, MEI stayed involved as the design engineer, and pressed for a resolution involving the contractor, subcontractors, suppliers, and factory; and ensured that the project concerns were resolved. Our change order rate is significantly below industry average, and we believe our aggressive construction administration is part of the reason.

GOAL THREE – Multi-Phase Construction and Owner-Occupied Facilities during Construction

MEI has designed many phased projects to permit the Owner to use part of a facility while the rest was renovated. A district plant represents a challenging but executable continued use. It requires a very high level of discussion, coordination, and planning with the Owner to address the Owner's operational realities. The detailed evaluation of the load profile of the plant referenced in goal number one is an important piece of this process. It helps us understand what is needed and when in terms of cooling and helps highlight and spot the windows of opportunity to perform work requiring partial shutdowns or outages. By interacting with the stakeholders and incorporating the phased construction plan into the documents, the risk of change orders due to use and occupancy concerns can be reduced.

Our team will work with the Owner and stakeholders to determine a plan which balances project requirements, operations, and cost to arrive at an executable plan for construction of the project. These plans often include identification and use of temporary relocations, swing space, temporary power, lighting, and HVAC adjustments that permits the Owner to continue work. We intuitively understand the critical nature of the Central Chiller plant and the nature and reality of the buildings it serves. Modifications to the plant will include any alterations or upgrades to accommodate the generator systems for a chiller prime mover, and outages of some duration will likely be required.

Craig, Travis, and MEI have done many large scale projects involving outages, in some cases to an entire campus such as the WV Main and Evansdale campuses, life critical systems in a hospital, or financially critical data centers required outages. We understand the need to design to minimum downtime, plan the work to acceptable outage durations, communicate the outages needs, risks, and backup plans, and complete the outages safely. We anticipate any maintenance work would be planned and bid for minimum impact on the campus and the ends users. Logically this tends to fall to the coldest part of the year under separate contract. We will look at the interrelationships of all work and spot "work ahead" or "set up" opportunities that might reduce or eliminate future outages. Items such as piping taps, piping installation, and prep electrical work during an outage are the kinds of opportunities we will work to use to your advantage.

Needs evaluation and assessments are only part of the implementation of phased construction projects. The design process must incorporate the identified needs into an actionable construction plan that is clearly set forth in the project drawings and specifications. In this case, it is likely, that will occur not only in the individual phase of the project but across multiple construction contracts, so working from the product backwards to the start is critical.

The final piece of the puzzle is boots on the ground. MEI will be the nexus of communication on the project and must reinforce this role when administering a contract with phasing and continued occupancy. On previous projects, we have used a weekly coordination phone conference call to closely track the progress and the concerns of the

stakeholders. In addition, we work to do timely site visits to more closely monitoring the situation on the ground, we work to make sure the flow of the work and the occupants remains as coordinated as possible. We work to ensure buy-in by all parties and document any changes or deviations to the best extent possible. Lastly, we interact with everyone to keep the 'look ahead' as far forward as possible during the project. If circumstances change, we work with everyone to gain a consensus plan to proceed and get or keep things on track.

Experience:
MEI has performed multiple-phase design and construction administration on projects including:

- Building 25 HVAC Piping Replacement
- Building 22 Second Floor
- Canaan Lodge Chiller Evaluation, Rental Chiller, and Chiller Replacement
- Mon County Deferred Maintenance/ Energy Project
- Pipestem State Park Electrical, HVAC, and Fire Alarm Renovations
- Grant County Bank
- Dominion Post Electrical and HVAC

We are currently in phase two design of the Mon County deferred maintenance project which is a multi-phase project with separate bid documents in separate construction contract over time.

At the Dominion Post Building, MEI's design incorporated multiple separate projects that were not funded at the time of design but had to coordinate to achieve the desired result in the end. The work at Pipestem State Park was broken down into a large electrical repair, a fire alarm upgrade, pool HVAC repair, and a large piping replacement (some 10,800 feet of HVAC piping was replaced while keeping the facility operational and under reasonable HVAC control). Projects at WV Buildings 25 and 22 had continuous owner occupancy with minimal negative effect on operations.

GOAL FOUR – Procurement Services Interface

On numerous occasions since 2005, MEI has served as prime consultant to many State of West Virginia agencies that utilize the WV Purchasing Division procurement processes, including WV General Services Division, WV Division of Natural Resources, WV National Guard, and Colleges and Universities. Additionally, we have performed services as prime consultant for county governments, county school boards, municipalities, (including water and sewer), and regional transit authorities whom also follow WV Purchasing Requirements under the WV State Code.

The bidding process, including conducting pre-bid meetings, answering questions by written addendum, and evaluating the bid results, is an essential link in the chain of a project. By effectively and quickly responding to bidder questions, the potential for change orders or of bidders 'padding' a bid due to uncertainty is reduced.

We understand the document structure preferred by WV Purchasing, including recent revisions, and General Services Division. We are adept at incorporating Owner and WV Purchasing review comments into our documents with minimal delay.

Experience:

Our experience has given us a firm and detailed understanding of the regulations and the procedures for publicly bidding work in WV and specifically with WV Procurement Services. A partial project list includes:

Building 25 HVAC Piping Replacement
Building 22 Second Floor
Building 36 HVAC Renovations
Pipestem HVAC Piping Replacement
WV Dept of Agriculture - Ripley Warehouse
WV Division of Natural Resources - Elkins Operations Center

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TAB 3 –STAFF QUALIFICATIONS

Staff – Proposed Staffing Plan

Team Leader/ Primary Point of Contact	***Craig Miller, PE***
Engineer in Responsible Charge	***Craig Miller, PE***
Application Consultant	***Dr. Ken Means, PE***
Electrical Code Specialist	***Jack Jamison***
Lead MEP Engineer	***Travis Taylor, PE***
Lead Designer/BIM Specialist/ BIM Coordinator	***Joseph Machnik***
Architect	***Tom Pritts, AIA***
Structural Engineer	***Carol Stevens, PE***

**Staff Resumes to Follow*

B. Craig Miller, PE

Craig founded Miller Engineering in 2003, and serves as President and Principal Engineer. He has more than 20 years experience in design, specification, operations and project management. During his employment with WVU, Craig was directly involved with approximately $130 million in new capital construction. His experience with a wide range of projects including HVAC, electrical, plumbing, infrastructure upgrades, building automation, energy efficiency and maintenance/renovation, among others, allows him to serve in multiple capacities within a given project. Craig will serve as the "Relationship Manager" for Miller Engineering as the main communication interface between the Owner, the design team, contractors and end users.

Project Role: Relationship Manager – Primary Point of Contact

- *Engineer in Responsible Charge*
- *Design and Project Management of Mechanical, Electrical, Plumbing Projects*
- *Concept and Construction Design*
- *Business Operations and Financial Management Oversight*
- *Quality Assurance and Control*

Professional Project Highlights

- Bobtown Elementary HVAC
- WVU Life Sciences Building and Student Recreation Center – Owner's Engineer
- Hawks Nest/Twin Falls HVAC
- Mapletown High School HVAC Replacement Phase I & II
- Advanced Surgical Hospital
- Holly River State Park Primary Electric Service Replacements Phase I & II
- Beech Fork State Park – MEP New Construction Design
- Cheat Lake Elementary & Middle School Renovations

Professional History

2003- Present	Miller Engineering, Inc.	President, Relationship Manager
2002-2003	Casto Technical Services	Existing Building Services Staff Engineer
2001-2002	Uniontown Hospital	Supervisor of Engineering
1995-2001	West Virginia University	Staff Engineer
1990-1995	BOPARC	Caretaker – Krepps Park
1983-1988	University of Charleston	Electrician/HVAC Mechanic

Education

1995	West Virginia University	BS- Mechanical Engineering
1988	University of Charleston	BA- Mass Communications

Licenses and Certifications

- Professional Engineer (West Virginia, Pennsylvania, Maryland, and Ohio)
- Licensed Master Plumber
- LEED-AP Certified

Biographical Sketch of Dr. Kenneth H. Means, P.E.

Present Position and Address

Professor, Mechanical and Aerospace Engineering, 841A Engineering Science Building, West Virginia University, P.O. Box 6106, Morgantown, WV 26506-6106, (304) 293-3141, FAX (304) 293-6689, e-mail: ken.means@mail.wvu.edu.

Education

- Ph.D. Mechanical Engineering, West Virginia University, Morgantown, WV, August 1973
- M.S.M.E. Mechanical Engineering, Drexel University, Philadelphia, PA, June 1967
- B.S.M.E. Mechanical Engineering, West Virginia University, Morgantown, WV 1963

Experience

- West Virginia University, Professor (1991-present), Associate Professor (1985-1991), Assistant Professor (1981-1985). Department of Mechanical and Aerospace Engineering.
- L.D. Schmidt & Son. Inc., Chief Engineer (1973-1981) HVAC Consultant, Fairmont,WV.
- West Virginia University, Instructor and Graduate Research Assistant, (1973-1969) Department of Mechanical Engineering and Mechanics.
- Westinghouse Electric Co., Aerospace Division, Senior Engineer (1967-1969), Aircraft Structures Design, Baltimore, MD.
- Martin-Marietta Co., Aerospace Division, Engineer, (1963-1967), Structures Design-Aircraft and Missiles, Baltimore, MD.
- Member of the West Virginia State Board of Registration of Professional Engineers 1982-1995

Honors and Awards

- Outstanding Teacher Award, College of Engineering 1999, 1994, 1993, 1992, 1985
- Outstanding Mechanism Paper – Proctor & Gamble Award 1985
- Outstanding ASME Mechanism Paper – Proctor & Gamble Award 1988
- SAE Ralph Teetor Award for Research & Education
- SAE Faculty Advisor Awards 1987, 1990 & 1995
- Appointed by three Governors to the West Virginia Sate board of Registration for Professional Engineers 1981 – 1996
- Selected by the Advisory Committee to MAE for the Lifetime Teaching Award for 2000
- Selected as the Outstanding Teacher for the College of Engineering and Mineral Resources for 2003-2004
- Appointed to the West Virginia Energy Task Force in 2003 by Governor Bob Wise

Activities Relative to State Service

- HVAC Consultant to the National Energy Technology Laboratory in

Morgantown, West Virginia since 1993.

- Consultant on Indoor Air Quality Problems for West Virginia Public Schools and the WV Legislative Subcommittee on Air Quality.
- Performed Optimization Studies on Ductwork, Exhaust Hoods, Machines and Processes, sponsored by NSF, DOE and DOD.
- Developed Sensitive Environmental Test Chambers for Accurate Microgram Weight Measurements, sponsored by DOE.
- Developer of HVAC questions for the Engineering Registration Exam for the National Council of Examiners for Engineering and Surveying
- Teaching HVAC courses at West Virginia University since 1983
- Industrial Energy Assessments on a Variety of Industries
- Contracted by the West Virginia Division of Energy to perform energy efficiency studies for industry and various types of buildings for 15 years

Partial List of Projects Relating to HVAC Design

- National Energy Technology Laboratory-District Chiller Plant
- Camp Dawson Geothermal System for the District Heating System
- District Cooling/Heating System - Mental Health Center Campus (budget hold)
- Professional Witness City of Baltimore District Steam System
- Energy Modeling of Buildings Using eQuest DOE 2 software
- National Energy Technology Laboratory- Lab Building HVAC Systems, steam and condensate piping including district steam supply, air quality studies, humidifier installation, chilled water studies, Day Care Center, over 40 total projects.
- Braxton County Memorial Hospital
- Canaan Valley State Park Lodge and Recreation Facilities
- Public Health Centers for Regions VII and IX
- Consolidation Coal Company Corporate Office Building
- Holiday Plaza Mall
- North Marion High School
- Morgantown Unity Manor High Rise Apartments
- Veterans Administration Hospital Additions
- Blackwater Falls State Park Lodge
- Marion County Elementary Schools
- Randolph County Elementary Schools Air Quality Study
- Fibair Corporation Humidification System
- Various Doctor Offices and Medical Centers
- Fairmont State College Buildings
- West Virginia University Buildings
- Air Quality and Sick Building Expert Witness Cases
- Product Liability Expert Witness Cases
- Expert System Software Development for the Use of Wood as an Energy Source
- Expert System Software Development for Energy Use in K-12 Schools
- Expert System Design Software of Ground Source Heat Pumps
- Deep well geothermal system design

- Leader of the Projects With Industry Program at WVU since 2001
- Director of the Center for Building Energy Use for the West Virginia Division of Energy

Professional Societies

- Member- American Society of Mechanical Engineers (ASME)
- Life Member- American Society of Heating , Refrigeration and Air Conditioning Engineers (ASHRAE)
- Member- Society of Automotive Engineers (SAE)

MILLER ENGINEERING, INC.

Staff – Qualifications and Experience

Jack Jamison

Jack brings 20 years as an electrical/building inspector and over 25 years of experience in the commercial electrical construction industry. His knowledge and experience are valuable resources to Miller's complete assessment process.

Project Role: Master Code Official

- *Facility Review, Code Research, Field Observations, Issue Resolutions, and Project Evaluation*

Professional History

2010- Present	Miller Engineering, Inc.	Code and Construction Specialist
1999-2010	Megco Inspections	Chief Inspector
1972-1998	Jamison Electrical Construction	Master Electrician

Education

1971 Fairmont State College, BS-Engineering Technology-Electronics

Licenses and Certifications

- Master Code Professional, IAEI Master Electrical Inspector, Class C Electrical Inspector – WV, PA, MD, & OH
- ICC Commercial Building, Building Plans, Commercial Plumbing, Residential Energy, and Accessibility Inspector/Examiner
- WV Master Electricians License
- NCPCCI-2B, 2C, 4B, 4C: Electrical & Mechanical General/Plan Review
- OSHA 30 Hour Course: General Industry
- NFPA Code Making Panel 14 – NEC 2014 Edition

Travis Taylor, PE

Experience in project management facilitates Travis's ability to create and design constructible projects. Prior to joining the Miller Engineering team he was directly responsible for managing $10 million in electrical construction budgets. His experiences encompass both new construction and renovation. Travis maintains professional competencies by attending seminars and continuing education classes. These include local ASHRAE classes in addition to classes on electrical systems, and also steam systems through Shippenburg Pump Company. As lead engineer he provides HVAC, mechanical, plumbing, and electrical design solutions and services for our clients. In addition, he is part of our team's complete assessment process in both planning and MEP design through construction administration.

Project Role: Lead MEP Engineer

- *Design of Mechanical, Electrical, and Plumbing Systems*
- *Building Information Modeling - Revit*
- *Constructible Materials Evaluation*
- *Site Evaluation and Mechanical System Review*
- *Submittal and RFP Review*
- *RFI Coordination, Review, and Response*
- *Construction Observation*

Professional Project Highlights

- Blackwater Falls Lodge Boiler Replacement
- MTEC Welding Shop
- North Elementary Boiler Replacement
- WV State Building 36 HVAC Upgrades
- WV State Building 25 HVAC Piping Replacement
- Graftek Steam Systems Evaluations and Modifications
- Bobtown Elementary School HVAC Upgrades
- Holly River State Park Primary Electric Service Replacements Phase I & II
- Pipestem Lodge McKeever Lodge HVAC Piping Replacement

Professional History

2011-Present	Miller Engineering, Inc.	Staff Engineer
2006-2011	Tri-County Electric, Co.	Project Manager
2006-2006	Schlumberger	Field Engineer Trainee - MWD

Education

2006 West Virginia University, BS – Mechanical Engineering

Licenses and Certifications

- Professional Engineer - State of West Virginia
- OSHA 10-hour Course: Construction Safety & Health

Joseph Machnik

Joe has experience with AutoCAD, MEP and Revit MEP. He provides design modeling, drafting and supervised design services and construction support for Miller Engineering.

Project Role: MEP Designer

- *Revit/CADD Coordination of New Construction and Renovation Designs*
- *Building Information Modeling Specialist*

Professional Project Highlights

- Bobtown Elementary HVAC
- WV State Building 25 HVAC Piping Replacement
- Blackwater Falls Boiler Replacement
- Suncrest Middle Gym HVAC
- North Elementary Gym HVAC
- Graftek Steam Systems Evaluations and Modifications
- WV State Building 36 HVAC Upgrades
- Pipestem Lodge HVAC Piping Replacement
- Westwood Middle Cooling Tower

Professional History

2010 – Present Miller Engineering, Inc. MEP Designer

Education

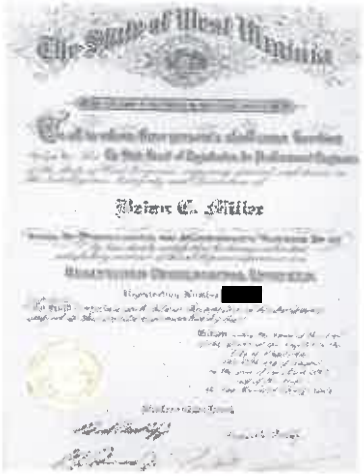
2008 Penn State – Fayette, AS - Building Engineering Systems Technology: *Building Environmental Systems Technology*

2007 Penn State – Fayette, AS - Building Engineering Systems Technology: *Architectural Engineering Technology*

Additional Training

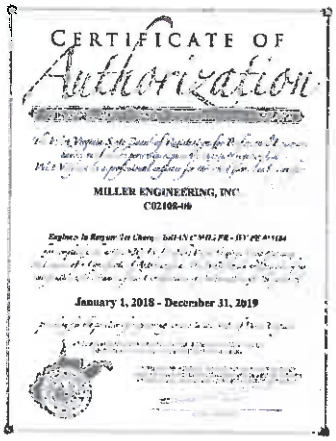
2016 – Shippenburg Pump Company – Steam Systems Training

Staff – Proposed Staffing Plan



Brian C. Miller

[redacted]



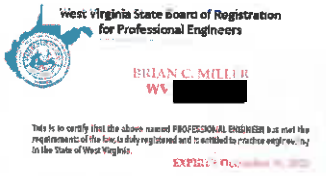
CERTIFICATE OF

Authorization

MILLER ENGINEERING, INC

C02108-06

January 1, 2018 - December 31, 2019



West Virginia State Board of Registration for Professional Engineers

BRIAN C. MILLER

WV [redacted]

This is to certify that the above named PROFESSIONAL ENGINEER has met the requirements of the law, is duly registered and is entitled to practice engineering in the State of West Virginia.

EXPIRES December 31, 2019

The State of West Virginia

To all to whom these presents shall come Greeting

The State Board of Registration for Professional Engineers

Travis W. Taylor

DOES IN PURSUANCE OF AUTHORITY VESTED IN IT

REGISTERED PROFESSIONAL ENGINEER

Registration Number [redacted]

Members of the Board

West Virginia State Board of Registration for Professional Engineers

TRAVIS W. TAYLOR

WV [redacted]

This is to certify that the above named PROFESSIONAL ENGINEER has met the requirements of the law, is duly registered and is entitled to practice engineering in the State of West Virginia.

EXPIRES December 31, 2019

Hereby Certifies that

Jack E. Jamison, Jr.

has demonstrated professional qualifications through a written examination based on the National Electrical Code® along with successful completion of field practice and documented expertise in required categories and has hereby achieved certification as

Master Electrical Inspector

Effective Through

September 30, 2011

Certificate/Identification No.

[redacted]

Montum Architecture

Thomas Pritts, AIA, LEED-AP, CSI-CCS

Tom founded Montum Architecture in 2017. He has more than 15 years experience in design, specification, and project management. During his former employment, Tom has designed and managed dozens of built projects. His experience encompasses a wide range of projects including K-12 and higher education facilities, financial Institutions, emergency services buildings, and automotive dealerships. A native of Mineral County, Tom is member of the West Virginia Chapter of American Institute of Architects and was involved in the establishment of the US Green Building Council's West Virginia chapter. He is highly skilled in the design of complex building systems, technical construction detailing and specifying, and construction contract administration. These skills were critical in the development and maintaining of many multi-year, multi-project relationships with Clients in his previous employment.

Project Role: Relationship Manager – Primary Point of Contact

- Principal in Charge
- Design and Project Management
- Concept and Construction Design
- Quality Assurance and Control

Professional History

2017- Present	Montum Architecture	Architect
2004-2017	Alpha Associates	Associate and Architect
2003	Marshall Craft Associates	Architectural Intern

Education

2004	Virginia Tech	Bachelors of Architecture

Licenses and Certifications

- Licensed Architect (West Virginia, Maryland)
- NCARB Certificate
- Construction Specifier Institute – Certified Construction Specifier
- LEED-AP Certified
- Part 107 Remote Pilot
- 30-hour OSHA Card

Associations and Memberships

- American Institute of Architects
- Mineral County Chamber of Commerce – 1st Vice President

Professional Project Highlights

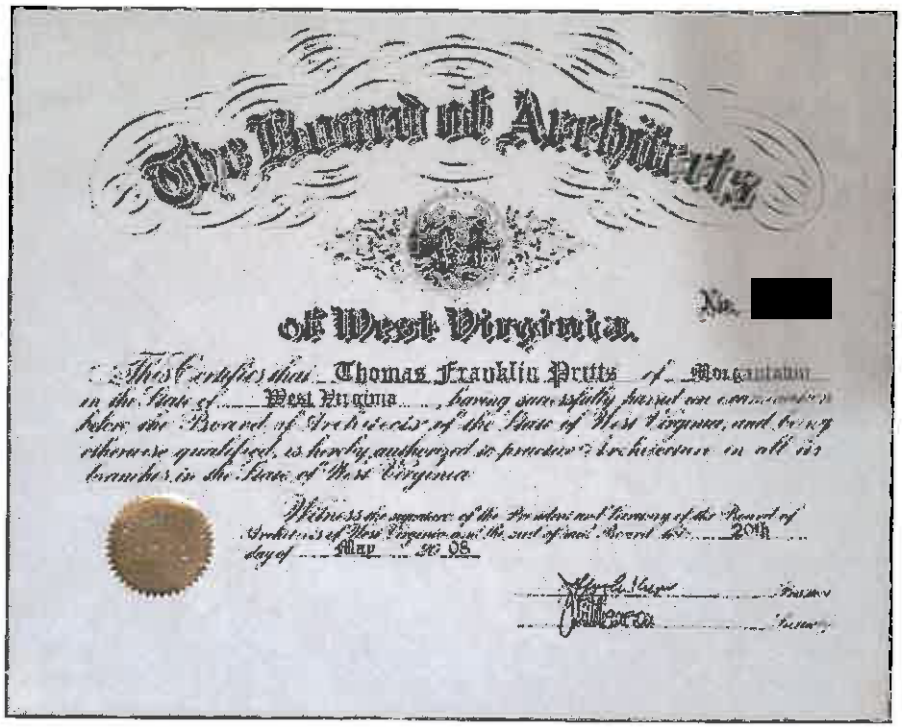
- Potomac State College – Bachelor of Nursing Renovation
- Wyoming East High School HVAC Renovation – Wyoming County Schools, WV
- Mountainview and MTEC HVAC Renovation – Monongalia County Schools, WV
- Berkeley Springs State Park – Pool Bathhouse Roof Replacement
- Berkeley Springs State Park – Old Roman Bath Renovation
- Blackwater Falls State Park – Boiler Room Renovation
- Our Lady of the Mountains Parish – Bathroom Renovation
- Mountain View Assembly of God – Rec Hall Ceiling Design

Professional Project Highlights (former employment built projects)

Montum

Architecture

- Potomac State College – ADA Connector Building, Church-McKee Plaza, Shipper Library Façade
- WVU Engineering Sciences Building – East Wing Addition, 10th Floor Fit-Out, Basement Renovation
- WVU Engineering Research Building – G07 & G08 Renovation
- WVU Equine Education Center
- WVU College of Physical Activities and Sports Sciences/ Student Health Center
- WVU Center for Alternative Fuel Engines and Emissions
- WVU Colson Hall Water Infiltration Repairs
- WVU Mountainlair Water Infiltration Repairs
- WVU Chemistry Research Laboratories Fit-Out
- WVU Creative Arts Center Wheelchair Lift
- Alderson Broaddus University – Pyles Arena Deck Replacement
- Glenville State College – Morris Stadium Skybox
- Washington High School, Jefferson County Schools, WV
- Pineville Elementary School, Wyoming County Schools, WV
- Huff Consolidated School, Wyoming County Schools, WV
- Aurora School Addition, Preston County Schools, WV
- Riverview High Field House Design-Build, McDowell County Schools, WV
- Safe School Entries, Monongalia County Schools, WV
- Morgantown High Elevator, Monongalia County Schools, WV
- 2010 Comprehensive Education Facilities Plan- Monongalia County Schools, Wyoming County Schools
- Clear Mountain Bank Branches, Oakland, MD - Reedsville, WV - Kroger-Sabraton, WV
- Grant County Bank, Petersburg, WV
- Fairmont Federal Credit Union, Bridgeport, WV
- Freedom Ford, Kia, and Volkswagen Automotive Dealerships, Morgantown and Clarksburg, WV
- Jenkins Subaru Addition, Bridgeport, WV
- Elkins Fordland Renovation - Elkins Chrysler Dealership, Elkins, WV
- Harry Green Nissan Design-Build, Clarksburg, WV
- Cool Green Automotive Addition and Renovation, Shepherdstown, WV
- Veteran's Affairs – OI&T Office Fit-Out, Shepherdstown, WV
- OPM, Eastern Management Development Center Addition, Shepherdstown, WV
- National Energy Technology Laboratory – Building B-8 Roof Replacement, Morgantown, WV
- US Coast Guard – Conference Room Renovation, Martinsburg, WV
- Eastern Panhandle Transit Authority Addition, Martinsburg, WV
- Cacapon State Park – Old Inn HVAC and Interior Renovation
- WV National Guard - Armory Office Fit-out, Parkersburg, WV
- South Berkeley Fire Station, Inwood, WV
- Jefferson County Emergency Services Agency – New Headquarters
- Berkeley County Ambulance Authority – South Station Renovation and Addition
- Poolhouse Renovation, McMechen, WV
- Community Center, Ridgeley, WV
- Wastewater Treatment Plant Renovations, Martinsburg, WV
- Public Works Building, Fairmont, WV
- Oatesdale Park Little League Fields, Martinsburg, WV
- St. Luke Canopy Replacement, Morgantown, WV
- Freshwater Institute – Aquaculture Building, Shepherdstown, WV
- Clarion Hotel Renovation, Shepherdstown, WV
- Shenandoah Village Apartments – Façade and Deck Replacement, Martinsburg, WV
- Regional Eye Associates/ Surgical Eye Center, Morgantown, WV
- Bavarian Inn – Infinity Pool/ Pool Bar, Shepherdstown, WV


The Board of Architects
of West Virginia.
No. [redacted]
This certifies that Thomas Franklin Pritts of Morgantown
in the State of West Virginia, having successfully passed an examination
before the Board of Architects of the State of West Virginia, and being
otherwise qualified, is hereby authorized to practice Architecture in all its
branches in the State of West Virginia.
Witness the signature of the President and Secretary of the Board of
Architects of West Virginia and the seal of said Board this 20th
day of May A.D. 08

The West Virginia Board of Architects

certifies that

THOMAS F. PRITTS

is registered and authorized to practice
Architecture in the State of West Virginia.

In testimony whereof this certificate has been issued
by the authority of this board.

Certificate Number 4049

The registration is in good standing until June 30, 2019.

STATE OF WEST VIRGINIA

Board Administrator

Carol A. Stevens, PE, F.ASCE

Structural Engineer

CAS STRUCTURAL ENGINEERING, INC.

EDUCATION

West Virginia University, BSCE, 1984
Chi Epsilon National Civil Engineering Honorary
The Pennsylvania State University, ME Eng Sci, 1989

PROFESSIONAL REGISTRATION

P.E.	1990	Pennsylvania
P.E.	1991	West Virginia
P.E.	1994	Maryland
P.E.	2008	Ohio
P.E.	2010	Kentucky
P.E.	2013	Virginia

BACKGROUND SUMMARY

2001 – Present	President, Structural Engineer CAS Structural Engineering, Inc.
1999 – 2001	Structural Engineer Clingenpeel/McBrayer & Assoc, Inc.
1996 – 1999	Transportation Department Manager Structural Engineer Chapman Technical Group, Inc.
1995 – 1996	Structural Engineer Alpha Associates, Inc.
1988 – 1995	Structural Department Manager Structural Engineer NuTec Design Associates, Inc.
1982 – 1988	Engineer AAI Corporation, Inc.

PROFESSIONAL ASSOCIATIONS

American Society of Civil Engineers
National Society of Professional Engineers
American Concrete Institute
American Institute of Steel Construction
West Virginia University Department of Civil and Environmental Engineering Advisory Committee
West Virginia University Institute of Technology Department of Civil Engineering Advisory Committee

EXPERIENCE

West Virginia, Collett House Structural Repairs: Structural renovations of 1770's log and framed structure to stabilize foundation and make repairs to log wall and floor. Building is on the National Register of Historic Places.

West Virginia, Job's Temple: Structural repairs to 1860's log structure. Building is on the National Register of Historic Places.

West Virginia, First Presbyterian Church Restoration: Structural renovations of steel in lantern level and terra cotta cornice, overview of repairs to limestone and terra cotta façade of 1920's structure.

West Virginia, Hawks Nest State Park Lodge: Repairs to spandrel beams at roof level and analysis and repairs of structural cracks in stairtower.

West Virginia, State Capitol Complex, Governor's Mansion: Structural analysis and design in addition to evaluation report for modifications and renovations to several areas of mansion. Building is on the National Register of Historic Places and was constructed in the 1920's.

West Virginia, State Capitol Complex, Holly Grove Mansion: Structural evaluation report for preliminary condition assessment of building structure. Building is on the National Register of Historic Places and was constructed in 1815.

West Virginia, Lewis County Courthouse: Structural investigation for work required to update structure and apply for grant monies through WVCFIA.

West Virginia, State Capitol Complex, Main Capitol Building Parapet: Exploratory investigation of limestone/brick parapet/balustrade of Main Capitol Building to determine cause of movement/cracking/ leaks. Construction contract for repairs has been completed. Building is on the National Register of Historic Places and was constructed in the 1920's and 1930's.

West Virginia, State Capitol Complex, Main Capitol Building Dome: Exploratory investigation of structural steel components of Lantern Level of dome and development of contract documents for repairs. Building is on the National Register of Historic Places and was constructed in the 1930's. Received a NYAIA Merit Award for Design Excellence.

West Virginia, Twin Falls Resort State Park: Structural evaluation of existing recreation building.

West Virginia, Pipestem Resort State Park: Structural evaluation of existing recreation building.

West Virginia, Historic Putnam-Houser House (Parkersburg): Designed system for stabilization and upgrades to floor framing of building that was constructed in the 1700's.

West Virginia, Upshur County Courthouse: Developed construction documents for structural repairs to main entrance, dome and monumental sandstone columns of 1899 structure. Work was recently completed and received a WVAIA Honor Award for Design Excellence.

Ohio, Mahoning County Courthouse: Completed preliminary structural observation report of exterior façade conditions to recommended phased repairs for terra cotta and granite façade. Building is on the National Register of Historic Places and was constructed in the early 1900's.

West Virginia, State Capitol Complex, Building 5: Structural design and analysis for support of new boilers and other mechanical equipment to be placed in mechanical penthouse.

West Virginia, Hampshire County Courthouse: Structural design for new elevator for existing historic building.

West Virginia, State Capitol Complex, Building 3: Structural design and construction administration of repairs to limestone canopy. Building is eligible to be placed on National Register of Historic Places and was constructed in the 1950's.

West Virginia, State of West Virginia Office Building #21, Fairmont, WV: Preliminary structural observation report for condition assessment of building structure.

PREVIOUS EXPERIENCE

West Virginia, State Capitol Building, North Portico Steps: Designed structural system to replace deteriorated reinforced concrete slab at landing on north side of Capitol steps. Building is on the National Register of Historic Places and was constructed in the 1930's.

West Virginia, Beech Fork State Park Pool, Bathhouse and Cabins: Designed structure for new bathhouse, swimming pool and cabins.

West Virginia, Moncove Lake State Park Pool: Designed structure for new swimming pool.

West Virginia, Upshur County Courthouse Annex: Performed structural evaluation and design for repairs to existing multi-story Annex addition.

West Virginia, Farrell Law Building: Performed analysis of existing deteriorated structural sidewalk over parking area. Recommended repair solutions for reinforced concrete and aged terra cotta façade of 1920's building.

West Virginia, Canaan Valley Resort and Conference Center: Structural feasibility study to upgrade lodging units.

West Virginia, West Virginia University Masterplan: Investigated structural floor load capacity of several university buildings as a consultant to a large national architectural firm for masterplan.

West Virginia, Morgantown High School Additions: Designed steel framing and foundations for science classroom, cafeteria and gymnasium additions to existing education complex.

West Virginia, Grafton High School Addition: Designed steel framing and foundations for new science classroom addition to existing high school.

Pennsylvania, York County Government Center: Structural analysis and design of 1898 former department store converted to county government offices. Interior renovations included adding floor framing at mezzanine level, analyzing and redesigning deficient floor framing, and adding new elevators. Exterior renovations included complete façade rework to recreate original appearance.

Pennsylvania, Metropolitan Edison Company, Headquarters: Structural design for new 80,000 SF two-story office addition to existing complex.

MILLER ENGINEERING, INC.

What our satisfied customers have to say...

"Hard working, do-whatever-it-takes, diligent team that provides excellent customer service is what you can expect from Miller Engineering."

--Chris Halterman

"As a design/build team, working with Miller Engineering, our project involving a private surgical hospital together was a success – completed ahead of schedule and on budget. Miller worked with us throughout the project to consult, engineer and inspect the mechanical systems. Craig Miller, PE and his staff are working with us again, and are very important members of our design/build team. I highly recommend their services.

--Richard J. Briggs

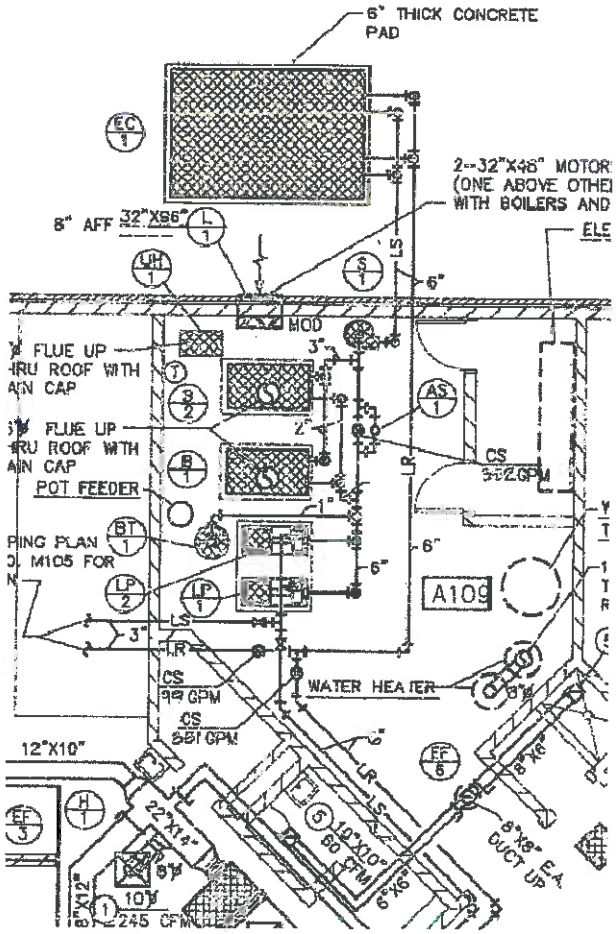
Brad Leslie, PE *Assistant Chief* *WV Division of Natural Resources* *State Parks Section* *324 4th Avenue* *South Charleston, WV 25303* ***(304) 558-2764 ext. 51823*** Bradley.S.Leslie@wv.gov	**Kerri J. Wade, MSW** *Extension Agent - Kanawha County* *West Virginia University* *4700 MacCorkle Avenue, SE* *Suite 101* *Charleston, WV 25304* ***304.720.9573*** Kerri.Wade@mail.wvu.edu	**J. Douglas Carter** *General Manager* *Potomac Valley Transit Authority* *185 Providence Lane* *Petersburg, WV 26847* ***(304) 257-1414*** jcarter@potomacvalleytransit.org
Bob Ashcraft *School Safety & Loss Coordinator* *Monongalia County Schools* *533 East Brockway Street* *Morgantown, WV 26501* ***(304) 276-0152*** rbashcraft@access.k12.wv.us	**Mike Trantham** *Program Administrator Senior* *WVU Environmental Health & Safety* *P.O. Box 6551* *975 Rawley Avenue* *Morgantown, WV 26506* ***(304) 293-5785*** Mike.Trantham@mail.wvu.edu	**Richard J. Briggs** *Vice President* *Lutz Briggs Schultz & Associates Inc.* *239 Country Club Drive* *Ellwood City, PA 16117-5007* ***(724) 758-5455*** lbsa@zoominternet.net

From Jonathan Miller, Mechanical Project Manager, Nitro Mechanical:

"Miller Engineering is not your average engineering company; they work with the owner AND the contractor to solve all issues that arise throughout the project to make the process as fluid as possible.

MILLER
ENGINEERING, INC.

TAB 4 – EXPERIENCE



MILLER ENGINEERING, INC.

Descriptions of Past Projects Completed – Mechanical

Canaan Lodge Chiller Replacement

Services Provided:

- Electrical
- Mechanical

Project Cost: $223K
Facility Area: 68,000 ft^2
Owner: West Virginia Division of Natural Resources

PROJECT GOALS: Improve part load cooling performance and improve reliability of lodge cooling.

MEI designed a small chiller plant comprising of two chillers allowing the plant to operate at maximum efficiency and performance.

The existing chiller serving the lodge at Canaan Valley Lodge suffered many premature failures due to a lightning strike, in addition to poorly handling part loads. Due to both the local climate and greatly varying occupancy, the lodge requires a significant portion of cooling season under partial load. Miller Engineering evaluated the existing chiller. MEI designed the replacement to be a "chiller plant", with a 60 ton and 120 ton chiller to handle the part and full loads of the lodge. Piping and controls were modified to optimize the performances of both chillers. Now the lodge cooling runs with optimal performance at part load while still having the capability to handle full load which happens during conferences.

Project Contact:
Bradley S. Leslie, PE, Assistant Chief
State Parks Section
Phone: (304) 558-2764

Project Experience - HVAC Upgrade

West Virginia State Building 36 (1 Davis Sq.)

Charleston, WV

Services Provided:

- HVAC System Replacement
- Mechanical Piping
- Electric
- Construction Administration

Estimated Budget: $2.1M
Facility Area: 58,400 ft²
Owner: State of West Virginia – General Services Division

PROJECT GOALS:
Design and implement the installation of a temporary chiller, then evaluate and design long terms HVAC renovations to the building.

The goals were met through immediate response to the need for a temporary chiller, including site visits on weekends and after hours. Once the temporary chiller was in place, intensive field work was used to verify and supplement the limited record drawings available. Evaluation and design was completed in a very short period for the project size. Detailed goal and concern tracking was used to avoid missing items in the abbreviated design timeline.

Project Contact:
David Parsons, Energy Manager
WV General Services
112 California Ave
Charleston, WV 25305
(304) 957-7122

The 30-plus year old chiller serving Building 36 failed in the spring of 2016. MEI was retained to design the installation of a temporary rental chiller, which remains in service at this time. MEI was then retained to evaluate the HVAC systems and design a full HVAC retrofit to the building due to the condition of the air handlers, ductwork, VAV boxes, and associated systems. The building presented unique challenges as it was originally two buildings in which the common space was later in filled to create one building. The deck to deck heights in some areas are very limited, resulting in the need for accurate evaluation, design, and detailing in the construction documents. MEI designed a phased approach to accomplish the project. The phasing was developed directly with the owner to minimize the impact on the building occupants; who had to relocate to swing space phase by phase. Instead of just replacing the existing system in-kind, MEI designed a system utilizing three rooftop units ducted vertically through the building, which eliminates the sole source failures that have plagued the building for several years. The project was bid and then cancelled by the Owner.

Morgantown Ice Rink Chiller Replacement

Services Provided:

- Piping Systems Evaluation
- Piping Design
- Electrical Design

Budget: $585K
Facility Area: Approx. 21,000 ft^2
Owner: BOPARC of Morgantown

PROJECT GOALS: Replace chiller with new one capable of operation at low ambient temperatures. Fix humidity issues.

MEI worked alongside the energy services company to choose a chiller which would meet the low ambient operation criteria and install with minimal modifications to the existing system.

Project Contact:
All Owner's Staff related to the project no longer work for the Owner. Names and numbers of those individuals are available on request.

Miller Engineering was contracted, by a third party energy services company, to design the modifications to the main equipment piping and facility electrical system in support of a new air cooled chiller for the ice rink low temperature systems. The original chiller used refrigerant R22, which was facing refrigerant phase out, and had reached the end of its serviceable life. A new chiller, sized and selected by the service company, was installed using our design to "plug" the new chiller into the existing systems.

The ice rink was originally built as a shaded structure but was enclosed in the mid 1990's with no consideration given to controlling humidity. Humidity had been a problem since the original construction due to the rink location. As part of the contract, we evaluated the need for additional system capacity, comfort heating, and most importantly, mechanical dehumidification. Our design was taken to the design development phase and this additional work was removed from the energy services contract and the project by the Owner.

MILLER ENGINEERING, INC.

Descriptions of Past Projects Completed – MEP

South Middle School HVAC Renovations

Services Provided:

- Mechanical
- Electrical
- Plumbing
- Fire Alarm

Contract Amount: $1.45M
Facility Area: 111,800 ft^2
Owner: Monongalia County Board of Education

PROJECT GOALS: Improve air quality and temperature controls. Limit school disruptions.

MEI designed retrofits to existing HVAC equipment which will allow the system to perform correctly. The project was detailed in phasing to permit some work to be performed during the school year during breaks and holidays to keep the school in operation.

South Middle School was served by a single DX AHU with various terminal devices such as VAV and self-piloted boxes. The school has been suffering from poor air quality and temperature control issues. Additionally, the condensing unit had failed. MEI designed a rebuild of the AHU; replacing the DX coils with HW and CW coils. The two large supply fans were replaced using a fan wall system which allowed the fans to operate at max output and minimize noise and vibration issues which plagued the old sled mounted fans. A new boiler serves the hot water coil and two chillers were installed with piping on the roof to serve the AHU cooling coil. The air terminal devices will be rebuilt and retrofitted to provide better control. The project is currently under construction with the AHU rebuild and chiller installation completed. The air terminal device retrofits will be completed during summer break.

Project Contact:
Robert Ashcraft
Monongalia County Facilities
Phone: (304) 291-9210

MILLER ENGINEERING, INC.

Project Experience: Renovation

Canaan Lodge Ice Rink Evaluations and Modifications

Services Provided:

- Systems Evaluation
- MEP Design
- Maintenance/ Repair Support

Budget: $225K
Facility Area: 12,800 ft^2
Owner: West Virginia Division of Natural Resources

PROJECT GOALS: Improve performance and reliability of ice rink chiller system.

MEI evlauated the chiller system and designed modificaitons and replacements to improve operation life. MEI also provided training to the staff on operation and maintenance to help keep the sytem in operation.

Project Contact:
Bradley S. Leslie, PE, Assistant Chief
State Parks Section
(304) 558-2764 ext. 51826

Miller Engineering was contracted, on two separate occasions, to evaluate and then design modifications and repairs to the ice rink low temperature refrigeration systems. The original heat recovery system has failed and previous attempts to modify the system to an air cooled solution were unsuccessful, resulting in poor or no ice during moderate weather; and failure of two compressors in a very short time. MEI performed a failure mode analysis and worked with the contractor to modify the systems to obtain significantly better system performance. The subsequent modifications were made as a result of controls obsolescence and our efforts included training of the staff on proper operation and monitoring of the systems. This phase included repairs to the power system serving the rink.

Project Experience – Electrical Upgrade and HVAC Renovation

Dominion Post – Greer Building

Morgantown, WV

Services Provided:

- Field Study
- HVAC Upgrade
- Electrical Upgrade
- Construction Administration

Estimated Budget: $1.8M
Facility Area: 18,000 ft^2
Owner: Greer Industries, Inc.

GOALS: Evaluate and make recommendations for HVAC issues.

Goals were accomplished by studying the building and making and implementing the recommendations of the study. The resulting 2 projects upgraded the electrical system, reconnected the backup generator, and upgraded the HVAC, with Owner continued occupancy, in a multi-phase approach.

MEI was asked to evaluate the HVAC systems and report our findings. During the field study, Miller Engineering learned of HVAC system disintegration, air quality concerns, and interconnection of air systems between two levels of the building. Our study revealed the need for a complete HVAC upgrade but also for the need to upgrade the power prior to the HVAC work. MEI design an electrical upgrade and implemented that while completing the HVAC design work. Our study included an evaluation of the existing backup generator, which we determined could be re-used.The goal of the project was to be a phased approach that integrated, updated and stabilized temperatures throughout the current floor plan, building levels and pending office reconfigurations. The main air handling systems, piping and ductwork were replaced and reconfigured as a necessity to serve the building's multiple levels and floor plan. The project was a success as a newly designed system was implemented into the existing floor plan and designed as scalable for future needs of the building's owner. Temperature control issues were resolved and the residents of the building could enjoy a more hospitable, consistent working environment. The Greer Building also serves as an emergency broadcast center for north central WV. MEI coordinated all aspects of construction with the owner to ensure there were no issues preventing the operation of the facility during construction.

Project Contact:
Chris Halterman, Director of Operations
The Dominion Post
Greer Industries, Inc.
Phone: (304) 376-2642

Project Experience – Electrical, HVAC Piping, Fire Alarm

Pipestem McKeever Lodge

Pipestem, WV

Services Provided:

- HVAC
- Plumbing
- Electrical
- Fire Alarm
- Accommodation of Existing Systems

Estimated Budget: $2.7M
Facility Area: 63,000 ft²
Owner: West Virginia Division of Natural Resources

PROJECT GOALS:
Coordinate and deliver multiphase project over multiple years with continued use of the building.

Goals met thru detailed use of BIM modeling to plan follow on phases early in initial design. Implemented interconnect of two separate chiller and boiler systems to permit continued operation. Repairs included plans for follow on mechanical, HVAC, Electrical, and fire alarm work.

Project Contact:
Brad Leslie, PE, Chief
WV DNR State Parks Section
(304) 389-7663

The original HVAC piping at McKeever Lodge had exceeded its lifespan and had been suffering from corrosion leading to multiple leaks, including one causing an electrical service outage. Miller Engineering was hired to investigate the existing piping, discovering all of the some 10,000 linear feet of piping required replacement. As this lodge is regularly occupied for larger conferences, the project had to be phased to minimize the amount of guest rooms taken out of service at one time. MEI also designed provisions to interconnect the lodge's two separate boiler/chiller plants so one plant could operate the entire lodge at a partial capacity while the other plant was replaced and re-piped. This interconnect also allows the lodge to operate in the event of a boiler or chiller outage. Power was provided to new equipment, and motor control centers were added to control the building loop pumps. A new building CW and HW plant control system was installed to allow the equipment to run at optimum efficiency while meeting the lodges heating and cooling needs. A follow on Fire Alarm Replacement constituted the last phase of the project.

Project Experience – Electrical

Ripley Warehouse Electrical Upgrades

Petersburg, WV

Services Provided:

- Backup Power
- Electrical

Electrical Budget: $860K
Facility Area: Approx 42,000 sq ft
Owner: WV Dept. Of Agriculture

PROJECT GOALS:
Upgrade service to handle future expansion and keep facility in operation.

MEI's plan to use a pre-fabricated building in conjunction with two generators allows the new service to be "built" prior to switchover. This will prevent long term outages as the facility can handle shorter duration outages.

Project Contact:
Alan Clemans
WV Dept. of Agriculture
(304) 558-2221

The West Virginia Department of Agriculture (WVDA) Ripley Warehouse houses the food distribution program, primarily for WV K-12 schools. The facility consists of office space, commodity warehouse, and approximately 20,000 square feet of cooler & freezer space for storing food. The WVDA is looking to expand its cooler / freezer space, thus requiring an electrical service upgrade to handle the additional cooler / freezer compressor loads. MEI performed a thorough evaluation of the existing electrical service and distribution system. After reviewing the system, performing load calculations, and coordinating with the refrigeration vendors, determined the service should be increased from 1,200 amps to 3,000 amps allowing for future expansion. As there is no space in the warehouse or compressor buildings for equipment, MEI has proposed to house the new service equipment in a pre-fabricated building. The new service equipment will allow the building distribution to be "split" allowing the existing generator to be re-used. A second generator will be installed to handle the remaining loads. This approach will allow a phased approach to installation preventing any long duration outages. The proposed solution also allows partial building operation in the event of a generator failure. This project is currently in design with the intent to be bid during the summer of 2019.

Project Experience – MEP

Grant Co. Bank Addition & Renovations

Petersburg, WV

Services Provided:

- Electrical
- HVAC
- Plumbing
- Fire Alarm

Addition Size: 3,200 sq ft
Original Bank Size: 13,400 sq ft

PROJECT GOALS:
To build the addition to meet the owner's needs and keep existing bank open for business.

MEI & Alpha designed a phased approach which called for specific construction activities to occur at each phase which allowed for the bank to remain in operation. The new generator allows the bank to serve as the call and network center for all of its branches.

Miller Engineering teamed up with Alpha Associates to design an addition to the Grant County Bank in Petersburg, WV. The 3,200 sq ft addition consists of a new main lobby, teller space, drive-through, and offices. A new rooftop unit serves the addition for HVAC. MEI provided design services for new electrical, lighting, data, and plumbing. The original bank building received a new fire alarm system in addition to a LED lighting replacement throughout. A backup generator was installed to serve the drive-through, teller area, security system, and data servers. MEI coordinated with bank consultants for power and data requirements for bank security and surveillance. Construction was phased so the original drive-through could remain in operation until the new drive-through area was operable to minimize customer disturbance.

Project Contact:
Rick Colebank, PE
Alpha Associates
(304) 291-2234

Project Experience – Electrical

Elkins DNR Operations Center Standby Generator

Elkins, WV

Services Provided:

- Backup Power
- Electrical Distribution
- Emergency Lighting

Electrical Budget: $92K
Facility Area: Approx 30,000 sq ft
Owner: WV DNR

PROJECT GOALS:
Provide backup power to allow for operations to continue and keep freezers in operation. Provide emergency egress lighting.

MEI selected a generator which would handle critical loads. The loads were broken out and a separate emergency distribution was set up. LED retrofit kits were used as the facility has a metric ceiling, which is uncommon in the area.

The WV DNR Operations Center in Elkins, WV requested to have an emergency generator installed due to losses incurred from a long power outage caused by Hurricane Sandy. MEI coordinated which systems the DNR wanted on standby power. This required the installation of new panels which are fed through a transfer switch. Critical operation loads were installed in these panels. The owner requested a natural gas fueled generator, requiring modifications to the building's gas service. Some of the buildings light fixtures were retrofitted to LED with battery backup to provide some emergency lighting in common areas.

Project Contact:
Zack Brown
WV DNR
(304) 558-2771

Project Experience – Electrical

City of Glenville Water Improvement Project

Glenville, WV

Services Provided:

- Backup Power
- Electrical Service Upgrade

Electrical Budget: $250K
Facility Area: Approx 4,500 sq ft
Owner: City of Glenville, WV

PROJECT GOAL:
Provide a generator which would allow the plant to operate.

MEI worked with the plant staff to determine the operation sequence of the plant equipment to size the generator by using load management.

As part of an overall improvement to the Glenville Water Treatment Plant, MEI was tasked with designing backup power to provide enough power to continue water treatment operations. Challenges with this project were providing enough power to handle the starting of a large pump serving the nearby Federal Correctional Institute, while having the generator footprint small enough to fit on the limited available site. MEI worked with the plant staff to determine priority and staging of pump start-up sequence to size the generator at 500 kW. A new service entrance rated automatic transfer switch was installed and the electrical service was re-configured. The final wiring connections were coordinated with the owner to be performed when the plant was not in operation. MEI and the generator manufacturer trained the plant staff on how to stage the start-up of the pumps, with set delays, to stay within the generator's parameters. Overall, the design provided the plant with dependable backup power, while fitting in small footprint and within budget.

Project Contact:
Mark Sankoff, PE,
Potesta & Associates, Inc.
(304) 342-1400

Project Experience – Electrical

WV Wildlife Center Electrical Emergency Repairs

French Creek, WV

Services Provided:

- Backup Power
- Electrical

Electrical Budget: $300K
Owner: WV DNR

PROJECT GOAL:
Replace electrical distribution while keeping enclosures in service.

The new distribution system and generator will be installed and phased to keep the old distribution online until the new system is operational. The generator will allow the system to remain energized while the new service is switched over.

MEI was called to the WV Wildlife Center in French Creek over some concerns related to grounding & bonding. Upon evaluation, it was determined there were many deficiencies in the electrical distribution system which serves many of the animal enclosures. MEI quickly designed a new replacement distribution system consisting of mini-power centers located at each enclosure to power fence energizers, water heaters, and convenience receptacles. MEI designed the distribution so each enclosure is on its own circuit, so a disruption of one enclosure does not affect the others. Power to the enclosures are a security priority to both the animals and guests. A generator will serve to allow the power to enclosures to remain active while the new service entrance equipment is being installed. After completion, the generator will serve as backup power to the enclosures. The project is currently being constructed and anticipated to be completed in June 2019.

Project Contact:
Brad Leslie, PE
WV DNR
(304) 558-2764

Project Experience – Electrical

Potomac Valley Transit Authority Generator

Petersburg, WV

Services Provided:

- Backup Power

Electrical Budget: $74K
Facility Area: Approx 10,000 sq ft
Owner: Potomac Valley Transit Authority

PROJECT GOAL:
Provide Generator to handle facilities operations.

MEI reviewed the existing drawings, distribution, and utility usage bills to determine 150kW generator could handle the entire facility. A service rated transfer switch was installed over a weekend to limit disruption to operations.

Miller Engineering was called back to the Potomac Valley Transit Authority to design a backup power system for the facility which is comprised of bus garages, dispatch, and office space. When evaluating the existing electrical distribution, it was determined that a whole facility generator would be the most cost effective, opposed to breaking out circuits and installing emergency distribution equipment. MEI worked with the PVTA staff to determine a location which would not interfere with bus routing and be above the flood plain. A new service rated automatic transfer switch was installed. The new ATS was installed over a weekend to keep the garage in operation. The project was placed to bid and successfully completed in September of 2017.

Project Contact:
J. Douglas Carter
Potomac Valley Transit Authority
(304) 257-1414

Project Experience - HVAC Upgrade

West Virginia State Building 25

Parkersburg, WV

Services Provided:

- Mechanical Piping
- HVAC
- Electric
- Lighting
- Construction Administration

Estimated Budget: $843k
Facility Area: 58,500 ft²
Owner: State of West Virginia – General Services Division

PROJECT GOALS:
Piping - Evaluate and replace HVAC Piping.
6th Floor - Provide full MEP service for fit-out of office space in 6th floor.

The piping project goal was met by extensive evaluation into existing conditions and review of original design documents. Thorough discussions with maintenance and operations staff allowed MEI to develop a complete and phased approach.

The 6th floor is currently under design. MEI is part of a design team with Alpha Associates. Experience with the existing project allowed MEI to design a practical solution which integrates into the existing MEP systems.

Project Contact:
David Parsons, Operations and Maintenance Manager
State Capitol, Room E-119
(304) 957-7122

The PVC piping system at Building 25 had a history of leaking, along with smaller piping sagging over time and breaking, prompting the owner to replace the entire system. The building was a logistic challenge to design due to offset multi-level mezzanines, resulting in low deck-to-deck heights in the lower levels. A new, rolled-groove piping system was installed, including a new cooling tower and supporting structure, and connected to the original boilers. To eliminate the problems associated with manganese, which forms solids and clogs piping, the system was converted from water to propylene glycol with the flow rates adjusted to accommodate the change. The water source heat pumps which serve the building were flushed and cleaned to prevent contamination of the new water. MEI designed a phased approach to accomplish the piping, which was adjusted in consultation with the owner and contractor during construction to minimize the impact on the building occupants, who remained in the building during the entire construction period. MEI worked on an almost daily basis with the contractor to accomplish the re-piping of the building, providing support and real-time answers to questions and to work around challenges.

Project Experience - HVAC Upgrade

Building 22 2nd Floor Upgrades

Charleston, WV

Services Provided:

- Mechanical
- Electric
- Telecommunications
- Architectural
- Construction Administration

Renovation Area: 7,400 sq ft
Contract Amount: $398k
Owner: State of West Virginia – General Services Division

PROJECT GOAL:
Revise the floor plan, HVAC, Electrical and Data for new check processing equipment, while Owner working in adjacent spaces.

Goal met by intensive field investigation, detailed documents, close monitoring of construction. Post substantial equipment issues pursued until fully resolved.

West Virginia State Building 22 required renovations to the 2nd floor, which houses the state tax office. New check processing equipment, which has specific cooling, power, and data requirements, was purchased by the state. The floor plan needed modifications to accept the equipment and improve work flow. This building is an extremely high security area. It houses the tax and revenue department for the State of WV. Approximately 2.5 million dollars is processed through the 2nd floor daily.

Miller Engineering, along with Montum Architecture, designed the renovations to the 2nd floor to accommodate the changes needed for the equipment. The existing space was served by a fan powered VAV AHU. The existing air distribution was modified to meet the requirements of the revised floor plan. The processing room and server rooms, which require year - around cooling, are being served with computer-room air conditioning (CRAC) units. The revised floor plan called for modifications to the power and telecommunications layouts for the integrated furniture systems. The grounding and bonding systems for the server room were upgraded as well. This project was completed in April, 2018. We followed and resolved some equipment issues related to initial startup until November 2018.

Project Contact:
David Parsons, Energy Manager
WV General Services
112 California Ave
Charleston, WV 25305
(304) 957-7122

MILLER ENGINEERING, INC.

Project Experience – HVAC, Electric

Withers Brandon Hall

Philippi, WV

Services Provided:

- Electrical
- HVAC

MEP Budget: $700k
Facility Area: 31,800 ft²
Owner: Alderson Broaddus University
Status: Bidding

PROJECT GOALS:
Evaluate HVAC and design new system to be completed during summer.

MEI determined that converting to WSHPs would save insulation costs while causing minimal disturbances out in office / class space. The majority of new piping and ductwork will be in mechanical areas. This will meet the compressed schedule requirement.

As part of renovations to Withers Brandon Hall at Alderson Broaddus University, MEI was brought in to evaluate and design upgrades to the HVAC system. The existing chiller and piping insulation had failed. The existing system was a two-pipe system with chiller and boilers serving fan coil units. MEI proposed to re-use the piping and replace the fan coil units with water source heat pumps (WSHP). This allows the existing piping to be re-used and piping insulation would not have to be replaced. The chiller will be replaced with a fluid cooler located outside the building. The three non-condensing boilers will be replaced with a much more efficient modulating condensing "double stack" boiler. The ventilation units are located in the unconditioned attic space and are difficult to perform maintenance on. New ducted heat pumps tied to energy recovery ventilators will tie into the existing fresh air duct to provide ventilation and relief air. The design limits the amount of modifications outside of the mechanical rooms which will aid with the compressed construction schedule. The project is out for bid to be complete by August 2019.

Project Contact:
David Snider, AIA
Omni Associates, Inc
(304) 367-1417

MILLER ENGINEERING, INC.

Project Experience – MEP

MTEC & Mountainview HVAC Upgrades

Services Provided:

- Mechanical
- Electrical
- Plumbing
- Fire Alarm

Estimated Budget: $1.505M
Contract Amount: $1.559M
Owner: Monongalia County Board of Education
Status: In Construction

PROJECT GOAL:
Design a replacement of non-operational equipment with minimal impact to building.

In lieu of replacing the large and expensive AHU which serves MTEC, MEI designed modifications to the existing unit which reduced budget and allowed the project to occur over several weekend shutdowns, minimizing class disruption.

MEI compared the HVAC and ventilation requirements at Mountainview to the existing equipment. This led to keeping modifications primarily to heat pump replacement and addition of ERVs.

Project Contact:
Robert Ashcraft
Monongalia County Facilities
Phone: (304) 291-9210

Both the Monongalia County Technical Education Center (MTEC) & Mountainview Elementary Schools have HVAC systems which have exceeded their serviceable life spans. For MTEC, MEI designed upgrades and modifications to the existing AHU serving the building. The boilers, water heaters were also replaced as well. A new make-up air unit is designed to serve the new welding shop. Mountainview Elementary School will have the water-source heat pumps replaced in addition to the replacement of the boilers and cooling tower. The annex building at Mountainview Elementary lacked proper ventilation. Energy Recovery Ventilators (ERVs) were added to the fairly new split system. ERVs allowed for additional outside air without having to replace the split systems. Also included in the project is the replacement of the building automation systems (BAS) for both schools.

MILLER ENGINEERING, Inc.

Project Experience – MEP

Morgantown High School Boiler Replacement/ Area 4 HVAC Renovation

Services Provided:

- Mechanical
- Electrical
- Plumbing
- Fire Alarm

Estimated Budget: $1.0M
Contract Amount: $1.038M
Owner: Monongalia County Board of Education
Status: Complete

PROJECT GOALS:
Improve air quality while keeping budget and school disruption to a minimum.

A detailed set of plans allowed the replacement of HVAC equipment to tie into existing piping and ductwork with minor modifications. This kept the contract amount down and allowed the construction schedule to occur during the summer months, limiting interruption to student activities.

Project Contact:
Robert Ashcraft
Monongalia County Facilities
Phone: (304) 291-9210

Morgantown High school, like others throughout the state, has seen many changes through the years. Unfortunately the steam boiler plant remained in operation but with little maintenance for a number of years.The 40 year old boilers had exceeded their operational life and were experiencing reliability issues. MEI Evaluated the boilers and the associated 80 year old steam systems, recommending their replacement. Steam heating control was a significant issue.

Previous projects installed split DX refrigerant based systems in several classrooms within the science and technology wing. These units were obsolete and required replacement with a more reliable system, which can meet current ventilation standards. Additionally, there were 3 classrooms, which were heating only with little or no control, that required addition to the overall solution for this section of the building. Based on the conditions of the steam systems piping and devices, new hot water boilers were installed. This project was completed in late 2017.

WYOMING COUNTY SCHOOLS
WYOMING EAST HIGH SCHOOL
HVAC AND ROOF REPLACEMENT

Montum Architecture

The West Virginia School Building Authority funded replacement of the HVAC systems and roofing at the existing Wyoming East High School in 2017. Montum Architecture is the architect-of-record for the HVAC project and integrated the roofing design consultant's information into bid package scenarios. Work is being performed within an occupied building with close coordination of school daily schedules and calendar of events. Many of the units are being replaced one-for-one with some zones being split into multiple units to allow flexibility of new curriculum within the spaces or needs for additional comfort control. Ceilings are being replaced to meet updated guidelines for educational facility acoustics.

COMPLETION: SUMMER 2019

BUDGET: $3.2M

SIZE: 130,000 SF EXISTING

LOCATION: NEW RICHMOND, WV

CONTACT:
Donald Clay
Director of Facilities
304-732-6262

Montum Architecture, LLC
37 ER Path, Keyser, WV 26726 ● 304-276-7151 ● tom@montumarch.com ● montumarch.com

Project Experience

CAPITOL PARAPET WALL REPAIRS

Charleston, West Virginia

This project included an exploratory investigation and preparation of construction documents for repairs to the limestone and brick parapet wall and balustrade at the top of the Capitol Building.

CAPITOL DOME RESTORATION

Charleston, West Virginia

This project included an exploratory investigation and preparation of construction documents for repairs to the structural steel in Capitol Dome.

CAS STRUCTURAL ENGINEERING, INC.

Project Experience

BUILDING 3 CANOPY REPAIRS
Charleston, West Virginia

Structural design of repairs to existing limestone canopy and supporting structural elements. Discovered that as-built conditions differed from original design documentation

GEORGE WASHINGTON HIGH SCHOOL
Charleston, West Virginia

Structural design of additions to include new 3-story classroom addition, new entrance/commons addition, and new gymnasium addition for Kanawha County Schools.

COVENANT HOUSE
Charleston, West Virginia

This 3-story structure utilized a structural steel frame and light-gauge steel roof trusses for the structural system. The 13,700 SF building was designed to appear as a residential structure, with vinyl siding, asphalt shingles, dormers and gingerbread accents.

Project Experience

JOHNSON AVENUE PROFESSIONAL BUILDING
Bridgeport, West Virginia

Structural design of new 9,400 SF steel framed office building.

YORK COUNTY GOVERNMENT CENTER
York, Pennsylvania

Structural analysis and design of 1898 former department store converted to county government offices. Interior renovations included adding floor framing at mezzanine level, analyzing and redesigning deficient floor framing, and adding new elevators. Exterior renovations included complete façade rework to recreate original appearance.

METROPOLITAN EDISON
Reading, Pennsylvania

The two-story, 5000 SF lobby replaced an outdated 1200 SF lobby and business office. The lobby addition, which serves as a focal piece for the Headquarters Complex, contains several conference rooms and a second floor bridge spanning the width of the lobby. The lobby addition consisted of structural steel framing. An 80,000 SF office addition was constructed during the second phase of this project. A semi-circular cafeteria addition was located at the rear of the complex.

MILLER ENGINEERING, INC.

Budget and Timeline History

Project Name	Project Type	Budget	Cost	Notes
Bluestone State Park	Pool Replacement	$1,000,000	$935,600	On budget
West Virginia State	HVAC Piping Renovation	$650,000	$533,400	On budget
Canaan Valley Resort	Emergency Electrical Repairs	$225,000	$129,829	On budget
Holly Grove Manor	Renovation	$885,000	N/A	On hold
Mapletown Jr/Sr High School	HVAC Renovation	$1,050,000	$1,105,900	5.19% over budget
Pipestem – McKeever Lodge	HVAC Piping Replacement	$1,600,000	$1,776,000	10.43% over budget
Tygart Lake State Park	Beach and Bathhouse	$750,000	$695,000	On budget

= Delivered on budget/on time

MILLER ENGINEERING, INC.

Budget and Timeline History

Project Name	Project Type	Contract Length	Contract Delivery	Notes
Blackwater Falls State Park	Boiler Replacement	120 days	180 days*	*Extended 60 days due to equipment delivery issues
Bluestone State Park	Pool Replacement	180 days	180 days	Delivered on time
Canaan Valley Resort	Construction Administration	3.5 years	3.5 years	Long-term project with varying facets – no direct schedule
Twin Falls/Hawks Nest Lodge	HVAC Renovation	90 days	90 days*	*Expedited delivery
Mapletown Jr/Sr High School	Boiler/ HVAC Renovation	180 days	180 days	Delivered on time
Pipestem – McKeever Lodge	HVAC Piping Replacement	365 days	365 days	Delivered on time
Tygart Lake State Park	Beach and Bathhouse	270 days	270 days	Delivered on time

MILLER
ENGINEERING, INC.

TAB 5 – PROJECT FORMS

Purchasing Divison
2019 Washington Street East
Post Office Box 50130
Charleston, WV 25305-0130

State of West Virginia
Centralized Expression of Interest
34 — Service - Prof

Proc Folder: 569921

Doc Description: EOI: Central Chiller Plant Ice Farm and Upgrades

Proc Type: Central Contract - Fixed Amt

Date Issued	Solicitation Closes	Solicitation No	Version
2019-04-18	2019-05-15 13:30:00	CEOI 0211 GSD1900000008	1

BID RECEIVING LOCATION

BID CLERK
DEPARTMENT OF ADMINISTRATION
PURCHASING DIVISION
2019 WASHINGTON ST E
CHARLESTON WV 25305
US

VENDOR

Vendor Name, Address and Telephone Number:

FOR INFORMATION CONTACT THE BUYER

Melissa Pettrey
(304) 558-0094
melissa.k.pettrey@wv.gov

ıature X **FEIN #** -1386 **DATE** May 9, 2019

All offers subject to all terms and conditions contained in this solicitation

FORM ID : WV-PRC-CEOI-001

DESIGNATED CONTACT: Vendor appoints the individual identified in this Section as the Contract Administrator and the initial point of contact for matters relating to this Contract.

(Name, Title)

Brian Craig Miller – Pres

(Printed Name and Title)

240 Scott Ave, Suite 1, Morgantown, WV 26508

(Address)

304-291-2234

(Phone Number) / (Fax Number)

cmiller@millereng.net

(email address)

CERTIFICATION AND SIGNATURE: By signing below, or submitting documentation through wvOASIS, I certify that I have reviewed this Solicitation in its entirety; that I understand the requirements, terms and conditions, and other information contained herein; that this bid, offer or proposal constitutes an offer to the State that cannot be unilaterally withdrawn; that the product or service proposed meets the mandatory requirements contained in the Solicitation for that product or service, unless otherwise stated herein; that the Vendor accepts the terms and conditions contained in the Solicitation, unless otherwise stated herein; that I am submitting this bid, offer or proposal for review and consideration; that I am authorized by the vendor to execute and submit this bid, offer, or proposal, or any documents related thereto on vendor's behalf; that I am authorized to bind the vendor in a contractual relationship; and that to the best of my knowledge, the vendor has properly registered with any State agency that may require registration.

Miller Engineering, Inc.

(Company)

(Authorized Signature) (Representative Name, Title)

Craig Miller, Owner

(Printed Name and Title of Authorized Representative)

May 9, 2019

(Date)

304-291-2234

(Phone Number) (Fax Number)

ADDENDUM ACKNOWLEDGEMENT FORM
SOLICITATION NO.: CEOI GSD1900000008

Instructions: Please acknowledge receipt of all addenda issued with this solicitation by completing this addendum acknowledgment form. Check the box next to each addendum received and sign below. Failure to acknowledge addenda may result in bid disqualification.

Acknowledgment: I hereby acknowledge receipt of the following addenda and have made the necessary revisions to my proposal, plans and/or specification, etc.

Addendum Numbers Received: None
(Check the box next to each addendum received)

- ☐ Addendum No. 1
- ☐ Addendum No. 2
- ☐ Addendum No. 3
- ☐ Addendum No. 4
- ☐ Addendum No. 5
- ☐ Addendum No. 6
- ☐ Addendum No. 7
- ☐ Addendum No. 8
- ☐ Addendum No. 9
- ☐ Addendum No. 10

I understand that failure to confirm the receipt of addenda may be cause for rejection of this bid. I further understand that any verbal representation made or assumed to be made during any oral discussion held between Vendor's representatives and any state personnel is not binding. Only the information issued in writing and added to the specifications by an official addendum is binding.

Miller Engineering, Inc.

Company

Authorized Signature

May 9, 2019

Date

NOTE: This addendum acknowledgement should be submitted with the bid to expedite document processing.

RFQ No. CEOI GSD1900000008

STATE OF WEST VIRGINIA
Purchasing Division

PURCHASING AFFIDAVIT

MANDATE: Under W. Va. Code §5A-3-10a, no contract or renewal of any contract may be awarded by the state or any of its political subdivisions to any vendor or prospective vendor when the vendor or prospective vendor or a related party to the vendor or prospective vendor is a debtor and: (1) the debt owed is an amount greater than one thousand dollars in the aggregate; or (2) the debtor is in employer default.

EXCEPTION: The prohibition listed above does not apply where a vendor has contested any tax administered pursuant to chapter eleven of the W. Va. Code, workers' compensation premium, permit fee or environmental fee or assessment and the matter has not become final or where the vendor has entered into a payment plan or agreement and the vendor is not in default of any of the provisions of such plan or agreement.

DEFINITIONS:

"Debt" means any assessment, premium, penalty, fine, tax or other amount of money owed to the state or any of its political subdivisions because of a judgment, fine, permit violation, license assessment, defaulted workers' compensation premium, penalty or other assessment presently delinquent or due and required to be paid to the state or any of its political subdivisions, including any interest or additional penalties accrued thereon.

"Employer default" means having an outstanding balance or liability to the old fund or to the uninsured employers' fund or being in policy default, as defined in W. Va. Code § 23-2c-2, failure to maintain mandatory workers' compensation coverage, or failure to fully meet its obligations as a workers' compensation self-insured employer. An employer is not in employer default if it has entered into a repayment agreement with the Insurance Commissioner and remains in compliance with the obligations under the repayment agreement.

"Related party" means a party, whether an individual, corporation, partnership, association, limited liability company or any other form or business association or other entity whatsoever, related to any vendor by blood, marriage, ownership or contract through which the party has a relationship of ownership or other interest with the vendor so that the party will actually or by effect receive or control a portion of the benefit, profit or other consideration from performance of a vendor contract with the party receiving an amount that meets or exceed five percent of the total contract amount.

AFFIRMATION: By signing this form, the vendor's authorized signer affirms and acknowledges under penalty of law for false swearing (*W. Va. Code* §61-5-3) that neither vendor nor any related party owe a debt as defined above and that neither vendor nor any related party are in employer default as defined above, unless the debt or employer default is permitted under the exception above.

WITNESS THE FOLLOWING SIGNATURE:

Vendor's Name: Miller Engineering, Inc.

Authorized Signature: _____ Date: May 9, 2019

State of West Virginia

County of Monongalia, to-wit:

Taken, subscribed, and sworn to before me this 9 day of May, 2019

My Commission expires October 30, 2022

AFFIX SEAL HERE

NOTARY PUBLIC Cindy W Dyer

NOTARY PUBLIC OFFICIAL SEAL
CINDY W DYER
State of West Virginia
My Commission Expires
October 30, 2022
407 Cimarron Pl Morgantown, WV 26508

MILLER
ENGINEERING, INC.

TAB 6 – APPENDIX SAMPLE REPORT

EVALUATION REPORT of FINDINGS
[redacted] CHILLER PLANT POWER SYSTEM

PURPOSE:

Evaluate the HV system serving the chiller plant as it relates to a loss of power and failure to restore incident. The plant receives power from the utility at 12,470 volts, 3 phase and has multiple step down transformers to reduce the high voltage to both medium and low (less than 600) operating voltages.

BACKGROUND:

The plant serves the [redacted] The plant is located on the northeast corner of the campus and serves several buildings by means of an underground chilled water piping loop network. The plant has a nominal capacity of 4,800 tons. The chillers are 4,160 volt and utilize reduced voltage motor starters. The plant utilizes liquid cooled chillers rejecting heat by roof mounted Marley cooling towers. The plant has various pumps for loop, heat rejection, and chiller circulation. There are multiple drives and motor control centers utilized for motor control at 480 volts for everything but the chillers.

MEI was asked to evaluate the HV system for concerns related to a failure in the automatic HV transfer that recently occurred, and to determine the root cause and the failure of some switchgear to operate properly. It was reported that on [redacted] a total outage occurred at the plant. It was also reported that power in an adjacent building blinked around the same time. As the plant is served by two separate utility (AEP) circuits utilizing an automatic transfer scheme, the likelihood of such an occurrence should be quite small. The utility was reportedly doing lines construction and maintenance on both circuits at the time of the outage, though they indicated to the staff that the circuits were not "off".

OBSERVATIONS:

Upon arrival at the site on 27Oct2017, the power to the chiller plant had been restored and one 1,200 ton chiller and its' associated systems were operating. MEI reviewed the events with the staff and proceeded to review the electrical system configuration.

The power to the plant has two sources from [redacted] 470 volts, 3 phase. When the plant was constructed, it was served by a single utility circuit. Previously, around 2007, a second source was added to increase redundancy. Loss of the plant has a significant deleterious effect on several large state buildings, and many employees. The two utility sources meet outside the plant walls at two Eaton 600A 15KV knife blade switches serving a common load buss. The load break switches have been equipped with electric/hydraulic linear operators and an Eaton ATS 600 automatic transfer switch controller. The purpose of these power actuated switches and controller is to constantly monitor the line voltage of each source, with one being primary, and switch to the best available source at the time. Each switch has a Kirk key interlock with an auxiliary

contact which disables the electric/hydraulic operator when the Kirk interlock is engaged to "lock out" the switch. This interlock is provided for personnel protection and can only be engaged when a switch is in the off position. For purposes of clarity, we will refer to these switches as the transfer switch.

The transfer switch serves the Utility Metering Tank, which is pad mounted proximate to the building. The metering tank serves the original 15KV disconnect switch to the plant and has been in service since 1999. A 5.0 MVA stepdown transformer reduces the voltage from 12,470V to 4,160V and is fed into the plant main switchgear. The 4,160 volt switchgear is and Eaton 1,200 station class indoor VacClad switchgear lineup, incorporating a single 1,200A Main breaker and eight 1,200A distribution breakers. The breakers each incorporate an Eaton DT-3000 controller (Photo1). The main is programmed with only long duration overcurrent whereas the distribution breakers have long duration, short duration, instantaneous, and ground fault trip capabilities. While not all the trip values were reviewed, the settings indicate that should a fault occur in the plant HV systems, the distribution breaker should trip first; as would be expected.

Five of the distribution breakers serve the chiller via Eaton AmpGuard reduced voltage motor starters (Photo 2) and the remaining 3 breakers serve the transformers providing power to the building (Photo 6) and the motor controllers (Photo 5) serving pumps, cooling tower, etc. The breakers utilize vacuum bottle (VI bottles) contacts and the operating energy to trip open is provided by high strength springs which are either compressed electrically or mechanically. This is done to allow the breakers to be opened by hand in the event of a power loss. The electrical compression is accomplished using a DC electrical motor. The switchgear utilizes a DC voltage control scheme which is powered by racks of lead/acid batteries located proximate to the switchgear charged by a floating charger. Some corrosion was noted on the batteries.

It was noted that no commissioning stickers were found on the gear. It is industry standard practice for a commissioning agency to place stickers on switchgear when they start and commission it.

The staff indicated they were not sure what caused the problem. As such, they had opted to leave the equipment that was running at the time of the incident off and utilize other equipment within the plant; which was a wise decision at the time. They further indicated that not only had the ATS failed to operate but the main breaker and two distribution breakers had failed to engage when they attempted to operate them. The charging motor just kept running after they attempted to close the breaker, and after a period of time, the motors would just shut off. It took many attempts to get the breakers to close. The staff indicated that none of the breakers showed any red trip LEDs, which would indicate that the trip units did not open the breakers. The trip units in question have no data logging so if one was to trip, and was reset, there would be no history to review for the cause.

Eaton Engineering Services (CHESS) was retained by MEI to assist in the evaluation due to their broad knowledge of the electrical equipment in the plant. Chess inspected and serviced four of the nine breakers which could be taken out of service with no effect on the plant. The breaker serving chiller number 3 was found to have a loose connection on the under voltage relay (Photo 4). This would have caused the breaker to try to close but the loose connection would open it just as soon as it closed. It would appear to the staff to have not engaged at all. The mechanisms of the four breakers were cleaned, inspected, check for operation, and re-lubricated. They breakers were cleaned with denatured alcohol and as much dust removed as possible. The breakers which kept running were found to have dried grease on the latching mechanisms blocking the spring from latching in the charged position and allowing the charging motor to keep running until it timed out. The four breakers were then opened and closed some 30 – 40 time to exercise the mechanisms. CHESS performed as much preventative maintenance as could be safely accomplished with the switchgear active. A staff electrician observed this work and was free to ask questions, which were answered. The gear was determined to be quite dirty and dusty inside and in need of a power-out servicing (Photo 3). The lamps on the breaker pilot lights are burned out, so there is no obvious indication of breaker status on the gear exterior.

[redacted]

DISCUSSION:

Based on the information available, it may never be possible to exactly identify the root cause of the original outage, however the most relevant clues are the utility line work in the vicinity and the report of a power blink. Based on that information, it seems likely that there was a transient in the primary 12KV circuit. This could be caused by two lines arcing phase to phase, or one line arcing to grounding for a brief second. These are relatively common occurrences during line construction or maintenance such as trimming. The power companies generally do not acknowledge their occurrence and don't consider them an outage. When this occurs, the substation breaker may or may not open but if it does, it will try to close on a "re-closer" function up to three times. Many times a downstream fuse will open, isolating the problem from the rest of the circuit and allowing many on the circuit to continue to have power. A re-closer operation would appear to be a blink in the power. An arc would probably be more like a dimming or nothing apparent, but the ATS controller could easily detect the voltage or frequency change and react.

It seems most likely that the ATS controller detected a problem on the primary source and opened it to change to the secondary, which would have read as electrically normal despite being locked out [redacted] It tried to go to the alternate source and that source was not available. There would then be a time delay before it returned to the

primary source. Once the power dropped, something, which may never be clear, opened the main breaker in the chiller plant 4,160 switchgear. The loose wire on the undervoltage relay on the chiller distribution breaker is a telling item as it points to the potential for other wires to be loose and possibly having intermittent contact in the future. Based on the interviews with the staff it seems highly likely that the main breaker experienced a similar problem where it would close and immediately open. After it was cycled several times, the vibrations allowed the circuit to make and the breaker to close (the breakers operating will physically jar the entire lineup, this is normal). The switchgear is housed in a plant with constant vibration, this can cause loose connections, and very rarely, unexpected operations of relays and contacts. As such the switchgear, which appears to have never been commissioned, exhibited malfunctions that while individually minor, prevented the breakers from being brought back into service in a timely manner.

FINDINGS and CONCLUSIONS:

As previously stated, the root cause of the event may never be known but the problems with restoration of service would seem to be readily identifiable. Once the main breaker opened in the plant and would not close, the reliability of the 12KV source came into question. There are seven levels of complexity from the utility to the chiller and there was no clear indication of a cause. This was exacerbated to some extent with a lack of understanding of the control equipment for both the ATS and the 4,160 switchgear.

This created a situation for the staff wherein the original source and problem becomes less obvious and creates a series of questions about each link in the chain from the utility to the chiller. For example, the questions might be: is it the utility? is it the ATS?, is it the transformer? is it the breakers? did the chiller motor fail and shut everything? Why won't the ATS transfer? While each of these questions may seem simple and easy to check, one must understand that pressing a wrong theory can lead to additional problems or damage. One must always be cautious when troubleshooting HV systems. As one who has personally been in these situations, at 3AM, be assured that it all looks much clearer in hindsight. At the time, it is very easy to chase one's tail. The lack of a unified one line HV diagram of the plant power that included the 2007 changes; which created a lack of confidence in understanding the system. Again, I have personally experienced the lack of a unified one line and it can lead to further confusion in real time.

In conclusion, the system is suffering from a lack of physical and electrical maintenance. There seems to be a lack of understanding and knowledge of the system configuration, its components and controls, and the lack of ongoing training for high voltage systems and components. As such, the staff seems to lack the confidence to identify and correct problems in real time. This is in no way meant as a criticism of the staff, but as a concern which needs corrected. The most effective means to correct this is to ensure the staff is trained on the operation of the equipment on a regular basis. Additionally, they must be given the opportunity to operate the equipment during planned outages when the equipment is tested or exercised.

RECOMMENDED COURSE OF ACTION:

The immediate recommendation is to take the system out of service at the first opportunity and perform extensive preventative maintenance. Within that, the 4,160V switchgear lineup represents the highest priority. During the first maintenance the switchgear should be commissioned by factory trained personnel who have performed such services in the past. We recommend the following steps in this order and recommend the electrical staff be involved in the entire process:

- Change the lamps in all pilot lights to LED replacement. This virtually eliminates the need to change them every 2,000 hours. It increases confidence in the status of the equipment.
- At the first opportunity, have the 4,160 switchgear taken out of service, fully cleaned, serviced, operationally tested, and commissioned. This should include testing of the VI bottles and line and load cabling. As the main breaker serving the plant had troubles and has not been serviced, this is the item that needs to occur ASAP.
- The medium voltage starters need to be fully serviced, cleaned, operationally tested, and commissioned. This should include testing the line and load cabling. The motor of each chiller needs to have the insulation resistance tested in accordance with the manufacturer's recommendations.
- The automatic transfer switch needs to be removed from services, cleaned, tested, and commissioned. This should include testing the line and load side cabling.
- The original 15 KV disconnect switch and the 5 MVA transformer needs to be tested and cleaned. The switch needs to be operationally tested. The transformer needs to have oil analysis performed and the insulation resistance tested.
- The 4,160 to 480 transformers needs to be serviced, cleaned, and the insulation resistance tested. The line side cabling should be tested. The motor control centers and the variable frequency drives need cleaned and serviced.
- Low voltage equipment such as motor controls and breaker panels need to be checked for loose connections. One very effective method to do this in an efficient manner is to use thermography. This provide instant identification of hot spots in panels and motor controls.
- There needs to be a unified drawing or set of unified one line drawings of HV power system on the capital complex. It needs to be simple and uncluttered but include all the necessary information to effectively troubleshoot the power systems in real time.
- The electrical staff needs to be trained by qualified factory personnel on the equipment, proper HV safety techniques, and rehearse outage restorations. This training need to be repeated on regular intervals. Much of this could be performed in conjunction with the 3 year service interval. New electricians joining the staff need to be trained on HV systems before being placed on call out status for HV issues.
- The systems need to be "exercising" or cycling the breakers on and off several times at least twice per year. This is always a good refresher training opportunity

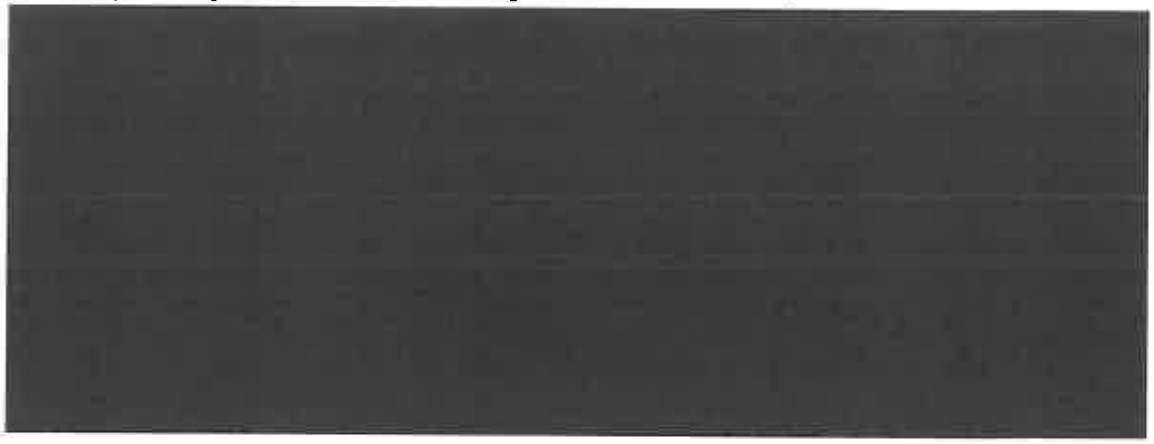
as it occurs during a planned outage and eliminates the pressure associated with the need to restore power.

- The systems need to be serviced and tested at 3 years intervals by factory trained personnel.
- All HV cabling and insulated equipment should be tested using high potential methods every 3 years immediately after being serviced. The data needs to be logged and recorded and compared as it can be used as a predictor of pending failures.
- Just as the HV breakers need to be exercised, low voltage (600V and below) breakers should be exercised at least once per year. This is particularly true of larger frame 3 phase breakers but applies to any breaker. The mechanisms need the chance to operate and prevent blockage by dried out lubricant on mechanisms.

In summary, the major concerns relating to the recent outage center around the need for planned maintenance and training of the electrical personnel assigned to resolve HV problems. We have not observed or identified any major deficiencies in the configuration of the systems that require changes. We believe with proper care and testing, the systems should operate into future with major changes or upgrades required.

We appreciate the opportunity to be of service. If we can be of further assistance in this matter please feel free to contact me at 304-291-2234 ext. 2 or cmiller@millereng.net.

Respectfully submitted this 1st day of November 2017.



[redacted]

[redacted] WAREHOUSE ELECTRICAL PROJECT NARRATIVE

BACKGROUND SUMMARY:

[redacted] Through the years, the warehouse has seen upgrades and changes which called the capacity, reliability, and code compliance of the electrical system into question.

Miller Engineering (MEI) was retained to evaluate the facility electrical system in terms of capacity, code compliance, reliability, and sufficiency of backup (emergency) power. Miller Engineering performed site evaluations of the electrical systems from the utility service down to the branch circuit wiring. MEI evaluated two years of utility usage, and reviewed the existing refrigeration and mechanical system as to their impact on the electrical service. The future plans for the facility were reviewed with warehouse management and operations personnel to gain a better understanding of the envisioned changed and growth likely to occur in the foreseeable future.

FACILITY DETAILS:

[redacted] The facility is approximately [redacted] including roughly [redacted] of cooler/freezer space. The remaining facility area serves as [redacted] warehouse and office space. Additionally, there are two small satellite buildings which house the electrical service equipment and the cooler / freezer compressors.

The existing electrical service is three phase, 277/480 volts rated at 1,200 amps. The incoming utility is from overhead pole mounted transformers. There is a CT cabinet located in one of the compressor buildings. The service wiring routes from the CT cabinet to the automatic transfer switch located just outside the compressor building. The ATS then feeds a 1,200 amp main lug only panel which serves as the main distribution. The main panel, panel A, contains sub feed breakers and lug only kits which feed smaller 277/480 volt panels located in the compressor buildings in addition to a 400 amp panel located in the warehouse. The 277/480 volt panels in the compressor buildings serve the compressors. The panel in the warehouse served the cooler / freezer indoor units, lighting, and step down transformers that feed 120/208 volt branch power panels. Panel A also serves the cooler / freezer floor heat. A 400 kW generator currently serves as emergency power to the warehouse and is undersized.

EVALUATION FINDINGS SUMMARY:

When examining the electrical distribution, several issues were found. The compressor room which serves the incoming electrical service contains a large wireway (wire trough) which houses the wiring from the CT cabinet to the ATS and to branch panels. This is not

acceptable by the National Electric Code (NEC) or utility requirements. The conduits which enter the wireway do not include grounding bushings. The wireway contains wiring for normal power, emergency power, and wiring of mixed voltage classifications; with no separation. Panel A has improper wire splices and double tapped lugs. The lug units were used in parallel and wired in a way which does not provide adequate overcurrent protection. There is a small wall mounted step down transformer which was installed in the required working clearance of another panel. Inside of the warehouse, the panel in the IT closet on the 2nd floor was fed using service entrance cable not installed in conduit.

There are deficiencies in the branch wiring which will have to be addressed, by code requirement, when any significant work is done to the facility. [redacted]

Construction may reveal additional code deficiencies that will need to be addressed so a contingency needs to be held for such occurrences.

DESIGN BASIS:
MEI performed load calculations in accordance with the National Electric Code (NEC) 2017 Edition. The loads were calculated using existing utility data, label nameplate of larger equipment (compressors, etc), and load density (lighting & branch wiring) based on space usage. Based upon the existing loads using available information and sound engineering judgment, the existing building load is calculated at approximately 1,300 amps. As the exact extent of expansion in regards to additional compressors is not yet fully determined, the assumption was for the addition of (4) compressors. The design assumption is that the compressors will have the same electrical load as the largest compressors currently on site. Those compressors are approximately 38 kW in running amps and 155 kW of locked rotor amps. When adding three compressors to the load calculations, the load would increase to 1,514 amps. A NEC required 20% safety factor is applied as standard overcurrent protection is designed to operate at 80% of its labeled rating for long duration. Listed is a summary of load calculations:

- Existing Load: 1,334 Amps
- New Load: 1,514 Amps
- New Load w/ 20% Factor: 1,817 Amps

DESIGN RECOMMENDATIONS:
Using standard electrical overcurrent device and bus sizing, the next size main device is 2,000 amps. However, installing a 2,000 amp service will not allow for any future growth. In practical engineering application, there is little difference in the cost of the main electrical distribution between 2,000 and 3,000 amp capacity as it falls into the same "class" of equipment. Additionally, the cost of changes to the utility will likely be zero for this upgrade, as it will revenue screen for a one time upgrade by the utility. [redacted] Based on the class of switchgear required and the revenue screening, we recommend installation of a new 3,000 amp, 480volt 3 phase service. This would allow for a future expansion without modifications to the new main system. Conduit provisions out of the new switchgear can make future expansion with

limited impact on the facility. MEI recommends installing such spare conduits for future expansion. The spare conduit stub-out is minimal additional cost at the time of installation, but trying to add these conduits afterwards is costly.
Due to the code deficiencies located at the service, the recommendation is to replace this equipment. A new switchgear will be installed and serve as the main service disconnect point. We recommend the building level distribution out of the main be separated for reliability and to enable the re-use of much of the existing equipment. Many existing panels can be re-used and will be fed as branch circuits from the new switchgear. New sub panels being installed where required by code or by load and will be fed from the new switchgear as well. This approach allows the new service to be installed while the existing stays in service. The branch circuits can be switched over on a phased approach, reducing required downtime and minimizing the potential loss of fresh and frozen foods.

The existing backup generator and automatic transfer switch can remain in place. As the system is fairly new, in good operating condition, and though presently undersized for the entire facility, it should remain to back up power to part of the facility. As existing loads will be split, an additional generator will be installed to handle the split loads in addition to the expansion. This will require slight modification to the existing transfer switch and the installation of a second transfer switch. When complete, the entire facility will have backup power, including all refrigeration equipment, lighting, offices, and plug loads. Attempting to split or parcel out certain loads would be highly labor intensive and disruptive to the day to day operations for a significant period of time; as wiring is predominantly in masonry walls and under floors. Separation of loads, would cost significantly more than providing backup power to the entire facility. The smaller loads that involved in separation represent no significant load in the sizing of the generators as compared to the equipment loads.

The current compressor buildings, which house the main and feed the existing electrical distribution, do not have adequate space to house new switchgear. The project will install a switchgear building, a stand-alone, pre-fabricated building housing the switchgear and any branch distribution devices required. The buildings will be configured with a small footprint and is shipped modular and assembled on site, reducing on site labor. The building comes with pre-installed lighting and HVAC systems. The switchgear building is more economical than construction of a new satellite building or installing the new electrical gear (switchgear, transfer switches, etc) in NEMA3R outdoor rated enclosures. Additionally, this will allow the new service to be fully in place prior to removing the existing service, minimizing downtime to transitional outages of short (a few hours) duration.

DESIGN PROCESS STATUS:
MEI has begun the design process and created project drawings detailing the work to be implemented under our recommendations. These include demolition plans, construction plans, one line drawings and panel schedules. On notification to finish the design, MEI will add the necessary detailing and create a project manual with front end contract documents and technical specifications; to ensure the project is delivered by competent personnel, meeting industry best practices, and in a manner that is minimally disruptive to the facility.

ESTIMATE:
MEI has prepared a budgetary construction cost estimate for the project, representing our best estimate at this time. [redacted] Our estimate breakout is attached.

CONSTRUCTION PERIOD:
The current estimate for the construction period is 270 days to substantial completion with another 30 days to reach final completion, for a 300 day contract from written notice to proceed.

The above reflects the findings and recommendations of Miller Engineering for the referenced project. Please do not hesitate to contact MEI with any questions or concerns regarding this evaluation.

Sincerely,

[redacted]

MILLER

FACILITY EVALUATION REPORT

[redacted]

Mechanical HVAC Systems

PURPOSE:

MEI has been retained by the Owner to evaluate the existing HVAC system at [redacted] and make recommendations for methods to increase the efficiency and reliability of the system in question. MEI has prepared this report based on observable conditions during sight visits, industry standards and rules of thumb, and our professional history with buildings of similar age, type, and condition. The scope of work did not include a full analysis of applicable codes or code deficiencies that may exist in the facility.

EXISTING CONDITIONS:

Heating, Ventilation, and Air Conditioning (HVAC) Systems:

The HVAC system is heating only with the exception of a small amount of square footage covered by small DX cooling systems. The heating system is served by a central boiler using a combination of steam radiators, steam unit ventilators, hot water air handling units, and hot water unit ventilators. The building heat sources is one Smith 4.0 MMBTU, gas fired, cast iron sectional, steam boiler with a power burner. Two older boilers are in place but out of service. The steam system is original to the 1920's portion of the building and shows evidence of ongoing repair on both the steam and condensate systems. The 1960s addition is served by not water and receives its heat from the central boiler via a steam to hot water converter and pumps located in an auxiliary mechanical room.

The 1920's steam systems are in a state of significant disrepair. The radiators lack functioning controls and functioning steam traps, causing overheating and significant energy waste. The condensate and steam piping have exceeded their life expectancy of fifty years by 25 – 35 years and are reportedly showing the expected signs of scaling and occlusion, which is affecting system capacity and functionality. The winter makeup water rate is 300 to 400 gallons per day and that indicates the presence of a condensate leak in the system. As no evidence of a leak has been noted in the visible piping, it is likely under the first floor in buried piping. The excessive amount of makeup water results in an inability to maintain proper chemical treatment

in the boiler and steam system; this further shortens their life expectancy and causes performance-reducing scale in the boiler and piping. Even though the boiler is "newer" its overall condition and remaining life is suspect. Starting chemical treatment of the system at this time would probably do more harm than good as the scaling in the piping is probably preventing or reducing the impact of leaks. Once removed, leaks might start or increase. We have observed this phenomenon before at other old installations.

The 1960's hot water piping systems appear to be in reasonably usable condition with minor problems except for a freezing problem during a power outage this last winter. The hot water piping insulation is in generally poor condition with some replacement and repairs needed. It needs to be confirmed as not asbestos containing prior to any work on the insulation. The hot water circulating pumps are all functional. However, they have exceeded their operational life and should be replaced.

The air systems serving the classrooms are unit ventilators which are designed to maintain both temperature and ventilation. In the older part, the fans are failing and controls are basically non-existent. In the newer part, the hot water unit ventilators are functioning but have failed fans and controls. The failed controls were a contributing factor in the freezing problem experienced last winter as the ventilation damper are mostly full open, which resulted in the infiltration of extremely cold air and freezing of the coils. The cost to repair the 1960's unit ventilators would be a significant portion of the cost to replace these units

The gymnasium air handling units are heating only fed by hot water and lack functioning controls. Also, any time the gym is used, the entire building must be heated resulting in a significant waste of energy. The locker room exhaust fans were not functioning during the site visit and this needs to be investigated and repaired. The locker rooms and weight room did show some evidence of excess moisture by minor ceiling mildew and rust on the lockers. The weight room may be short of ventilation air since the alteration of the space from its original use. The exhaust systems for the locker rooms need reviewed in detail and either repaired or replaced. With an aggressive maintenance program, the air handling systems in the gym might last 3 to 5 more years before requiring replacement but utility and repair costs will continue to increase.

Building Automation and Control System:

The building controls system was originally pneumatic. The remaining pneumatic controls are failed or out of calibration. The pneumatic tubing suffers from oil/water contamination and leakage resulting in faulty operation. There is no setback or occupancy function within the control system to help control energy usage throughout the building. The building is energy

inefficient, resulting in increased utility operating costs.

Domestic Water Heating System:

The domestic hot water system is composed of copper piping with original fixtures. The piping appears to be in good condition with no evidence of leaks. The hot water systems are in effect two separate systems; one for the building and one for the kitchen. The building system is served by a large approximately 750-1000 gallon steam hot water tank. The hot water is re-circulated and serves the showers in the gymnasium. It is reported that the gymnasium showers are almost never used and the building has no other major uses of the water other than the kitchen. The kitchen is served by a small gas fired hot water tank with an approximately 300 gallon storage tank. The system originally delivered 180 degree water but it reportedly has been turned down to 140 as the dishwasher has its own booster water heater. The steam hot water tank represents an energy efficiency concern if the usage is as low as has been reported. Several solutions exist to resolve the domestic HW demand, including point of use devices or smaller, locally located storage tanks. In terms of operating cost, the HW system inefficiencies are a much smaller part of the bigger picture but should be addressed if possible as they do add up over time.

Fenestration:

An ongoing project is replacing the windows in the facility; this will help decrease utility costs and provide operable windows to users for better adjustment of ventilation requirements. Windows typically represent the longest term return on investment energy conservation measure that can be done to a school.

General Observations/ Discussion:

The steam system has exceeded its original design life expectancy by at least 25 years. It is grossly inefficient and will require a significant investment to continue to operate. Steam systems are maintenance intensive and this one suffers from a lack of proper maintenance for many years. Boilers of this type are typically over-sized relative to the actual load. It has been a common practice in both the contracting and engineering industry to do so, no one wants to get a phone call that a building will not stay warm and therefore "more is always better". For decades boilers were rated for their efficiency at full load, a condition they rarely, if ever, actually see even on the coldest of days. Only in recent years, have engineers and equipment manufacturers begun to understand how heating system operate in real world conditions and develop equipment more suited to the conditions. The boiler could be re-used and could be converted to hot water heating but as the load decreases due to newer windows or giving the gym its own heating systems (more later), the

boiler becomes less efficient. Based on the heating gas bills we have reviewed, industry standards, the amount of condensate loss, the overall condition of the steam system, and the efficiency of the boiler, we believe that somewhere between 35% and 50% of the heating energy used is being wasted. This of course means that 35% – 50% of the heating dollars are also wasted.

RECOMMENDATIONS:

Replace Heating, Ventilation, and Air Conditioning (HVAC) Systems:

- Replace the existing steam boiler systems with high efficiency, condensing, hot water heating boilers. Such boilers have a combustion efficiency of 93% to 95% and perform extremely well in terms of part load efficiencies. The boilers would provide hot water for the old and new parts of the building and could be configured in several different ways to increase efficiency and reliability (ie: using several smaller boilers or leaving the system separate but providing an interconnect between them to share the available heat in an emergency). Such things are design considerations that can be worked out at a later time.
- Demo the existing steam piping and replace with new hot water piping utilizing fusion welded composite polymer piping. Such piping installs faster and more cost effectively than steel or copper.
- Replace the existing steam fired unit ventilators in the older portion of the facility with hot water units. This will increase comfort as the systems will have control, increase efficiency, and permit the use of night setback of the building to reduce heating costs.
- Replace the existing hot water unit ventilators in the newer portion of the facility with new unit ventilators for reason as stated above.
- Separate the gymnasium from the rest of the facility using gas fired rooftop units. This would then permit the gym to be used after hours without the necessity of heating the whole facility. A standard rooftop unit would include cooling and would give the ability to air condition the gym for school events. Many districts charge extra to facility rentals for cooling to help offset the cost of the equipment and electricity. The systems would work together to cool from a unified control and can be security controlled to prevent excess use. More importantly, the units could utilize outside air "free cooling" much of the time to make the space more comfortable in spring and fall at no additional energy cost. We will need to verify the sufficiency of the existing electrical system to accommodate the addition of cooling by data readings but we believe it should be sufficient.

ESTIMATE OF PROBABLE COST/ SAVING RETURN ON INVESTMENT:

Replace Heating, Ventilation, and Air Conditioning (HVAC) Systems:

We estimate the cost to implement the above recommendations has a budgetary order of magnitude of [redacted] plus engineering fees. This number represents a budgetary number and could increase or decrease depending on the decisions made during the design process. We estimate that the energy savings could approach 50% if this option is implemented.

Based on the natural gas costs over the last 2 years, it appears that the average annual usage is approximately $85,000 per year. A 50% reduction in heating costs resulting from an investment of [redacted] would have a simple payback of [redacted] While this doesn't meet the commercial threshold of 7 – 10 years, it meets the institutional threshold of 10 – 20 years. If one assumes an annual 3% escalation (nor unrealistic) in natural gas prices over that period, the payback drops to 14 years. Most institutions would deem this "economically viable".

OWNER REQUESTED OPTION: REUSE STEAM SYSTEM

Heating, Ventilation, and Air Conditioning (HVAC) Systems Option:

- Reuse the existing steam systems by replacing all of the steam traps in the existing steam heating devices in the older portion of the building and installing control system on the steam heating devices.
- Make adjustments and repair to the boiler to maximize the efficiency of the steam boiler. (note: the best efficiency will be at least 25% less than the new boilers mentioned above)
- Replace the existing condensate piping below the floor and reuse as much of the upper floor steam and condensate piping as possible (note, the piping age makes this an item of significant concern)
- Re-work the condensate return and feed-water systems for the boiler.
- Demo the HW converter serving the newer portion and replace with high efficiency boilers.

ESTIMATE OF PROBABLE COST/ SAVING RETURN ON INVESTMENT:

Heating, Ventilation, and Air Conditioning (HVAC) Systems Option:

We estimate the cost to implement the above Option has a budgetary order of magnitude of [redacted] plus engineering fees. This number represents a budgetary number and could increase or decrease depending on the decisions made during the design process. We estimate that a 10% - 15% reduction in energy usage would result from the

changes listed in the option.

Based on the natural gas costs over the last 2 years, it appears that the average annual usage is approximately [redacted] per year. A 10% reduction in heating costs resulting from an investment of [redacted] would have a simple payback of [redacted] While this doesn't meet the commercial threshold of 7 – 10 years, it meets the institutional threshold of 10 – 20 years. If one assumes an annual 3% escalation (nor unrealistic) in natural gas prices over that period, the payback drops to [redacted] Most institutions would deem this "economically viable". However, this option does not address the life expectancy of the equipment and it is unlikely the equipment will continue to function long enough to realize the payback.

PROJECT TIMING/ IMPLEMENTATION

We believe that if a decision can be made by May 1st to start the design process, it should be possible to bid the project on or about June 1st. If a contract can be awarded by 15 Jun, the work within the classrooms should be complete prior to the start of school (15 Aug). As heating is not required until around 1 October at the earliest, the contractor would have 6 additional weeks to complete the installation of the boilers (if not complete), test and balance the systems, and complete the controls systems work. The contractor could either be restricted to working evenings (some cost impact) and/ or required to have background check on the personnel at the facility during school hours. While the schedule is aggressive, we believe it can be accomplished in the time frame.

SUMMARY

[redacted] has reached a decision point in terms of the heating system for [redacted] The existing systems have far exceeded their useful life and will continue to present and ongoing maintenance, operations, and energy concern for the district unless positive action is taken. Any action which does not address the observations in this report will only be stopgap in nature and system will require more investment later at higher cost. By separating the gymnasium from the rest of the facility, savings can be realized by "setting back" the temperature in the building overnight and then warming it prior to the arrival of the students. The gym, operating as an independent system can be used on weekends or after school for practice at a much more favorable cost to the district. The installation of high efficiency hot water boiler will result in significant cost savings to the district which can, over time, pay for the system renovations. With the inclusion of controls to better regulate temperature and ventilation, the occupants will be more comfortable and will experience a much more positive learning environment.

We understand the magnitude of the estimate we have given for a renovation of

significant magnitude and understand there may be some "shock factor" in the number. We work to balance real world costs we see in bidding with the fact that we're putting numbers to concepts, not project drawings. Our budgetary estimates at this phase in a project typically range plus or minus up to 15 %. There are methods to finance such a project and we would be glad to discuss them with the Board, Superintendent, and Business Manager at the appropriate time.

We appreciate this opportunity to be of service and will be glad to discuss this report the project in further detail should there be further questions.

Respectfully submitted this 9th day of April 2010.

MAU's 1,2,3 Locations: 1 - North Wing, 2 - South Wing, 3 - South Wing WEEKLY

MAINTENANCE ITEM: Ck Operation/ Disch Temps

	Jan	Feb	Mar	Apr	May	Jun	Info	Ref	Comments (fill in)
	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)			
Wk1							Set controls to heating and cooling and verify proper operations in both modes	O&M Manual Section 19: "AAON H3V3 Series AHU IOM" Pgs 34-50	
Wk2									
Wk3									
Wk4									
WK5									

	Jul	Aug	Sep	Oct	Nov	Dec	Info	Ref	Comments (fill in)
	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)			
Wk1									
Wk2									
Wk3									
Wk4									
WK5									

MAINTENANCE ITEM: Visual Check Cond Unit/ Noises?

	Jan	Feb	Mar	Apr	May	Jun	Info	Ref	Comments (fill in)
	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)			
Wk1									
Wk2									
Wk3									
Wk4									
WK5							0		

	Jul	Aug	Sep	Oct	Nov	Dec	Info	Ref	Comments (fill in)
	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)			
Wk1									
Wk2									
Wk3									
Wk4									
WK5									

MAU's 1,2,3 Locations: 1 - North Wing, 2 - South Wing, 3 - South Wing MONTHLY

MAINTENANCE ITEM: Change Filters

Jan	Feb	Mar	Apr	May	Jun	Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	0	O&M Manual Section 19 "AAON H3V3 Series AHU IOM" Pgs 34-50	

Jul	Aug	Sep	Oct	Nov	Dec	Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)			

MAINTENANCE ITEM: Check Belt condition/ tension

Jan	Feb	Mar	Apr	May	Jun	Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	Does it squeek on start?		

Jul	Aug	Sep	Oct	Nov	Dec	Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)			

MAINTENANCE ITEM: Grease Bearings - 1 stroke

Jan	Feb	Mar	Apr	May	Jun	Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Wipe away excess)		

Jul	Aug	Sep	Oct	Nov	Dec	Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)			

MAU's 1,2,3 Locations: 1 - North Wing, 2 - South Wing, 3 - South Wing MONTHLY

MAINTENANCE ITEM: Ck Refrigeration sight glass for bubbles/moisture

Jan	Feb	Mar	Apr	May	Jun	Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)			
						0		

Jul	Aug	Sep	Oct	Nov	Dec	Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)			

MAINTENANCE ITEM:

Jan	Feb	Mar	Apr	May	Jun	Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)			

Jul	Aug	Sep	Oct	Nov	Dec	Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)			

MAINTENANCE ITEM:

Jan	Feb	Mar	Apr	May	Jun	Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)			

Jul	Aug	Sep	Oct	Nov	Dec	Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)			

MAU's 1,2,3 Locations: 1 - North Wing, 2 - South Wing, 3 - South Wing QUARTERLY

MAINTENANCE ITEM: Clean Interior of unit intake/filter section

QTR 1	QTR 2	QTR 3	QTR 4			Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)			0		

MAINTENANCE ITEM: Check Condensing unit fan for vibration and speed

QTR 1	QTR 2	QTR 3	QTR 4			Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)			Does fan start quickly?		

MAINTENANCE ITEM:

QTR 1	QTR 2	QTR 3	QTR 4			Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)					

MAINTENANCE ITEM:

QTR 1	QTR 2	QTR 3	QTR 4			Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)					

MAINTENANCE ITEM:

QTR 1	QTR 2	QTR 3	QTR 4			Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)					

MAU's 1,2,3 Locations: 1 - North Wing, 2 - South Wing, 3 - South Wing SEMI-ANNUALLY

MAINTENANCE ITEM: Clean DX coil on indoor unit

1	2					Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)					Use Calgon HD and water, rinse fully. Do not use pressure washer		

MAINTENANCE ITEM: Clean Condensing Unit Coil

1	2					Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)					Use Calgon HD and water, rinse fully. Do not use pressure washer		

MAINTENANCE ITEM: Hand ck airflow at all diffusers and grilles on system

1	2					Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)					0		

MAINTENANCE ITEM:

1	2					Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)							

MAINTENANCE ITEM:

1	2					Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)							

MAU's 1,2,3 Locations: 1 - North Wing, 2 - South Wing, 3 - South Wing ANNUALLY

MAINTENANCE ITEM: Ck Indoor unit blower motor amps and record

1	2					Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)							
						0		

MAINTENANCE ITEM: Ck Indoor unit heating amps and record

1	2					Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)							
						Perform at full call for heating		

MAINTENANCE ITEM: Ck outdoor unit fan motor amps and record

1	2					Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)							
						0		

MAINTENANCE ITEM: Ck outdoor unit compressor amps and record

1	2					Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)							
						Perform at full call for cooling		

MAINTENANCE ITEM: Ck wear on indoor unit blower sheeves

1	2					Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)							
						0		

MAU's 1,2,3 Locations: 1 - North Wing, 2 - South Wing, 3 - South Wing ANNUALLY

MAINTENANCE ITEM: Ck condition of indoor unit blower bearings

1	2	3				Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)	(Init/Date)				0		

MAINTENANCE ITEM:

1	2	3				Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)	(Init/Date)						

MAINTENANCE ITEM:

1	2	3				Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)	(Init/Date)						

MAINTENANCE ITEM:

1	2	3				Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)	(Init/Date)						

MAINTENANCE ITEM:

1	2	3				Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)	(Init/Date)						

MAU's 1,2,3 Locations: 1 - North Wing, 2 - South Wing, 3 - South Wing THREE YEARS

MAINTENANCE ITEM: Clean Condensate Pan and check for proper flow

1	2	3				Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)	(Init/Date)				Investigate deviations of more than 5%		

MAINTENANCE ITEM:

1	2	3				Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)	(Init/Date)						

MAINTENANCE ITEM:

1	2	3				Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)	(Init/Date)						

MAINTENANCE ITEM:

1	2	3				Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)	(Init/Date)						

MAINTENANCE ITEM:

1	2	3				Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)	(Init/Date)						

VAV Boxes MONTHLY

MAINTENANCE ITEM: Verify Space served is holding temp

Jan	Feb	Mar	Apr	May	Jun	Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)			
						0		

Jul	Aug	Sep	Oct	Nov	Dec	Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)			

MAINTENANCE ITEM: Hand check for airflow/ VAV Fan operation

Jan	Feb	Mar	Apr	May	Jun	Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)			
						0		

Jul	Aug	Sep	Oct	Nov	Dec	Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)			

MAINTENANCE ITEM:

Jan	Feb	Mar	Apr	May	Jun	Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)			

Jul	Aug	Sep	Oct	Nov	Dec	Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)			

VAV Boxes

QUARTERLY

MAINTENANCE ITEM: Change Filters in return of box

QTR 1	QTR 2	QTR 3	QTR 4			Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)					
						0		

MAINTENANCE ITEM: Check Airflow Operation of Box

QTR 1	QTR 2	QTR 3	QTR 4			Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)					
						Adjust setpoint to drive box open in cooling, then heating, hand check volume		

MAINTENANCE ITEM: Check Operation of reheat coil

QTR 1	QTR 2	QTR 3	QTR 4			Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)					
						Adjust setpoint to call for full heating then ck disch temp		

MAINTENANCE ITEM:

QTR 1	QTR 2	QTR 3	QTR 4			Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)					

MAINTENANCE ITEM:

QTR 1	QTR 2	QTR 3	QTR 4			Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)	(Init/Date)	(Init/Date)					

VAV Boxes

3 YEARS

MAINTENANCE ITEM: Vaccuum Reheat coil

1	2	3				Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)	(Init/Date)						
						0		

MAINTENANCE ITEM:

1	2	3				Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)	(Init/Date)						

MAINTENANCE ITEM:

1	2	3				Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)	(Init/Date)						

MAINTENANCE ITEM:

1	2	3				Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)	(Init/Date)						

MAINTENANCE ITEM:

1	2	3				Info	Ref	Comments (fill in)
(Init/Date)	(Init/Date)	(Init/Date)						

Preventative Master Maintenance Plan

Unit	Room Number	Type	Serves	Action	Daily	Weekly	Monthly	Quarterly	Semi Annually	Annually	3 Years	Information
SFC		El Heat/DX Cool	Hallway	Check Operation/ Disch Temps		X						Set controls to heating and cooling and verify proper operations in both modes
				Visual Check Cond Unit/ Noises?		X						
SFC-1	114			Change Filters			X					
SFC-2	144			Check Belt condition/ tension			X					Does it squeek on start?
SFC-3	165			Grease Bearings - 1 stroke			X					(Wipe away excess)
SFC-4	C41A			Check Refrigeration sight glass for bubbles/moisture			X					
SFC-5	C42A			Clean Interior of unit intake/filter section				X				
SFC-6	Z124			Check Condensing unit fan for vibration and speed				X				Does fan start quickly?
SFC-7	171			Clean DX coil on indoor unit					X			Use Calgon HD and water, rinse fully. Do not use pressure washer
				Clean Condensing Unit Coil					X			Use Calgon HD and water, rinse fully. Do not use pressure washer
				Hand ck airflow at all diffusers and grilles on system					X			
				Check Indoor unit blower motor amps and record						X		
				Check Indoor unit heating amps and record						X		Perform at full call for heating
				Check outdoor unit fan motor amps and record						X		
				Check outdoor unit compressor amps and record						X		Perform at full call for cooling
				Check wear on indoor unit blower sheeves						X		
				Check condition of indoor unit blower bearings						X		
				Check airflows with hood against Balance report							X	Investigate deviations of more than 5%
VAV Box		Fan Powered	Varies	Verify Space served is holding temp			X					
				Hand check for airflow/ VAV Fan operation			X					
FPB-1-1	Z123			Change Filters in return of box				X				
FPB-1-2	100			Check Airflow Operation of Box				X				Adjust setpoint to drive box open in cooling, then heating, hand check volume
FPB-1-3	162			Check Operation of reheat coil				X				Adjust setpoint to call for full heating then ck disch temp
FPB-1-4	161			Vaccuum Reheat coil							X	
FPB-1-5	174											
TB-2-1	261											
TB-2-2	265											
TB-2-3	260											
TB-2-4	265											
TB-2-5	Mezzanine South											
TB-2-6	Mezzanine South											
TB-2-7	Mezzanine South											
TB-2-8	Mezzanine South											
TB-2-9	Mezzanine South											
FPB-2-10	x214											
Exhaust Fans				Check Operation/ hand check grilles for airflow			X					
				Visual Check Unit/ noises?			X					
EF-1	104			Check Belt condition/ tension			X					

EF-2	134			Grease Fan Bearings - 1 stroke			X					Use lubricants found on page 6 of IOM Manual (Wipe away excess)
EF-3	204			Oil Motor bearing				X				Use lubricants found on page 6 of IOM Manual (Wipe away excess)
EF-4	234			Check Fan bearing wear					X			
EF-5	304			Clean exhaust grilles					X			
EF-6	334			Clean Fan housing					X			
EF-7	404			Check fan motor amps and record						X		Compare to previous year
EF-8	434			Change Belt						X		
EF-9	Mezzanine North			Visual and hand check ductwork for leaks						X		
EF-10	Mezzanine North			Check airflows with hood against Balance report							X	
AHU				Check Operation/ Disch Temps		X						Log in unit specific logbook
				Visually check for leaks, drips		X						
				Change Filters			X					Log date of change in logbook, ensure filters fit properly and any fill plates are re-installed. Shut unit down during filter change. Vacuum filter housing while filter are out.
AHU-10	158			Check Belt condition/ tension			X					
AHU-11	160			Grease Bearings - 1 stroke			X					
AHU-12	158			Put tabs in condensate pans			X					
AHU-13	161			Check operation of HW /CW valves			X					
				Check operation of mixing section dampers			X					
				Clean interior of unit intake/filter section				X				
				Check blower fan for vibration and noise				X				
				Hand check airflow at all diffusers and grilles				X				
				Clean Heating and cooling coils				X				Check in late August for proper operation
				Clean Condensate Pan and check for proper flow				X				
				Clean and lubricate mixing section damper linkages and bearings				X				Use approved dry lubricant, no oil, no oil based sprays
				Cycle HW/CW isolation valves open/closed 3 times					X			
				Check and record testing of duct detectors				X				Check both supply and return detectors, if so equipped
				Check outdoor unit fan motor amps and record						X		Check supply and return fan motors, if so equipped
				Check outdoor unit compressor amps and record						X		
				Check wear on unit blower sheeves						X		
				Check condition of indoor unit blower bearings						X		
				Replace belt(s)						X		
				Check system airflow with hood and compare to TAB report values							X	
Pumps		Base Mounted Pumps		Visually check for leaks, change in sound		X						
				Check temps, suction and discharge pressures, log		X						
P-3	158			Grease bearings - 1 stroke			X					
P-4	158			Check condition of pump/ motor coupling			X					
P-5	158			Check Oil sump if so equipped			X					
P-6	158			Shut off pump and cycle isolation valves open/closed 3 times					X			
P-7	158			If VFD equipped, cycle speed on BAS and verify pumps slow					X			

P-8	158			Check motor starter or VFD overcurrent protection						X		
				Check motor amps and record						X		If VFD, must use TRUE RMS Ammeter
				Remove and inspect strainer						X		
				Remove gauges and test them with low pressure air for operation						X		Gauge should read zero when exposed to atmosphere, must remove to check
				Check and record motor amps and pressures and compare to TAB report							X	
				Change rubber insert in pump/ motor coupling							X	
Pumps		Inline Circulator Pumps		Visually check for leaks, change in sound		X						
				Check temps, suction and discharge pressures, log		X						
P-1	158			Check Oil sump if so equipped			X					
P-2	158			Shut off pump and cycle isolation valves open/closed 3 times					X			
				Check motor starter overcurrent protection						X		
				Check motor amps and record						X		
				Remove gauges and test with air for operation						X		
				Check and record motor amps and pressures and compare to TAB report							X	If VFD, must use TRUE RMS Ammeter
				Change motor coupling for condition and alignment							X	
Boiler		Condensing Boilers	Heating	Check Boiler Room clear of debris, dirt, combustibles	X							Pay Particular attention to combustibles in space - Log in Notebook left in boiler room
				Once each Shift, log temperature and pressure from temp/pressure gauge	X							Log in Notebook left in boiler room
B-1	158			Check Venting and Air Inlet piping for integrity, along its entire length			X					Use roof safety practices
B-2	158			Check Screens on Vent and Inlet on roof for obstructions			X					Use roof safety practices
				Inspect the relief valve and relief valve pipe for signs of weeping or leakage			X					If valve often weeps, contact service technician, expansion tanks may be faulty
				Check Condensate drain systems			X					Inspect the boiler condensate drain, vent line, fittings, and trap for flow, blockage, and damage
				Flush Condensate Trap with water				X				See procedure on page 54 of Installation & Operation manual
				Test low water cutoff					X			See Manufacturers instructions, reset by hitting button to re-fire boiler
				Check Boiler gas and water piping for leaks					X			Check gas using bubbles or leak detector, ck supply piping and gas train while firing (if unsure have gas train checked by service tech)
				Operate relief valve to ensure it is not corroded or blocked						X		Visually verify flow from relief drain
				Annual Tune Up						X		Have boiler services and adjusted, including combustion analysis, by factory trained service tech utilizing pages 54-57 of the Installation & Operation Manual as the requirement for the work. Follow recommendations to replace any wear parts, perform this is late August.
				Third party inspection of relief valve							X	Inspect Relief Valve
Condensing Units/Heat Pum		Small and Large	Various	Check General Operation		X						Check weekly in season for general proper operation
				Check Refrigeration sight glass for bubbles/moisture			X					

HP-1	104			Check Condensing unit fan for vibration and speed				X				Does fan start quickly?
HP-2	134			Clean Condensing Unit Coil					X			Use Calgon HD and water, rinse fully. Do not use pressure washer
HP-3	228			Hand check airflow on unit in cooling					X			Is discharge volume significant? Is it warm?
HP-4	258			Check outdoor unit fan motor amps and record						X		
HP-5	328			Check outdoor unit compressor amps and record						X		Perform at full call for cooling
HP-6	358											
HP-7	428											
HP-8	458											
HP-9	134											
Cabinet Unit Heaters				Check for proper general operation				X				Cycle thermostat, good airflow? Heating?
				Vacuum clean unit						X		Prior to start of heating season
CUH-1	259			Check and log unit amps						X		Compare to previous year
CUH-2	259			If motor has oil ports, oil motor; other wise vaccuum motor cooling ports						X		
CUH-3	278											
CUH-4	170											
Modular Radiant Panels				Check for proper general operation						X		Cycle thermostat and verify heating.
				Clean panels by vacuuming, then damp cloth and mild detergent						X		
Modular Radiant Panels	158											
Fire Dampers				After first year of operation, test fire dampers, then every 3 yrs after							X	Log each test, keep for review by WVSFM
Fire Dampers	158			Review Manufacturers service literature prior to start							X	
				Check Closure Springs, replace if defective or broken							X	
				Operate damper by removing fusible link, allow shutters to close							X	(CAUTION: Keep fingers out of blade package path of travel)
				Check the damper for rust or corrosion							X	
				Clean Damper and lubricate parts using dry silicon lubricant							X	
				Replace the fusible link if damaged or melted in testing							X	
PTACs	Rooms	Sleeve, removable		Check operation in both heating and cooling mode			X					
				Clean and Replace Filter			X					Turn off unit before cleaning filter. Wash in mild deteregent solution and allow to dry before replacing
PTACs	Varies			Pull unit, clean coils on bench, clean drain, check sleeve drain, vacuum sleeve.					X			Use Calgon HD and water, rinse fully. Do not use pressure washer
				Bench test - after cleaning, check operation on bench, including excessive noise, return unit					X			
				Bench test - check and log: unit, compressor, and fan motor amps					X			Compare to previous readings
VTACs	Rooms	Closet, removable		Check operation in both heating and cooling mode			X					
				Clean and Replace Filter			X					Turn off unit before cleaning filter. Wash in mild deteregent solution and allow to dry before replacing

VTACs	Varies			Pull unit, clean coils on bench, clean drain, check sleeve drain, vacuum closet, check louvers for debris					X			Use Calgon HD and water, rinse fully. Do not use pressure washer
				Bench test - after cleaning, check operation on bench, including excessive noise, return unit					X			
				Bench test - check and log: unit, compressor, and fan motor amps					X			Compare to previous readings
Mini Split Systems		Ductless		Check General Operation			X					
				Clean and replace filter			X					Turn off unit before cleaning filter. Wash in mild deteregent solution and allow to dry before replacing
Mini Split System	C11 Corridor - First Floor			Clean Exterior Unit coils					X			Use Calgon HD and water, rinse fully. Do not use pressure washer
Mini Split System	C12 Corridor - First Floor			Clean Interior Unit coils						X		Vacuum coils thoroughly. Clean more often if dirty
Mini Split System	C21 Corridor Second Floor											
Mini Split System	C22 Corridor - Second Floor											
Mini Split System	C31 Corridor - Third Floor											
Mini Split System	C32 Corridor - Third Floor											
Mini Split System	C41 Corridor - Fourth Floor											
Mini Split System	C42 Corridor - Fourth Floor											
Face and bypass coils				Check general condition and operation			X					Particular condition to cleanliness of operators and linkages
				Clean Coils				X				Use Calgon HD and water do not use pressure washer
Face and Bypass Coils	158			Check for worn or loose linkage parts and smooth damper operation, lubricate with dry silicone spray				X				
Chiller		Multi compressor scroll		In the event of a re-occuring fault, cease re-setting and call a service technician								
C-1	Chiller Courtyard			Check general operation of Chiller	X							Check for leaves or other buildup on inlet of coils - Log in Notebook left in boiler room
				Check and log supply and return temps, time, Suction pressure, Discharge pressure, Discharge superheat, Suction superheat	X							Use manufacturer's Log Sheet in bound logbook - Log in Notebook left in boiler room
				Visually check fan operation, ck for noises, etc	X							LOG ALL FAULTS in logbook, with fault code, full chiller readings, and ambient temp at time of fault - Log in Notebook left in boiler room
				Check for water leaks in piping	X							Log in Notebook left in boiler room
				Check for refrigerant leaks as evidenced by oil on refrigeration piping of under chiller	X							Log in Notebook left in boiler room
				Log compressor and fans amps from display		X						
				Check refrigerant circuit sight glasses for proper liquid and moisture		X						Use flashlight, if bubbles or moisture indicated, call service technician
				Check compressor oil sight glasses for level		X						Use flashlight, if foam on surface, normal, if full of foam, shut down and call service tech

				Clean Condensing coils with water			X					Do not use pressure washer
				Clean Condensing coils with Calgon HD and water				X				Use Calgon HD and water do not use pressure washer
				Monitor chiller pump amps, log, and compare results			X					If VFD, use true RMS ammeter
				Check strainer and clean mesh screen						X		
				Have chiller operation checked by experienced trained technician at least twice before 15 Jul after startup						X		
				Have chiller winterized by experienced, trained technician						X		
				Have Chiller started in spring by experienced, trained technician						X		
Glycol System				Monitor and log glycol system pressure			X					Keep in system logbook
				Test operation of feed pumps by manual operation				X				
Glycol System	158			Pull sample in spring and fall and test for concentration & inhibitors by reputable water treatment co.					X			Follow recommendations, inhibitor levels are critical to a long term life of Glycol
Tempering Valve				Check and log operating temperatures and pressures	X							Log in notebook left in boiler room
				Utilize 3rd party technician to disassemble, clean and flush unit. Reassemble, start and adjust.						X		File copy of field report in logbook
Tempering Valve	158											
Backflow Preventers				Check for excess dripping or running water from BFP		X						Log in logbook
				Have tested by 3rd party for compliance with WVDoH Requirements						X		File copy of report in Logbook
Backflow Preventers	158											
Hot Water Tank				Check water heater area	X							Log in notebook left in boiler room
				Check pressure/temperature	X							Log in notebook left in boiler room
Hot Water Tank	158			Check vent piping			X					
				Check air piping			X					
				Check air and vent termination screens			X					
				Check relief valve			X					
				Check condensate drain system			X					See IOM pages 68-71
				Check automatic air vents			X					
				Check Delta T (Temperature Rise)			X					
				Check water heater piping (gas and water) for leaks					X			
				Operate relief valve					X			
				Inspect annually by a 3rd party qualified service technician in accordance w/ IOM instructions						X		
Generator Fuel System				Visually inspect and check day tank level		X						Log in logbook, record hours
				Visually inspect and change flexible lines and connections		X						Log in logbook, record hours
Generator Fuel System	Chiller Courtyard			Visually inspect and test fuel level switch		X						Log in logbook, record hours
				Check main tank supply level		X						Log in logbook, record hours
				Visually inspect and test solenoid valve operation		X						
				Visually inspect and test transfer pump operation		X						

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Purchasing Division
2019 Washington St. E.
Charleston, WV 25305

SEALED BID: Building 22 HVAC Renovations Design Project
BUYER: Linda Harper
Solicitation Number: CEOI 0211 GSD1900000006
Bid Opening Date: 4/19/2019
Bid Opening Time: 1:30 pm EST
FAX NUMBER: 304-558-2221