Litchfield Courthouse Adaptive Reuse
Litchfield, CT

Conceptual Design Report

for

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Table of Contents

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A. INTRODUCTION

The current Litchfield courthouse was originally constructed in 1890 in Litchfield, Connecticut after a fire destroyed two prior wooden structures. It was the third oldest of Connecticut's court houses when the State of Connecticut ceased using it in August 2017. A two-story addition was constructed on the rear of the building in 1930. The clock tower was fully reconstructed in the 1990s.

The building is proposed to be repurposed to the Litchfield Town Hall. This narrative describes the proposed engineering systems for the repurposing project, based on the scope indicated in the Cambridge Seven Associates architectural conceptual design drawings dated February 20, 2018. Information contained within this narrative should be considered conceptual in nature and will be further developed in the subsequent design phases.

B. STRUCTURAL

1. Structural Systems

Structural systems will be designed in accordance with the International Existing Building Code (IEBC), as amended by the 2016 Connecticut State Building Code (SBC). All repairs, alterations, additions, and changes of occupancy will comply with the provisions of the SBC.

Existing structure will be evaluated based on the procedures of the SBC. Existing structural elements carrying gravity load that are determined to have insufficient capacity to support the SBC prescribed design loads will be strengthened, supplemented, replaced, or otherwise altered to meet the requirements of the code.

<u>Design Loads</u>

Dead Loads:
Dead loads will consist of weights of the building materials.

Live Loads:
Offices (including partitions).............................. 65 PSF
Corridors/Lobbies (at first floor)........................ 100 PSF
Corridors (above first floor) .... 80 PSF
Storage & Mechanical Rooms........................... 125 PSF

Snow Loads:
Ground Snow Load .... 40 PSF
Snow Importance Factor 1.00
Snow Thermal Factor...................................... 1.00
Snow Exposure Factor.................................... 1.00
Flat Roof Snow Load....................................... 30 PSF (Minimum per SBC)
Sloped Roof Snow Load .... per ASCE 7
Drifting Snow Load... per ASCE 7

Wind Loads:
Basic Wind Speed .... 100 MPH
Wind Importance Factor 1.00
Wind Exposure Category .... B

2. *Foundations:*

The 1890 building has a stone foundation with a concrete slab-on-grade. The 1930 addition has concrete foundations with a concrete slab-on-grade. The existing foundation appears to be in generally good condition, but does show signs of ground water infiltration, including effervescence on exposed walls and water damage in finished space. Two (2) sump pumps have been added along the east wall. Improved site drainage and a perimeter foundation drain are recommended.

3. *Superstructure:*

The 1890 building superstructure consists of masonry bearing walls, interior cast-iron posts, with timber floor framing. Timber attic and roof framing is support by timber trusses that span the full width of the building and bear on the exterior walls. Exterior walls are clad in granite. The fire-safe vaults at the basement and ground levels were constructed with a double layer of masonry walls separated by an air gap and a masonry ceiling that is vaulted between steel beams.

The 1930 building superstructure consists of exterior clay tile bearing walls, and interior brick bearing walls, with concrete waffle slab floor and roof framing. Exterior walls are clad in brick. A fire-safe vault was added in the basement between interior bearing walls. An interior steel post was added for support of a concrete vault ceiling.

The existing superstructure appears to be in generally good condition with no visible signs of substantial structural damage. Proposed modifications to the existing load bearing structure will be designed to support code prescribed loading.

4. *Lateral System:*

Lateral resistance of the existing building structure is provided by the masonry bearing walls. Proposed modifications to the existing structure that result in a load-demand ratio increase of more than 10% will require the building to conform with the reduced seismic forces specified in the International Building Code. It is recommended that modification be kept below a level that would require seismic conformance.

5. *Elevator Addition*

An addition is proposed at the south~~east~~west corner of the building that will contain a new elevator and egress stair. The addition will be supported on concrete foundations. The superstructure will be either a steel frame, or load bearing masonry walls with concrete floor slabs. The elevator shaft will be constructed on 8" concrete masonry unit (CMU) block. Adjacent foundations may require underpinning for construction of the elevator pit.

The seismic mass of the addition shall be considered in the load-demand ratio of the lateral system. Given the large mass of the existing granite clad building, and the relatively small size of the proposed addition, the mass increase alone is not expected to trigger seismic conformance. The masonry walls of the addition may be considered as a 'voluntary lateral-force-resisting system alteration'.

6. *Miscellaneous:*

The brick cladding of the 1930s addition is supported by steel lintels over window openings. The lintels appear to have varying levels of deterioration. Repair may be possible for some of the less deteriorated lintels, but the original, untreated steel will require maintenance over the life of the building. It is recommended that the lintels be replaced with galvanized steel as part of the window replacement to minimize future maintenance.

C. HEATING, VENTILATING AND AIR CONDITIONING

1. *General*

Heating, ventilating, and air conditioning (HVAC) systems for the building will be designed in accordance with the Connecticut State Building Code and the following adopted model codes:

- 2012 International Building Code
- 2012 International Mechanical Code
- 2012 International Energy Conservation Code

As appropriate, standards, guidelines, and recommendations pertaining to energy efficiency, environmental quality, and building performance, such as those developed by ASHRAE, USGBC, and the USDOE, will be applied to the selection and design of the HVAC systems for the building.

2. *Existing Conditions*

The existing heating system consists of two (2) oil-fired steam boilers located in separate boiler rooms, 2-pipe distribution, cast iron radiators, and pneumatic control system. The steam system is antiquated and in poor condition. Fuel oil is stored in two (2) 1000-gallon underground tanks of unknown age. Mechanical ventilation is limited to local exhaust fans. Air conditioning equipment is limited to a packaged rooftop unit and split DX system serving the Courtrooms.

Overall, the existing HVAC systems are antiquated, in poor condition, inefficient, and/or incompatible with the proposed new space use and recommended for replacement as part of any long-term infrastructure upgrade project. Proposed replacement systems are as described below.

3. *Design Conditions*

The building will be fully air-conditioned, except for mechanical rooms, electrical rooms, stairs, and entry vestibules which will be heated and ventilated only.

The exterior design conditions will be based on the Climatic Design Conditions found in the 2017 ASHRAE Handbook - Fundamentals for Hartford, Connecticut. The interior design conditions will be based on the minimum and maximum temperatures stipulated in the 2012 IECC.

Exterior and interior design conditions will be as follows:

Condition	Heating Design	Cooling Design
Exterior	8.2°F DB, 13.1°F WB ASHRAE 99.6%	90.9°F DB, 73.1°F WB ASHRAE 0.4%
Interior	72°F DB	75°F DB, 62.5°F WB

4. *Heating and Cooling Source*

<u>Option #1A – Oil Fired Boilers and Air-Cooled Chiller</u>

Heating: The heating source for the building will be two (2) oil-fired hot water boilers located in the basement mechanical room. The boilers will be of the high-efficiency condensing type with an input capacity of approximately 750 MBH. The boilers will be vented up through the existing chimney using stainless steel liners and combustion air will be ducted through the sidewall. Hot water will be distributed throughout the building using two (2) 100 GPM floor-mounted inline pumps configured for lead/standby operation. The two (2) existing 1000-gallon underground storage tanks located along the west side of the building will be removed. Fuel storage replacement options under consideration are as follows:

- A single 2,000-gallon underground oil storage tank located along the west side of the building.
- Multiple 330-gallon oil storage tanks located in the basement within a fire-rated room. This could potentially be one of the existing vaults.

Cooling: The cooling source for the building will be a split air-cooled chiller located in the basement mechanical room with remote condensing unit located on the flat roof at the south end of the building. The chiller will be of the modular scroll type with an output capacity of approximately 40-tons. Hot water will be distributed throughout the building using two (2) 100 GPM floor-mounted inline pumps configured for lead/standby operation.

Option #1B – Propane Fired Boilers and Air-Cooled Chiller

Heating: Same as Option #1A, except the heating source for the building will be propane fired boilers in lieu of oil-fired boilers and multiple underground LPG tanks will be located at the south end of the building in lieu of oil tanks.

Cooling: Same as Option #1A.

Option #2A – Air Source Heat Pumps with Supplemental Oil Fired Boiler

Heating and Cooling: The heating and cooling source for the building will be multiple air-source heat pumps (ASHPs) located on the flat roof at the south end of the building. The ASHPs will be of the variable refrigerant flow (VRF) heat recovery type with cumulative output capacity of approximately 40-tons. Refrigerant piping will be routed from each ASHP to respective VRF indoor units through refrigerant control boxes located within the attic. Supplemental heat will be provided using a single oil fired boiler with on-site fuel storage as described under Option #1A.

Option #2B – Air Source Heat Pumps with Supplemental Propane Fired Boiler

Heating and Cooling: Same as Option #2A, except supplemental heat will be provided using a single propane fired boiler in lieu of oil fired boiler and on-site fuel storage will be as described under Option #1B.

Option #2C – Air Source Heat Pumps with Supplemental Electric Heat

Heating and Cooling: Same as Option #2A, except supplemental electric resistance heat will be used in lieu of boiler with on-site fuel storage.

5. *Space Heating, Cooling and Ventilation*

Option #1A – Oil Fired Boilers and Air-Cooled Chiller

Spaces will be heated and cooled using 4-pipe hydronic fan coil units. Fan coil units will be a combination of ceiling concealed, ceiling cassette and floor-mounted exposed types. Perimeter hydronic fin-tube radiation will be provided as a draft barrier where necessary and hydronic unit heaters will be provided to serve building entries, stairs, basement and attic. Hot and chilled water will be distributed throughout the building from the boiler and chiller plants located in the basement mechanical room.

Spaces will be ventilated using two (2) energy recovery units located in the attic. One unit will serve the north end (1,500 cfm capacity) and the other will serve the south end of the building (1,000 cfm capacity). The units will contain supply fan, exhaust fan, heat recovery core, hot water coil and chilled water coil. Outside air and exhaust air will be ducted to each unit within the attic through wall louver at dormer and/or clock tower. Conditioned supply air and return air will be ducted down through the building to each space.

Option #1B – Propane Fired Boilers and Air-Cooled Chiller

Same as Option #1A.

Option #2A – Air Source Heat Pumps (ASHP) with Supplemental Oil Fired Boiler

Spaces will be heated and cooled using VRF indoor units. VRF indoor units will be a combination of ceiling concealed, ceiling cassette and floor-mounted exposed types. Refrigerant piping will be distributed from roof-mounted ASHPs through refrigerant control boxes to VRF indoor units. Perimeter hydronic fin-tube radiation will be provided as a draft barrier where necessary and hydronic unit heaters will be provided to serve building entries, stairs, basement and attic. Hot water will be distributed throughout the building from the boiler plant located in the basement mechanical room.

Spaces will be ventilated using two (2) energy recovery units located in the attic. One unit will serve the north end (1,500 cfm capacity) and the other will serve the south end of the building (1,000 cfm capacity). The units will contain supply fan, exhaust fan, heat recovery core, hot water coil and refrigerant coil. Outside air and exhaust air will be ducted to each unit within the attic, through wall louver at dormer and/or clock tower. Conditioned supply air and return air will be ducted down through the building to each space.

Option #2B – Air Source Heat Pumps (ASHP) with Supplemental Propane Fired Boiler

Same as Option #2A.

Option #2C – Air Source Heat Pumps (ASHP) with Supplemental Electric Heat

Same as Option #2A except that supplemental electric resistant heat will be used in lieu of hydronic heat.

6. *Recommended System*

Option 2A is recommended over the other options due to the following considerations:

1) Option 2A versus Option 1A/1B: Has lower energy use and energy cost (see Energy Modeling section) and requires less on site fuel storage.

2) Option 2A versus Option 2B: Has similar energy use and energy cost (see Energy Modeling section) and allows fuel oil storage within building versus propane which must be located outside building.

3) Option 2A versus Option 2C: Has similar energy use and energy cost (see Energy Modeling section) and requires a smaller electrical service size. In addition, the hot water system provides better control and flexibility versus electric resistant heat.

7. *Miscellaneous Systems*

Tel/Data Cooling: Dedicated cooling systems will be provided for Tel/Data Rooms as required. Systems will of the ductless split type similar to that manufactured by Mitsubishi. The mini-split system will be provided with a manufacturer's stand-alone packaged controller.

8. Materials

Refrigerant Piping: Piping will be Type L ACR copper tubing with wrought or cast copper fittings and brazed joints and insulated with 1" thick flexible elastomeric insulation (Armacell).

Ductwork: Ductwork will be G60 galvanized sheet steel constructed in accordance with SMACNA standards. Supply and outside air ductwork will be insulated with 1-1/2" thick fiberglass duct wrap with FSK facing. Exhaust ductwork located within 10-feet of connection to building exterior will be insulated with 1-1/2" thick fiberglass duct wrap with FSK facing.

Drain Piping: Piping will be Type L copper tubing with wrought or cast copper fittings and soldered joints and insulated with 0.5" thick flexible elastomeric insulation (Armacell).

9. Automatic Temperature Controls

A direct digital control (DDC) system with electric actuation will be provided for HVAC system control and monitoring. The DDC system will be web-based with remote access capability and the ability to send critical alarm via multiple channels. The DDC system will be designed to allow for flexibility in scheduling of building occupancies. Specific control and energy management approaches will be coordinated with the Owner during design.

10. Energy Modeling

General: Energy modeling was performed to estimate the energy use and energy cost performance of the HVAC options previously described. Trace 700 energy modeling software was used for this purpose which is capable of simulating building energy use and energy cost using typical full-year weather data for region. The software is widely used in the industry for this purpose and complies with Appendix G using the Performance Rating Method of ASHRAE Standard 90.1-2010 for LEED analysis.

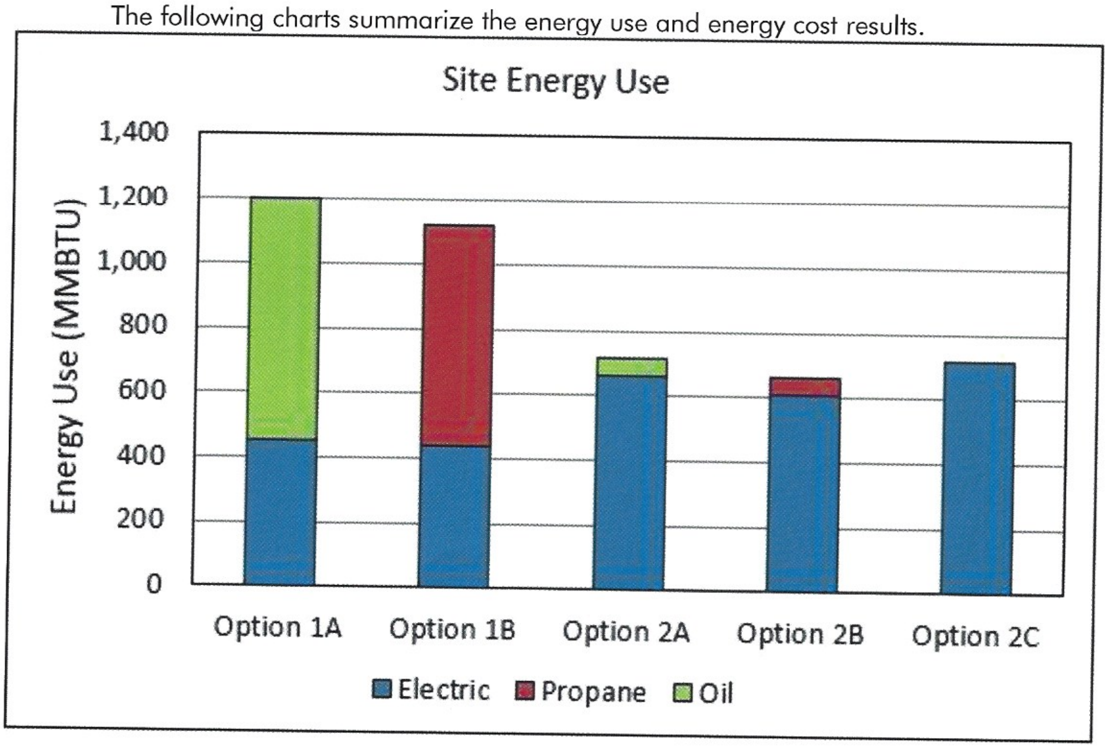
Assumptions: The following is a list of input assumptions built into the simulation model.

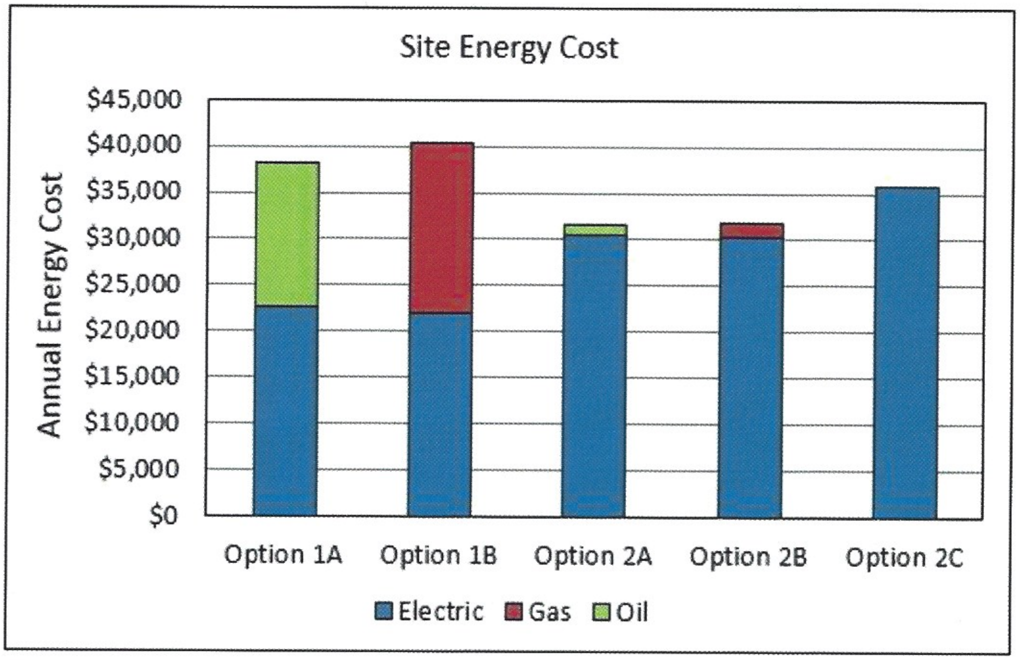
- The building envelope will remain as-is except that the windows will be replaced with code compliant assemblies.
- Program: 80% office space with full HVAC and 20% support space with H&V only
- Core weekday operating hours will be 8am-5pm with light use on weekends
- Glazing: 23% window-to-wall ratio; assembly U-factor = 0.42; SHGC = 0.40
- Exterior Walls: assembly U-factor = 0.5
- Roof: assembly U-factor = 0.2
- Lighting Power Density: 0.9 W/ft2
- Equipment Power Density: 0.80 W/ ft2 in offices

- Electricity Rates: $0.17/kWh
- Propane Rate: $2.72/therm ($2.50/gal)
- Oil Rate: $2.10/therm ($2.90/gal)
- Option 1A: Oil-fired boiler at 82% efficiency and air-cooled chiller at 10.1 EER.
- Option 1B: Propane-fired boiler at 90% efficiency and air-cooled chiller at 10.1 EER.
- Options 2A: ASHP at 10.4 EER / 3.2 COP and supplemental oil-fired boiler at 82% efficiency.
- Options 2B: ASHP at 10.4 EER / 3.2 COP and supplemental propane-fired boiler at 90% efficiency.
- Options 2C: ASHP at 10.4 EER / 3.2 COP with supplemental electric resistance heat.

Results: The ASHP options perform similarly and have the lowest energy use and energy cost versus the other Boiler/Chiller options. The primary reason for the improved performance is the much higher heating efficiency of heat pumps relative to boilers. The heat pumps have a heating COP of 3.2 (300% efficiency) versus the oil and propane fired boilers which have an efficiency of 82% and 90% respectively.

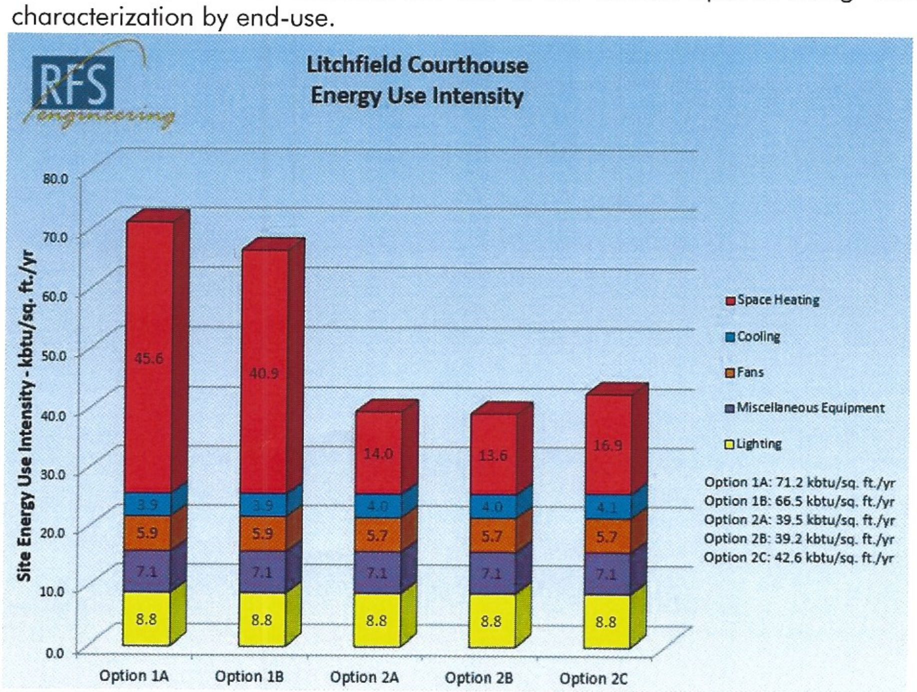
The following charts summarize the energy use and energy cost results.





A widely used metric for comparisons purposes is "Energy Use Intensity" (EUI), which is a way of comparing the energy use of different building and system types, and is expressed in terms of energy per square foot (kBtu/SF). Again, the ASHP options have the lowest EUI.

The following chart summarizes the EUI of the various options along with energy use characterization by end-use.



D. FIRE PROTECTION

1. General

A fire protection system will be designed in conformance with the 2016 Connecticut State Building Code, which is based on the 2012 International Building Code. An automatic sprinkler system will be provided throughout the building.

2. Fire Service

The building is currently provided with a 6-inch fire service, which is provided with an exterior vertical post indicating valve. The fire service enters the basement level, and includes a 6-inch double check valve assembly, and a 4-inch dry-pipe valve. Automatic sprinklers are provided throughout the building structure, but are not provided in the 1930 addition.

Due to the age of the existing fire service and sprinkler distribution piping, it is recommended the existing fire protection system be replaced in its entirety. A new 6-inch fire service, wet-alarm check valve, dry-pipe valve and all associated piping shall be provided. A new 6" fire service and exterior vertical post-indicating valve will be provided and will connect to the municipal water service five (5) feet beyond the building exterior wall.

The existing exterior post indicating valve and Siamese fire department connection are obstructed by site vegetation. It is recommended the vegetation be removed for clear access by the Litchfield Fire Department once the new equipment is installed.

3. Automatic Sprinkler System

It is assumed the entire building, including the attic, will be a conditioned space and will be served with a wet sprinkler system. (Note that the building attic is currently unconditioned). The new automatic sprinkler system will be provided throughout the facility. A dry-pipe valve shall be provided to serve the clock tower.

The sprinkler system will be designed as Light Hazard in all offices, assembly areas, common spaces and toilet rooms and will be provided with a density of 0.10 gpm per square foot over 1,500 square feet of design area. The system will be designed as Ordinary Hazard Group I in mechanical, electrical, and storage areas and will be provided with a density of 0.15 gpm per square foot over 1,500 square feet of design area.

A current hydrant flow test will need to be completed to verify the water volume and pressure available at the site to be used for the hydraulic design of the new system.

E. PLUMBING

1. General

The plumbing systems will be designed in accordance with the 2012 International Plumbing Code as adopted and amended by the State of Connecticut.

2. Domestic Water

The existing domestic water service which enters the basement level will be removed in its entirety. A new 4" domestic water service will enter the basement level water service room and will be provided with a meter and backflow preventer, and will connect to the municipal water service five (5) feet beyond the building exterior wall.

Due to the age of the existing domestic water pipe and equipment, it is recommended it be removed and replaced in its entirety.

Domestic hot water will be generated by a new electric water heater with integral storage and will be generated to 140-degrees. A master thermostatic mixing valve will be provided to reduce the temperature to 120-degrees for distribution to the domestic plumbing fixtures throughout the building.

Domestic cold water, hot water, and hot water re-circulation piping will be routed through the building, as necessary, to serve all plumbing fixtures. Both hot and cold water distribution mains will be routed parallel with each other for similar pressure drops to the points-of-use throughout the system. Hot water recirculation risers will be piped back to the water heater and will be used to maintain domestic hot water temperatures close to points of use.

Reduced pressure backflow preventers will be provided on the domestic water service feeds to HVAC equipment and the chemical feed system at the janitors sinks.

3. Fixtures

All existing domestic plumbing fixtures will be removed in their entirety. New plumbing fixtures will consist of wall-mounted high efficiency 1.28 gpf water closets and 0.125 gpf urinals, each sensor flush valves, lavatories with sensor faucets and low flow aerators. Dual-height water coolers with bottle fillers will be provided. Janitors' sinks will be floor-mounted terrazzo mop basins with wall mounted faucets with an integral vacuum breaker spout.

All fixtures will be ADA compliant where required.

Interior recessed hose bibs will be provided in all gang bathrooms. Floor drains will be provided in all mechanical spaces and gang bathrooms. Floor drains will be provided with electronic trap primers and ½-inch cold water pipe to each floor drain trap.

4. Sanitary System

Due to the age of the existing sanitary waste and vent piping system located within the building, it is recommended it be replaced in its entirety.

The new sanitary waste piping within the building will collect waste from the domestic plumbing fixtures and exit the building by gravity. The sanitary drain system will connect to the existing municipal sanitary sewer five (5) feet beyond the building exterior wall.

A duplex sewage ejector will be provided to serve the domestic plumbing fixtures located in the basement level, if it is determined they are subject to surcharge. The sewage ejector will discharge to the municipal sanitary sewer system beyond the building foundation wall.

5. *Storm System*

The existing pitched roofs discharge rain water to gutters and downspouts which discharge directly to grade. There is no proposed modification to this arrangement.

Due to the age of the existing storm drainage system located in the 1930 addition, it is recommended it be replaced in its entirety.

New conventional roof drains will be provided for all flat roof sections and will be installed within existing roofing membrane. The roof storm drainage will be routed internally through the building and exit the building by gravity. The storm drain will connect to the on-site municipal storm sewer and will extend five (5) feet beyond the building exterior wall. The secondary overflow roof drain system will be piped independently through the building and discharge to grade. Installation of new roof drain bodies will be coordinated with any potential roofing work.

Areaway drains will be piped to a basement level duplex sump pump, if it is determined they are subject to surcharge. The sump pump will discharge to the municipal storm sewer system beyond the building foundation wall.

6. *Natural Gas*

It was verified by Eversource that natural gas is not available to serve the building.

F. BUILDING ELECTRICAL SYSTEMS

1. *General*

The electrical systems for the building will be designed in accordance with:

- 2012 International Building Code as adopted and amended by the State of Connecticut 2016 State Building Code including Errata #1.
- 2012 International Energy Conservation Code as adopted and amended by the State of Connecticut 2016 State Building Code including Errata #1.
- 2014 National Electrical Code (NFPA 70) as adopted and amended by the State of Connecticut 2016 state Building Code including Errata #1.
- Life Safety Code (NFPA 101).
- National Electrical Safety Code (1996 ANSI C2).

- IEEE STD 739-1995 Recommended Practice for Energy Management in Commercial and Industrial Facilities.

- Lighting fixtures, fire alarm and electrical devices will be provided and located per requirements of the current Americans with Disabilities Act (ADA) Guidelines.

As appropriate, standards and guidelines developed by ASHRAE, LEED, and USDOE pertaining to efficiency, environmental quality, and building performance shall be applied to the design of the electrical systems.

2. *Electrical Service*

The existing electrical service is rated 400A, 208Y/120V, 3-phase, 4-wire from the electric distribution utility, Eversource. It is anticipated that the renovated building will require an increase in size and that the increase will vary based on the mechanical option selected for the building. There are five (5) options proposed for consideration for the HVAC renovation of the building:

- Option #1A is Oil Fired Boilers with Air-Cooled Chiller. This option will require an estimated electrical service of approximately 700A.

- Option #1B is Propane Fired Boilers with Air-Cooled Chiller. This option will require an estimated electrical service of approximately 700A.

- Option #2A is Air Source Heat Pumps (ASHP) with Supplemental Oil Fired Boiler. This option will require an estimated electrical service of approximately 900A.

- Option #2B is Air Source Heat Pumps (ASHP) with Supplemental Propane Fired Boiler. This option will require an estimated electrical service of approximately 900A.

- Option #2C is Air Source Heat Pump (ASHP) with Supplemental Electric Heat. This option will require an estimated electrical service of approximately 1,100A.

Coordination will be required with Eversource to increase the capacity of the electrical service.

3. *Site Lighting*

It is anticipated that the site lighting for the building and grounds will mainly be from building mounted lighting. The existing exterior building mounted lighting is non-compliant because it is not provided with emergency backup power. All new lighting will be energy efficient LED luminaires with full cut-off light distribution. An effort will be made to make the exterior lighting fixtures historically accurate to the building.

4. Power Distribution:

The new electric service will be sized for a total capacity to support 18,000 sq. ft. of finished space at 208/120 volts. As discussed above, the electrical size will vary based on the selection of the building mechanical system.

Power shall be distributed at 208/120 volt, 3-phase to additional panelboards as required within the building. All feeders will be designed with less than a 2% voltage drop.

Calculation of short-circuit momentary and interrupting duties for a three-phase bolted fault at each distribution switchgear, panelboard and other significant locations throughout the system will determine equipment ratings.

Equipment:

Local disconnect safety switches will be provided for all permanently connected equipment to allow a lockout point for zero energy in compliance per OSHA requirements and NEC 422.

Building service, transformer, and panelboard sizes will be based on estimated maximum demand plus known or reasonably anticipated future loads. Estimated maximum demand calculations will utilize appropriate NEC demand factors.

Branch circuit panelboards will be copper bussed with bolt-in breakers and door-in-door trim.

Grounding and Bonding:

A separate, insulated equipment grounding conductor, sized per NEC, will be provided within each raceway and cable tray, with each end terminated on a suitable lug, bus, enclosure, or bushing.

The electrical grounding system will include a concrete encased electrode. The grounding system will also include the bonding of all metal piping and ductwork to the main electrical ground bus located in the electrical room. The grounding system will include ground bars installed in all telecommunication rooms (TR) bonded to the building electrical ground through copper conductors.

A supplemental grounding electrode system will also be provided at the perimeter of the transformer pad.

Motors and Motor Control:

Mechanical equipment rated below ½ HP will be supplied by 120V single-phase power. Mechanical equipment rated ½ HP and above will be supplied with 208V three-phase power.

Stand-alone motor disconnects (separate from starter) will be non-fused, and shown for each motor. In specific cases where groups of motors are fed using a common feeder the individual disconnects will be fused.

Motor starters for HVAC equipment will be wall mounted in various mechanical spaces or will be unit-mounted for equipment located outdoors.

Circuit Breakers:

Electronic trip circuit breakers with field-adjustable and field-changeable trip units will be specified for frame size 250 amps and larger.

Interrupting capacity of circuit breakers in switchgear or panelboards will be suitable for the power system feeding them.

Coordination of the overcurrent protection is developed throughout the entire electrical distribution system by designing to a fully rated standard.

Feeders, Branch Circuits and Wiring Devices:

The distribution of power in the building shall be copper conductor and concealed. Wiring for panel feeders shall be individual conductors installed in conduit. For each power or lighting circuit, conduit will be utilized from the panelboard to the first junction box. MC type cable will be used from the junction box to electrical devices or luminaires. No conduits or cable will be exposed in finished areas. Columns, walls, and ceiling plenums will be used for power distribution where possible.

No more than six (6) duplex receptacles will be included on a general receptacle circuit. Where a circuit is designed for shop type equipment, maintenance equipment, appliances, etc., as few as one or two receptacles per circuit might be appropriate. Special receptacles will be provided for individual shop equipment as required.

Ground fault protected receptacles will be provided in all bathrooms, kitchens, vending areas, and unfinished basement areas, within 6 ft. of a sink, interior wet locations and exterior locations.

Coordination with Other Divisions:

Coordination will be made for electrical systems with the mechanical requirements. Electrical services will be included to HVAC and plumbing equipment.

The architectural and electrical design will be integrated so as to provide adequate space to install and maintain all equipment. No electrical equipment subject to failure will be installed in any location that would require excavation or building modification in order to replace such equipment.

Ventilation and Cooling - Adequate ventilation or cooling will be provided for electrical rooms and equipment. As a minimum, ducted fresh air will be provided for electrical rooms. Ventilation and cooling requirements will be coordinated with the Architect and Mechanical Engineer.

Electrical Room Requirements:

The following are the requirements for the electrical room in the building:

- The main room requires one door opening in the direction of egress from the room.
- Doors must have panic hardware.
- Rated Construction: NFPA 13 covers the requirements for fire ratings of electrical rooms, requiring sprinkler protection in electrical rooms unless all of the following conditions are met; 1) The room is dedicated to electrical equipment only; 2) Only dry type transformers are used; 3) The room is rated 2-hour construction; 4) No combustible storage is allowed in the room.
- The main electrical room should be sized approximately 10 ft. X 20 ft. to accommodate the main distribution panel with several branch panels. The size of the electrical room may vary with the size of the electrical service.

5. *Emergency Power:*

No emergency generator will be provided for the facility. Emergency lighting will be provided by individual battery pack units or an emergency lighting battery powered inverter to power selected interior and exterior lighting.

6. *Lighting:*

In general, the lighting design will be based on the guidelines of the Illumination Engineers Society of North America (IES) lighting handbook (latest version). The lighting design will use the recommendations given in this handbook for vertical and horizontal illuminance levels required in a given space. The LPD (lighting power density) will be complaint with IECC 2012.

Space Type	Horizontal (FC)	Vertical (FC)	LPD (watt/sq.ft.)
Offices	30		0.9
Lobbies	10	3	0.9
Stairs, Corridors	10		0.69
Restrooms	10	3	0.98
Outdoor Entrance	5	3	30 w/ft
Hearing Room, Interview Room	40		1.0
Recreation	30		1.0

Energy efficient lighting fixtures shall be provided throughout the new building. Lighting in finished spaces shall be energy efficient LED. LED lighting provides energy savings and long life with minimal maintenance. LED type lighting fixtures provide dimming capabilities and will be used to the greatest extent possible.

Corridors will utilize recessed LED fixtures and stairwell lighting will consist of wall or ceiling-mounted LED linear surface-mounted fixtures. Common spaces will utilize architectural fixtures with direct and indirect lighting distribution. Fixtures in the toilet rooms will be mounted along the walls to provide illumination of mirrors. Downlights in entry vestibules and common spaces will use LED technology. Utility areas without ceilings including mechanical, boiler, and electric rooms will be provided with industrial-type fluorescent fixtures with wire guards. Light fixture selections will be coordinated as the design progresses.

Exit lights will be LED, cast aluminum, in most areas with edge-lit exit sign in the lobby and public areas.

7. *Lighting Control Systems*

Automatic lighting control will be provided in spaces required to conform to the latest energy code adopted by the State of Connecticut. The lighting controls will be occupancy sensors for most applications and timers in specific applications where occupancy sensors are not suitable.

Lighting Controls Will Include:

- Occupancy or vacancy sensors will be used as much as practical. They will typically be used in all restrooms, common rooms, and individual offices.
- Day lighting/photo sensors will be used to provide dimming control of lighting systems in day-lit areas.
- Stand-alone digital timer switches will be used for storage areas, closets, and maintenance rooms.
- No automatic lighting control will be provided in mechanical and electrical rooms.
- The lighting control system will also operate corridors and common areas using astronomical time of day programming. Lights will be switched ON and OFF based upon preset time schedules or astronomical clocks. Occupancy sensors will also be integrated into the design. After hours, the occupancy sensor will turn lights ON and OFF based on occupancy.
- Exterior lighting will be controlled by an astronomical time clock.
- Emergency lighting will be powered either by battery packs or by emergency lighting inverter with battery backup. Emergency lighting will be provided along all means of egress, including exterior fixtures at all exits from the building. UL924 code compliant controls will be provided for the emergency lighting.

8. *Fire Alarm System*

A new addressable-type fire alarm system for the building will be provided. The fire alarm system will include duct-mounted smoke detectors, heat and photoelectric smoke detectors, manual pull stations and alarm horn/strobe units.

Devices will be in accordance with IBC 2012, NFPA 72, Litchfield Fire Alarm Regulations and ADA requirements and will include:

- Smoke detectors in elevator lobbies and the elevator machine room for elevator recall functions.
- Manual pull stations within 4 ft. of all exit doors.
- Notification appliances in all occupied spaces.
- Duct type smoke detectors will be located in supply and return air ducts in systems operating at 2,000 cfm or greater.
- Magnetic door holds will be located where requested with smoke detectors located for door release service.
- The fire alarm system will interface to the sprinkler system using supervisory pressure, tamper and alarm flow switches.
- Smoke detector located at the main fire alarm panel.
- Class A wiring will be specified unless specifically requested otherwise.
- Devices located in remote areas shall have remote indicators.
- A red external strobe to illuminate upon alarm activation.
- A green external strobe to illuminate upon sprinkler flow or pressure alarm.
- Master box or radio master box, per Litchfield Fire Department requirements for connection to the fire department reporting system.
- Knox box outside for fire alarm access key.

9. *Telephone/Data/CATV*

The telecommunications system will include a structured cabling system, backbone cabling and telecommunications room build-outs to support the renovation and addition. The horizontal cabling system will consist of Category 6 data and voice outlets (100/1,000 Mbps). The telecommunications system will include Category 6 cables, patch panels and blocks to create a fully operational system. Data outlets will be provided throughout the building for wireless access points.

The cabling system will be tested and certified by the telecommunications contractor to meet Category 6 and TIA/EIA standards.

Structured horizontal cabling for each floor will route to the telecommunications room and equipment racks with patch panels and wire management, grounding equipment, cable tray, conduit sleeves and backboards will be installed in the telecommunication room.

10. *Audio/Visual System*

Distribution raceways, floor boxes, specialty wall boxes and necessary data and CATV cabling to support audio/visual systems will be provided as required and determined in the design development phase of the project.

Mechanical

Electrical

Plumbing

Fire Protection

Telecommunications

Structural

Civil

Commissioning

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