LN CONSULTING

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Re: Town of Bennington Old Benn High Re-Development Project-Mechanical, Electrical, Plumbing, and Fire Protection (MEP/FP)

L.N. Consulting, Inc. has been retained to provide a mechanical, electrical, plumbing, and fire protection narrative regarding the approximately 29,200 sq. ft Area B portion of the proposed renovated facility that will house the YMCA, town offices, a senior center, Meals on Wheels kitchen and dining facilities and workshop space. The renovated facility is located at the existing old Bennington High School at 650 Main Street, Bennington Vermont, 05201.

Outdoor Design Conditions

Elevation	100	ft.
Winter		
Dry bulb	-9	F
Summer		
Dry bulb	84	F
Wet bulb	69	F
Relative Humidity	47	RH
Dew Point	62	F
Moisture	82	grains/lbs.

Indoor Conditions
Preliminary thermostat/sensor set points will be as indicated below. Space humidity levels will be continuously monitored via thermostats and sensors located throughout the facility. During the cooling season, the humidity levels will be controlled by the individual space conditioning air-source heat pumps. The air-source heat pumps will utilize factory controls to adjust fan speed and unit capacity control to adjust humidity levels. The space humidity levels will be monitored but will not be controlled during heating mode (there will not be any humidification).

General Classroom/Office Space Temperature/RH Control Schedules

	Winter Occupied	Winter Unoccupied	Summer Occupied	Summer Unoccupied
Temperature	72 F	62 F	75 F	82 F
RH %	Uncontrolled	Uncontrolled	<50%	<50%

General Lab Space Temperature/RH Control Schedules

	Winter Occupied	Winter Unoccupied	Summer Occupied	Summer Unoccupied
Temperature	70 F	60 F	75 F	84 F
RH %	Uncontrolled	Uncontrolled	<50%	<50%

General Back of House Spaces Temperature/RH Control Schedules

	Winter Occupied	Winter Unoccupied	Summer Occupied	Summer Unoccupied
Temperature	70 F	60 F	76 F	84 F
RH %	Uncontrolled	Uncontrolled	<50%	<50%

Mechanical

Ventilation Design

The ventilation rates supplied to each space within the facility will be calculated based on the procedures outlined in ASHRAE 62.1-2016. Ventilation air will either be provided by dedicated indoor Energy Recovery Ventilators (ERVs) or roof mounted ERVs depending on the space and the HVAC option selected for all spaces. As part of the base kitchen plan which utilizes gas appliances, grease laden vapor exhaust systems will be provided for the kitchen exhaust hoods and a roof mounted Make-up Air Unit (MAU) will be installed to provide the make-up air for the kitchen exhaust hoods.

Existing HVAC System(s)

Our understanding is that all of the existing mechanical systems including the steam supply and condensate return heating systems, ductwork, gas fired furnaces etc. and all supporting equipment and utilities will be demolished. All space conditioning and ventilation will be provided by new equipment as indicated below.

Heating and Cooling

The primary means of building conditioning shall be via an air-based system. Space conditioning will be via an air-to-air (air source) heat pump system. Below are (2) options for conditioning the facility. Option #1 primarily uses smaller VRF (Variable Refrigerant Flow) air-source heat pumps for space conditioning with multiple smaller ERVs to provide the code required ventilation. This system will utilize simplified controls to reduce costs with some small sections of a Direct Digital Controls (DDC) system for larger

ventilation equipment only. Option #2 primarily utilizes larger VRF systems and larger, high efficiency roof mounted ERVs with Variable Air Volume (VAV) boxes to adjust the ventilation air to each space. This system will utilize either DDC controls throughout or will utilize manufacturer controls for the VRF systems and DDC for the ventilation equipment. See more information regarding each proposed option below.

For all HVAC options, an exhaust fan is to be installed above Comp./H.P.W.H Rm. M112 to discharge cool or warm air into the Pantry/Storage M108 area and draw transfer air back from the Corridor M105 space if the area because overly cooled or too warm if the domestic hot water load is insufficient. Exhaust fan to be equivalent to a Greenheck SQ-120 with ½ HP EC motor.

For all HVAC options, an exhaust fan is to be installed in Y101.1 that discharges air into Fitness Center Y101 and draws transfer air from the Fitness Center into the space if the space becomes overly cooled from the domestic hot water heater. Exhaust fan to be equivalent to a Greenheck SQ-120 with ½ HP EC motor.

An existing to be relocated exhaust hood will be installed over the gas fired range, gas fired stacked ovens, and the convection (steam) oven. The existing hood is 108" long. Preliminary exhaust air sizing is for a 2,000 CFM exhaust fan to be located on the roof of the Dining/Café F100 space with a vertical discharge. Preliminary exhaust fan selection is for a Captiveaire DU85HFA with an EC motor installed on an 18" ventilated roof curb with a hinged access. Fan is to be UL762 rated for grease exhaust and is to be provided with high temperature gasketing and a grease collection tray. Make-up air will be provided by a roof mounted air-source heat pump unit with propane (gas-fired) backup heating. The Make-up Air Unit (MAU) will be equivalent to a Captiveaire CASTRU3 with a modulating EC supply fan, modulating air-source heat pump with modulating hot gas reheat for dehumification, modulating EC condenser fans, an 18" insulated roof curb, supply air duct smoke detector, a modulating gas fired burner and factory controls. The MAU will be sized to match the exhaust fan flow rate and will discharge approximately 1,000 CFM of make-up air into the Dining/Café space and 1,000 CFM in the kitchen. A Captiveaire variable volume controls system is to be installed on the hood to operate the exhaust fan and the make-up air unit. If it is feasible to retrofit the existing exhaust hood, an electronic Captiveaire isolation damper will be installed to isolate the ductwork from the outdoors when the exhaust system is not operating. All code required separation distances will be maintained from the exhaust discharge to ventilation and make-up air equipment intakes.

The grease laden vapor exhaust ductwork is to be welded stainless steel with 3" of fire wrap. The ductwork is to be installed per NFPA 96 guidelines and requirements

An existing exhaust hood will be relocated and installed over the existing to be relocated dishwasher. A roof mounted dishwasher exhaust fan will exhaust the vapor generated by the dishwasher. Preliminary sizing is for a fan equivalent to a Captiveaire DU33HFA to be installed on an insulated roof curb on above Dining/Café F100. A stainless-steel isolation damper equivalent to Nailor 2020-IB-SSF-FD-BS will be installed to isolate the ductwork from the outdoors when the dishwasher is not operating.

The walk-in cooler's/freezer's will have their condensing unit discharge in the space adjacent to the walk-ins. The domestic hot water heater will be located in this space to capture the waste heat to heat the domestic hot water.

If there is a desire to completely eliminate fossil fuel usage, electric cooking equipment (induction range etc.) could be installed in place of the existing to be relocated gas fired equipment. If all cooking appliances are electric, a recirculating ventless exhaust hood equivalent to Wells Manufacturing WVU-96 with 4-stages of air filtration, Type 1 compliant rated for grease laden vapors, and ANSI UL710B approved with an integral ANSUL fire suppression system. If this change is made, in lieu of the previously indicated make-up air unit, a dedicated ERV would be installed on the roof of the Dining/Café space rated for 3,000 CFM. Under Option #1, the ERV will be equivalent to a Semco FV4000. Under Option #2, the ERV will be equivalent to a Petra PAH.

HVAC Option #1 – Smaller VRF systems with multiple smaller ERVs

The primary means of space conditioning will be via air-source VRF heat pumps. Air-source VRF heat pumps utilize the refrigeration cycle to both heat and cool air. They accomplish this using a refrigerant reversing valve allowing the equipment to run the cycle as an air conditioner, or they can reverse the cycle to operate the system as a heater. Air-source units locate a unit outdoors (outdoor unit) which contains a large coil, fan(s) and the compressor which either operates as a condenser while running in cooling mode or as an evaporator while running in heating mode. The outdoor unit exchanges energy with the outdoors (either extracting heat energy from the air in heating more or rejecting heat energy to the air in cooling mode) and transfers that energy to the indoor equipment (indoor units) via refrigerant in refrigeration tubing. The proposed systems are a mixture of 1-to-1 VRF systems which have a dedicated outdoor unit to a single indoor unit or multi-head systems which utilize a single outdoor unit to serve multiple indoor units. VRF systems have variable speed inverter driven compressors that modulate the compressor(s) to match the load of the system which reduces compressor cycling and increase the system efficiency. The smaller multi-head heat pump systems do not have the ability to provide simultaneous heating and cooling and therefore all heads connected on a single system must either be in heating mode or cooling mode.

The VRF heat pumps will have low-ambient heating capabilities, factory controls utilizing a wired or wireless permanently mounted local controller (preliminary selection is to utilize a Mitsubishi MHK2 controller) which will provide scheduling capabilities along with dehumidification controls. The basis of design VRF systems are the 1-phase Mitsubishi Hyper-Heat units. Outdoor units will be roof mounted and installed on 18" tall stands equivalent to Quick-Sling units selected for the specific equipment.

We have completed preliminary sizing, zoning and equipment selections of the VRF systems. The proposed zones and equipment will be revised once final programming, envelope, and zoning decisions have been made utilizing a revised energy model. See below for proposed VRF Zoning:

System	Outdoor Unit	Indoor Unit	Space(s) Served	Ducted (Yes/No)	Outdoor Unit Location
1	MXZ-SM42NAMHZ-U1	(2) PLA-A24EA7R1.TH	Exercise Room #2	No	Gymnasium Roof
2	MXZ-SM48NAMHZ-U1	SLZ-KF09NA.TH	Northwestern Corridor Entry	No	Gymnasium Roof
		(2) SLZ-KF18NA.TH	Universal Locker Rm. Y106	No	
		MSZ-FS06NAU1	Changing Y106.4	No	
		MSZ-FS06NAU1	Restroom Y106.16	No	
3	PUHY-HP192TSNU-A	(4) PVFY-P54NAMU-E1	Gym Y107	Yes	Gymnasium Roof
4	MUZ-FS09NAH-U1	MSZ-FS09NA	Northern Exit Stairwell	No	Gymnasium Roof
5	PUHY-HP96TNU-A	(2) PLFY-EP48NEMU-ER1	Fitness Center Y101	No	Gymnasium Roof
6	PUHY-HP72TNU-A	(2) PLFY-EP36NEMU-ER1	Exercise Rm. #1 Y100	No	Gymnasium Roof
7	MXZ-SM48NAMHZ-U1	(2) PLA-A24EA7R1.TH	Functional Fitness Y102	No	Gymnasium Roof
		MSZ-FS06NAU1	Office Y102.1	No	
8	SUZ-KA18NAHZ	SVZ-KP18NA	Workshop 4 V103	Yes, Provide	Dining/Café Roof

				MERV 13 Return Filter Grilles	
9	SUZ-KA30NAHZ	SVZ-KP30NA	Workshop 3 V102	Yes, Provide MERV 13 Return Filter Grilles	Dining/Café Roof
10	SUZ-KA24NAHZ	SVZ-KP24NA	Workshop 2 V101	Yes, Provide MERV 13 Return Filter Grilles	Dining/Café Roof
11	SUZ-KA36NAHZ	SVZ-KP36NA	Workshop 1 V100	Yes, Provide MERV 13 Return Filter Grilles	Dining/Café Roof
12	MUZ-FS09NAH-U1	MSZ-FS09NA	Northeastern Exit Stairwell	No	Dining/Café Roof
13	MUZ-FS09NAH-U1	MSZ-FS09NA	Eastern Corridor	No	Dining/Café Roof
14	MUZ-FS09NAH-U1	MSZ-FS09NA	Receiving M110	No	Dining/Café Roof
15	MXZ-SM48NAMHZ-U1	(2) PLA-A30EA7R1.TH	Corridor/Kitchen M105/109	No	Dining/Café Roof
16	MXZ-SM36NAMHZ-U1	SLZ-KF09NA.TH	Reception Desk 101	No	Dining/Café Roof
		SLZ-KF09NA.TH	Corridor 102	No	
		SLZ-KF09NA.TH	Northern Corridor to Vestibule 103	No	
		SLZ-KF09NA.TH	Middle of Corridor 104	No	
		SLZ-KF09NA.TH	Office S102	No	
		SLZ-KF09NA.TH	Entry S100	No	
17	MUZ-FS09NAH-U1	MSZ-FS09NA	Craft/Painting Rm. S106	No	Single Story Roof
18	MUZ-FS09NAH-U1	MSZ-FS09NA	T.V./Computer Room S107	No	Single Story Roof
19	MXZ-SM36NAMHZ-U1	PLA-A18EA7R1.TH	Activity Room 2/Lounge S105	No	Single Story Roof
		(2) SLZ-KF09NA.TH	Activity Room 1 S109	No	
20	MUZ-FS09NAH-U1	MSZ-FS09NA	Southern End of Corridor 104	No	Single Story Roof
21	SUZ-KA09NAHZ	PEAD-A09AA2	Offices M100 through M104	Yes	Single Story Roof

22	PUHY-HP144TSNU-A	(2) PVFY-P48NAMU-E1	Dining/Café F100	Yes	Single Story Roof
		PVFY-P48NAMU-E1	Café/Stage F101	Yes	
23	MUZ-FS09NAH-U1	MSZ-FS09NA	Entry 112	No	Gymnasium Roof

Vestibules will be heated by electric resistance heaters to keep spaces conditioned to 50°F per the Vermont Commercial Building Energy Standards.

Building Ventilation

All of the spaces will have their ventilation air supplied by Energy Recover Ventilators (ERVs). The ERV's will be dedicated ventilation units that are 100% outdoor air and 100% exhaust air (no air is recirculated). The proposed indoor mounted ERV's will be equivalent to Renewaire EV Series and HE Series and Semco FV units for outdoor roof mounted equipment. All ERV's will have MERV 8 filters on the outdoor air intake airstream and the exhaust air returned to the unit airstream to protect the energy recovery wheels/cores. Units are to be provided with bypass dampers for economizer mode where applicable. All ERV's will operate with either time-clock control or occupancy sensing controls to enable/disable the units. Renewaire ERVs that serve fitness/exercise spaces, activity/lounge spaces etc. will utilize CO2 sensors to enable high fan speed for the equipment. ERV's serving restrooms will operate at constant volume during occupied hours or when occupancy is detected. Semco ERV's serving the Dining/Café and gymnasium spaces will utilize DDC controls and CO2 sensors to modulate the fan speeds. Renewaire ERV's will Renewaire RH electric duct heaters installed to warm the discharge air to approximately 60°F during the heating season. The Semco ERVs will have their ventilation supply air connected into the return ductwork in the spaces served. Supply duct smoke detectors will be installed for the Semco ERV's which will be tied into the building fire alarm system and shall be wired to shut down the equipment. All ERV's will have variable speed Electronically Commutated Motors (ECMs) where available and premium efficiency, inverter duty rated motors operated by Variable Frequency Drive(s) where ECMs are not available.

Indoor ERVs will be suspended in the space with vibration isolators and installed to provide manufacturer required clearances for maintenance and servicing. Outdoor/roof mounted equipment will be installed on 18" insulated roof curbs.

Louvers equivalent to Ruskin ELF6350DMP with bird screen and Kynar coating will be installed in the exterior walls to provide outdoor air intake and exhaust for the indoor mounted ERVs. Insulated control dampers equivalent to Ruskin TED50XT will be installed near the roof deck or the exterior louver to isolate the indoor ductwork with the ERV(s) are not operational.

The outdoor air supply ductwork will be insulated with 1" of 1.5 PCF duct wrap (for ductwork smaller than 24" wide) or 1" of 3 PCF duct board insulation (for ductwork 24" or larger wide).

ERV	Location	Spaces/Area Served	Model
ERV-1	Exercise Rm. #2 Y108	Exercise Rm. #2 Y108	Renewaire HE1XINV
ERV-2	Exercise Rm. #2 Y108	YMCA Lockers	Renewaire HE1XINV
ERV-3	Gym Y107 Roof	Gym Y107	Semco FV5000
ERV-4A & ERV-4B	Fitness Center Y101	Fitness Center Y101	(2) Renewaire HE1.5XINV
ERV-5	Functional Fitness Y102	Functional Fitness Y102	Renewaire HE1XINV
ERV-6	Exercise Rm #1 Y100	Exercise Rm #1 Y100 + Corridor Y104 South	Renewaire HE1.5XINV
ERV-7	Roof Above Activity #2	Lounge, Reception, Senior Offices, Central	Renewaire HE1XRTC

		Restrooms, Kitchen Storage	
ERV-8	Roof Above Activity Rm. #1	Activity Rm. #1, Kitchen S110, Activity #2/Lounge, Craft/Painting, T.V. Computer Room	Renewaire HE1.5XRT
ERV-9	Roof Above Dining/Café F100	Dining/Café F100, Café/Stage F101	Semco FV3000
ERV-10	Workshop 4 V103	Workshop 4 V103	Renewaire EV450 ECM
ERV-11	Workshop 3 V102	Workshop 3 V102	Renewaire HE1XINV
ERV-12	Workshop 2 V101	Workshop 2 V101	Renewaire HE1XINV
ERV-13	Workshop 1 V100	Workshop 1 V100	Renewaire HE1XINV

HVAC Option #2 – Larger Commercial VRF systems with simultaneous heating and cooling and fewer larger ERVs

The primary means of space conditioning will be via air-source VRF heat pumps. The VRF systems will be similar to the VRF systems indicated in Option #1 above, however, all of the systems will utilize larger outdoor units that serve multiple indoor units. The refrigerant piping will be routed from the condensing units to Branch Selector Boxes (BS Boxes) which contain multiple valves which allow individual zones to be either in heating or cooling modes (simultaneous heating and cooling). Simultaneous heating and cooling enables energy sharing between spaces that are in cooling mode and spaces that are in heating mode which saves energy.

As with Option #1 above, the VRF heat pumps will have low-ambient heating capabilities, factory controls utilizing a wired or wireless permanently mounted local controller (preliminary selection is to utilize a Mitsubishi MHK2 controller) which will provide scheduling capabilities along with dehumidification controls. The VRF system will be connected to the DDC system via the BACnet interface module which will allow remote access and control of the system. The basis of design VRF systems are the R2 and Y 3-phase Mitsubishi Hyper-Heat units. Outdoor units will be roof mounted and installed on 18" tall stands equivalent to Quick-Sling units selected for the specific equipment.

We have completed preliminary sizing, zoning and equipment selections of the VRF systems. The proposed zones and equipment will be revised once final programming, envelope, and zoning decisions have been made utilizing a revised energy model. See below for proposed VRF Zoning:

System	Outdoor Unit	Indoor Unit	Space(s) Served	Ducted (Yes/No)	Outdoor Unit Location
1	PURY-HP192TSNU-A	(2) PLFY-EP18NEMU-ER1	Exercise Room #2	No	Gymnasium Roof
		PLFY-P08NFMU-E	Northwestern Corridor Entry	No	
		(2) PLFY-P12NFMU-E	Universal Locker Rm. Y106	No	
		PLFY-P05NFMU-E	Changing Y106.4	No	
		PLFY-P05NFMU-E	Restroom Y106.16	No	
		PKFY-P08NLMU-E	Northern Exit Stairwell	No	

		(2) PLFY-EP36NEMU-ER1	Fitness Center Y101	No	
		(2) PLFY-EP24NEMU-ER1	Exercise Rm. #1 Y100	No	
		(2) PLFY-EP18NEMU-ER1	Functional Fitness Y102	No	
		PKFY-P04NLMU-E	Office Y102.1	No	
		PLFY-P12NFMU-E	Entry 112	No	
2	PUHY-HP192TSNU-A	(4) PVFY-P48NAMU-E1	Gym Y107	Yes	Gymnasium Roof
3	PURY-HP192TSNU-A	PVFY-P18NAMU-E1	Workshop 4 V103	Yes, Provide MERV 13 Return Filter Grilles	Single Story Roof over Corridor 104
		PVFY-P30NAMU-E1	Workshop 3 V102	Yes, Provide MERV 13 Return Filter Grilles	
		PVFY-P24NAMU-E1	Workshop 2 V101	Yes, Provide MERV 13 Return Filter Grilles	
		PVFY-P36NAMU-E1	Workshop 1 V100	Yes, Provide MERV 13 Return Filter Grilles	
		PKFY-P08NLMU-E	Northeastern Exit Stairwell	No	
		PLFY-P08NFMU-E	Eastern Corridor 104	No	
		PLFY-P05NFMU-E	Reception Desk 101	No	
		PLFY-EP12NEMU-ER1	Corridor 102	No	
		PLFY-P05NFMU-E	Northern Corridor to Vestibule 103	No	
		PLFY-P05NFMU-E	Middle of Corridor 104	No	
		PLFY-P05NFMU-E	Office S102	No	

		PLFY-P05NFMU-E	Entry S100	No	
		PLFY-P08NFMU-E	Craft/Painting Rm. S106	No	
		PLFY-P12NFMU-E	T.V./Computer Room S107	No	
		PLFY-EP18NEMU-ER1	Activity Room 2/Lounge S105	No	
		(2) PLFY-P12NFMU-E	Activity Room 1 S109	No	
		PLFY-P08NFMU-E	Southern End of Corridor 104	No	
		PEFY-P12NMAU-E4	Offices M100 through M104	Yes	
4	PURY-HP144TSNU-A	PKFY-P12NLMU-E	Receiving M110	No	Dining/Café Roof
		(2) PLFY-EP30NEMU-ER1	Corridor/Kitchen M105/109	No	
		(2) PVFY-P36NAMU-E1	Dining/Café F100	Yes	
		PVFY-P36NAMU-E1	Café/Stage F101	Yes	
5	PUHY-EP312TSNU-A	LEV Kit(s) and Control Boxes PAC-LVxxxAC-1's	ERV-1	No	Gymnasium Roof
6	PUHY-EP144TSNU-A	LEV Kit(s) and Control Boxes PAC-LVxxxAC-1's	ERV-2	No	Roof above Activity Room #2

Building Ventilation

All of the spaces will have their ventilation air supplied by Energy Recovery Ventilators (ERVs). The ERV's will be dedicated ventilation units that are 100% outdoor air and 100% exhaust air (no air is recirculated). Generally, all spaces will be ventilated via roof mounted ERVs with the exceptions of the (4) Workshops which will utilize indoor Renewaire or equivalent units as indicated in Option #1 above until the specific program requirements are determined. The proposed roof mounted ERV's will be equivalent to Petra PAH. The ERVs will utilize a high efficiency Sorption Coated dual heat exchanger core (AccuBloc) with a nominal energy transfer efficiency of approximately 85%. All units will have MERV 8 pre-filters and MERV 13 final filters. The units will have EC fans with modulating speed capabilities. The fan speed will be modulated to maintain a static pressure set point in the ductwork which will vary based on the ventilation requirements in each individual zone. An inline DX cooling coil will be installed with the units with refrigerant piping connected to an adjacent VRF system (systems #5 through 7). The units will be provided with integral supply and return duct smoke detectors. The outdoor air supply ductwork will be insulated with 1" of 1.5 PCF duct wrap (for ductwork smaller than 24" wide) or 1" of 3 PCF duct board insulation (for ductwork 24" or larger wide).

Outdoor/roof mounted equipment will be installed on 18" insulated roof curbs. As indicated above in Option #1, louvers equivalent to Ruskin ELF6350DMP with bird screen and Kynar coating will be installed in the exterior walls to provide outdoor air intake and exhaust for the indoor mounted ERVs. Insulated control dampers equivalent to Ruskin TED50XT will be installed near the roof deck or the exterior louver to isolate the indoor ductwork with the ERV(s) are not operational.

The ventilation air will be distributed throughout the facility with ductwork (the system will be fully ducted and will not utilize any ceiling plenum returns). Each ventilation zone will have an outdoor air supply and exhaust air Variable Air Volume (VAV) boxes. These boxes independently measure the air going through them and modulate a damper to maintain a desired airflow set point. There will be (2) types of ventilation zones. There will be constant volume ventilation zones such as zones that serve restrooms and janitor's closets, and there will be variable volume zones for the balance of the building. The variable volume ventilation zones will modulate the ventilation air delivered to and exhausted from each space to ensure that no space exceeds CO2 set point levels. By reducing ventilation air to the spaces that do not need design flow, significant energy is saved by both not conditioning and not moving the excess air volume. Each fitness/exercise room, Activity Room, Classroom/Craft Room or Painting Room etc. will have dedicated zones (1 supply and 1 exhaust VAV each). Multiple office spaces will be combined into a single ventilation zone with ventilation air distributed to each office with a fully ducted supply and exhaust system. CO2 will be monitored in every office space and the VAV boxes will modulate as necessary to ensure no office exceeds CO2 set points.

ERV	Location	Zones/Spaces Served	Model
ERV-1	Gym Y107 Roof	Exercise Rm. #2 Y108	Petra PAH, approximately 8,500 CFM
		YMCA Lockers	
		Gym Y107	
		Fitness Center Y101	
		Functional Fitness Y102	
		Exercise Rm #1 Y100 + Corridor Y104 South	
ERV-2	Roof Above Dining/Café F100	Lounge 100 + Reception Desk 101	Petra PAH, approximately 4,500 CFM
		Central Restroom and J.C. 105-110 and Corridor 104, Pantry/Storage M108 + J.C. M106, Office/Entry Area S100 to S104, Restroom S101.1	
		Craft/Painting Room S106	
		Activity Rm 2/Lounge S105	
		T.V./Computer Room S107	
		Activity Room 1 S109	
		Office Suite M100 to M104	
		Dining/Café F100	
		Café/Stage F101	
ERV-3	Workshop 4 V103	Workshop 4 V103	Renewaire EV450 ECM
ERV-4	Workshop 3 V102	Workshop 3 V102	Renewaire HE1XINV
ERV-5	Workshop 2 V101	Workshop 2 V101	Renewaire HE1XINV
ERV-6	Workshop 1 V100	Workshop 1 V100	Renewaire HE1XINV

Controls

A Direct Digital Controls (DDC) system will be utilized to provide proper control and monitoring the new HVAC equipment depending on the HVAC option selected. For Option #1, only the rooftop ERVs, control dampers, electric heaters, exhaust fans and the make-up air unit will be controlled by the DDC system. For Option #2, all HVAC ventilation equipment will be controlled by the DDC system and all of the VRF systems will utilize manufacturer controls with DDC interconnection for remote monitoring. The DDC system will be web-based which will enable remote access and will utilize the BACnet protocol. This system will be capable of managing energy savings functions of the mechanical systems and provide alarms to the building manager/service team. The building automation system shall include the following functionality:

- Each independent space in the building shall be configured with a wall mounted temperature/humidity sensor.
- Certain spaces will be equipped with occupancy sensors to operate HVAC equipment. See controls drawings for specific locations.
- Ventilation systems shall be configured as a variable volume system based on space occupancy and CO2 levels where applicable.

HVAC Ductwork and Piping Materials

Refrigerant piping shall be Type L (ACR) copper with brazed joints and fittings. All piping shall be insulated per the 2020 Vermont Commercial Energy Code using flexible elastomeric foam insulation. All exterior piping insulation will be painted with UV resistant paint and will be covered with an aluminum jacket.

Building Conditioning and Building Ventilation Systems ductwork materials shall be G-90 galvanized steel. All ductwork shall be insulated per the 2020 Vermont Commercial Energy Code using 1.5 PCF fiberglass duct wrap with FSK jacket equivalent to Knauf Earthwool for all ducts less than 24" and 3.0 PCF board insulation with FSK jacket for 24" and larger ducts.

The HVAC air distribution systems (fan coil units and ventilation system) shall be fully ducted, including all supply and return/exhaust air ductwork. The air distribution systems shall be designed in accordance with the recommended practices of ASHRAE, Chapter 21, "Duct Design", 2013 "Fundamentals" Handbook and SMACNA "HVAC Duct System Design". Supply and return ductwork shall be designed to maintain an air velocity below 800 FPM near duct transitions and take-offs and below 500 FPM near terminal units to minimize noise levels.

All discharge and return air ducts supporting diffusers and registers shall be fitted with adjustable locking quadrant type volume dampers to allow balancing and adjustment of air flows into each room. Dampers shall be located at takeoffs from main air ducts to minimize noise at registers.

Flexible air ducting shall be limited to 6 feet total length per take-off. All distribution ductwork shall be sealed to a Class B seal.

All penetrations through fire rated shaft partitions shall be fitted with combination fire and smoke dampers with duct access doors, and breakaway connections as required. Switches shall be provided to test the smoke dampers.

The HVAC systems sound levels shall meet the following sound criteria: Less than 35 dB (A) at any location 2'-0" from noise source, air outlet or equipment.

Plumbing

Existing Plumbing System(s)

Our understanding is that all sanitary waste and domestic water piping within the space will be demolished. All storm drainage piping and storm drainage exit will remain existing.

Sanitary Waste and Vent System

Waste and venting piping shall be installed per the latest adopted edition of the International Plumbing Code. An existing 4" waste exit location is expected to remain that exits to the south near the new Lounge 100 space. The new kitchen and all eastern plumbing fixture waste will tie into this line. A new 4" waste exit will be installed that exits to the north towards Pleasant Street near the new YMCA Universal Locker Room. This line will serve the new locker rooms and a planned (15) 2-bedroom apartments located above the YMCA space. A future connection will be provided for these future apartments to tie into.

All water closets will be ADA compliant, low flow capable with an anti-microbial coating. Water closets will utilize sensor operated flush valves with 1.1/1.6 gallon per flush operation.

All lavatories will be mounted on concealed arms carriers (unless installed in casework) and installed per ADA requirements. All lavatories will have sensor operated faucets with 0.5 GPM flow rate. Faucets will have temperature control capabilities and will have an under-sink mixing valve to provide tempered water per ASSE 1070 requirements. Lavatories will have ADA insulation kits for the sink drains.

Showers will be installed per ADA requirements with all necessary grab bars and a detachable handheld shower heads. As an alternative energy savings option, showers will drain to an in-floor horizontal drain water heater recovery system equivalent to an EcoDrain A1000 installed in an accessible concrete trench.

All non-hand washing sinks will discharge through floor sinks within the kitchen. Floor sinks are to be constructed of PVC equivalent to Sioux Chief #861-3PZ. The dishwasher discharge is to be tempered with a drain water tempering valve to limit the discharge water temperature to less than 140°F.

Floor drains will be installed throughout the kitchen area for easy cleaning.

The janitor's closets should be fitted with floor mounted 24"x24" basins with utility faucet, mop holder, wall guards, and bucket hose.

Grease Waste and Vent System

The kitchen grease waste system will be supported from a new 4" grease waste main and an interior buried (or exterior if a suitable location is selected) grease trap. Final grease trap sizing to be determined once the kitchen design is completed and expected meal types/quantities are determined. Fixtures in the cooking kitchen that contain grease waste shall discharge to the grease waste system through indirect drains (floor sinks) where required per code. All kitchen floor drains shall drain through the grease trap. The grease trap will be an engineered polyethylene interceptor equivalent to Trapzilla TZ-600. Cleanouts will be provided upstream of the grease trap and the grease trap will be vented to comply with manufacturer requirements with a dedicated vent to the outdoors.

Fixtures

All fixtures shall comply with Vermont's Anti-Lead law VT ACT 193 (0.25% weighted average lead content for fixtures). Water fountains (where applicable) should be based upon a standard ADA wall mounted unit that is fitted with a carbon filter system and water bottle filler. Fixtures are to have an anti-microbial finish where applicable.

Water Supply Systems and Domestic Water System

A new domestic water service entrance will be brought into the facility from the north into room Y101.1. Final water service sizing will be determined once final fixture quantities/types are determined including future housing needs. Preliminary sizing is for a 3" domestic cold-water service. The water entrance shall have a backflow preventer, water meter, pressure reducing valve, pressure gauges, and isolation valves.

Domestic Hot Water System

The domestic hot water systems shall be configured with main electronically control mixing valves located at the domestic hot water heaters to maintain the hot water supply temperatures below 120°F. Preliminary sizing is for (1) A.O. Smith CHP-120 Hybrid Heat Pump Water Heater to be installed in Y101.1 to serve the YMCA showers and fixtures at the west end of the facility and a separate A.O. Smith CHP-120 water heater located in Comp./H.P.W.H Rm. M112 to serve the kitchen and fixtures at the east end of the facility. Preliminary sizing of the mixing valves is for each domestic hot water system to be controlled by a Powers Intellistation Jr. LFIS100VL. A domestic hot water recirculation (DHWR) system will be installed for each domestic hot water system that will recirculate hot water to limit the time it takes for hot water to reach each fixture. Balance valves (Lead Free) will be installed on each branch of the system to ensure each branch is receiving adequate flow. The DHWR systems will be controlled by temperature sensor(s) and building occupancy sensor(s) along with timeclock control. The DHWR pumps will be equivalent to Grundfos Alphas with stainless steel construction rated for potable water.

Plumbing Piping Materials

DCW piping shall be Type L copper with soldered joints and fittings or Aquatherm green (Polypropylene-R) piping and electro-fusion welded joints and fittings. DCW piping shall be insulated per the 2020 Vermont Commercial Energy Code with fiberglass pipe insulation with an All-Service Jacket.

DHW and DHWR piping shall be Type L copper with soldered joints and fittings or Aquatherm green (Polypropylene-R) piping and electro-fusion welded joints and fittings. DHW and DHWR piping shall be insulated per the 2020 Vermont Commercial Energy Code with fiberglass pipe insulation with an All-Service Jacket.

Sanitary waste and vent piping shall be schedule 40 PVC piping for both above and below ground piping with solvent cement joints.

All grease waste and vent piping shall be schedule 40 PVC piping from the fixture to the exterior grease trap.

Electrical

Distribution

The entire building is served via an existing 2000 amp, 120/208 volt, three phase, four wire service entrance that terminates in a 2000 amp Square D switchboard. The new 30,000 sf renovation area will be provided with a separate new 1200 amp, 120/208 volt service entrance. The 30,000 sf renovated area will be removed from the existing 2000 amp switchboard and the existing switchboard will remain to serve the non-renovated portion of the building. The new 1200 amp panelboard shall be provided with breakers for all the new panelboards within the renovated spare. The new 1200 amp service will be on a single meter. It is assumed the new service can be fed from the existing pad mounted transformer.

During future phases of work, such as expansion for residential apartments or other commercial spaces within the non-renovated portions of the building, the existing 2000 amp switchboard will have to be removed or replaced to accommodate them.

All the electrical distribution within the renovated space will be removed. The preliminary design is to provide a dedicated 225 amp panelboards for each occupant space (Housing, Meals on Wheels, Senior Center, Workshop Area, YMCA) as well as a dedicated 800 amp house panel for elevators, flex space, common space and exterior.

Branch Circuiting

All existing branch circuiting within the renovated space will be removed.

Where feasible, there will be no exposed circuiting or conduits. Where exposed circuiting or conduits are required, EMT conduit is to be used where approved by electrical codes. For corrosive areas Schedule 40 PVC conduit to be used. Rigid steel conduit only used in areas subject to physical damage where required by electrical codes. Schedule 40 PVC conduit to be used for underground circuits. All other spaces within walls or above ceilings will be MC cable.

Where running circuits to exterior locations, smaller surge protective devices will be provided at the panelboard or breaker serving these circuits.

For feeders over 100 amps, aluminum conductors will be used. For elevators or larger HVAC equipment, aluminum may be used up to the contractor-furnished disconnect switch however copper conductors shall be used between disconnect and unit.

As required, circuiting for mechanical and plumbing equipment will be provided based on the proposed systems.

Lighting

All existing lighting within the renovated space will be removed.

New LED light fixtures would be used throughout the facility. Other than in rooms such as closets, electrical, elevator, storage, mechanical rooms, and similar, or other minimally occupied spaces, dimming will be provided per Vermont Commercial Building Energy Standards. The dimming function will also be used in locations with exterior light exposure as required by these standards.

For corridors and similar spaces with grid tile ceilings, 2x2 lighting would typically be used, except in special circumstances, and spaced approximately 12’ on center. Most other rooms will be either 10’ on center or 8’ on center as required to meet IESNA lighting recommendations for schools.

Large restrooms to be controlled via occupancy sensors for auto on/auto off. Small, single person restrooms provided with manual on/auto off control and occupancy sensor. All bathrooms will be provided with emergency lighting.

For gymnasiums, the design foot candle level will be approximately 75. Lighting will be provided with dimming capability. Control of lighting to be via wall-mount occupancy sensors, keyed switches, and programmed operation (manual or via “scenes”) via the lighting control system.

Stairwells will be provided with wall mount direct/indirect on wall along stair risers. These fixtures are to be provided with integral battery backup. Control of these fixtures, including occupancy sensors will allow lights to dim when stairwell not occupied, will be tied to the network.

Storage closets, shops, maintenance spaces or other similar locations without a ceiling grid will be provided with chain or ceiling surface mounted LED strip lighting.

All lighting shall be DLC or EnergyStar rated, where applicable.

Emergency interior lighting will be typically via exit signs with integral “eyeball” emergency lighting. Where additional emergency lighting required that cannot be provided via exit signs, wall mounted “eyeball” type fixtures will be provided. In large spaces with high ceilings such as gymnasiums or auditoriums, the use of a lighting inverter that powers some ceiling mounted lighting in the space will be used. All emergency lighting will be battery backup type with self-diagnostics.

All exterior exit locations shall be provided with egress lighting. This will be via building mounted lighting. Emergency power would be provided via a lighting inverter located indoors to provide power to the exterior building mounted fixtures around the renovated portion of the building. Exterior building mounted lighting will be controlled via the lighting control system based on local outdoor-rated occupancy sensors and ambient light levels.

For the parking areas, new pole mounted area lighting will be provided. All new lighting would be fed via a new circuit(s) from the building and where the path would be considered an egress path the lighting would be provided with emergency backup power.

A photometric study will be performed for all exterior lighting to verify light levels meet the requirements of the local authorities having jurisdiction.

Unless directed by others, all lighting foot candle levels will be based on latest edition of the IESNA (Illuminating Engineering Society of North American) design handbook.

Lighting Controls

The new lighting control system will be a digital, similar to the Acuity nLight system. Lighting shall be controlled in zones. It may be desirable, based on costs, to provide a networked control system to allow for easier commissioning as well as providing the owner with the means to monitor the lighting remotely, or perform such functions as have the lighting automatically turn on during a fire alarm. However, it is assumed networked control will not be used.

The exterior lighting will also be tied into the control system to enable remote timeclock and occupancy control. The new pole mounted lighting will be controlled via an integrally mounted lighting control system that allows both ambient light level and occupancy sensor control. The new exterior lighting will be dimmable.

Lighting for individual rooms will be provided with local control. All spaces shall be provided with occupancy sensors. Where required by energy code, daylight harvesting control will be provided. Egress paths, large restrooms, electrical and mechanical spaces will be auto on/auto off control. Non-egress paths will typically be manual on/auto off control, with exceptions as required for safety.

General Power

Provide commercial specification grade 120 volt NEMA 5-20R receptacles as follows:

- (1) Receptacle every 25’ along walls in corridors.
- Coordination will be required for locations such as shop and science classrooms to ensure adequate power and receptacles. Provide “non-standard” receptacles as needed.
- General-use GFCI receptacles in kitchen, prep areas, service areas, in addition to receptacles indicated on kitchen vendor plans. Locate every 20’ along walls. Provide GFCI receptacle every 4’ along kitchen countertops.

The intent will be to keep the number of 20-amp receptacles per circuit to less than 6. Some locations may be less depending on requirements.

Where required by energy code or other ordinances, some receptacles will be tied into the lighting control system for load shedding when areas are not occupied. This is expected to be minimal.

All single-phase receptacles less than 150 volts to ground up to 50 amps and 208/240-volt three phase receptacles up to 100 amps in kitchens, bathrooms, within 6' of sinks, wet locations indoors or outdoors, locker rooms, garages and service bays, or other similar rooms, shall be provided with GFCI protection. Where GFCI protection is not "readily accessible" (i.e., behind dishwasher, etc.), the GFCI protection shall be provided with the circuit breakers in panelboards or the use of "blank face" devices with GFCI test buttons located adjacent to receptacle and in an accessible location.

In some locations such as the dining/café area or other public areas, receptacles with USB ports will be provided.

Coordinate with mechanical contractor and mechanical controls contractor for all power for HVAC and plumbing equipment. All controls including 120-volt power for control systems to be provided under mechanical work. All VFDs or other motor control equipment to be provided under mechanical work.

Fire Alarm

The existing fire alarm system is relatively new and reusable and will remain to serve the non-renovated portion of the building. A new fire alarm panel with annunciator with full voice evacuation for the gymnasium that complies with local, state and NFPA requirements will be provided for the renovated space. The fire alarm would tie into the security and lighting control systems for enhanced safety or as required for lock release. Manual pull stations at each exit and at stairwells will be provided. At locations open to the public, protective covers (such as STI Stopper II) to be provided on pull stations. The new fire alarm system will tie to the existing system for full building alarm coverage and notification to fire department.

Smoke detectors to be provided only in a few areas, such as storage rooms or other rooms where normally not occupied, and corridors where doors are provided with door holders. Duct smoke detectors to be provided in supply ductwork for all HVAC equipment with a supply CFM of 2,000 or higher and in the return ductwork where return CFM is 15,000 or greater. Locate detectors per manufacturer's standards and prior to branching of ductwork.

Wherever magnetic door hold-opens a provided to hold doors open, additional smoke detectors will be provided at each of these doors.

The fire alarm system will have connections to fire protection systems such as, but not limited to, the sprinkler and kitchen suppression systems.

Provide smoke detectors at each elevator lobby and each elevator machine room.

At no location within the building will the decibel level for the fire alarm system be less than 75 dBA.

The fire alarm will communicate with the fire department via the requirements set forth by the local authority having jurisdiction.

Telecommunications

It is understood the existing telecommunication system within the building can accommodate the renovated space. All new data will be fed from this location. Provide ceiling mounted data jacks for wireless access ports (AP). Estimate (1) jack every 50' square (2,500 sf) per floor, with each classroom provided with a dedicated wireless access port.

At a minimum, (2) data jacks shall be provided in each room.

Miscellaneous

A new security system will be provided, with cameras, card readers, etc. as required. The security system would tie into the BMS system. Means to perform functions such as automatic lockdown, lighting control, monitoring by remote means (police department, etc.) would be provided. Security cameras will be located throughout the campus, both indoors and outdoors. Panic buttons as noted in fire alarm section will be provided at specific locations.

It is assumed no work is required for the elevator. Normally, an area of rescue communication system with push button stations on all "non-exit" floors, with all required signage, would be required. It is assumed this work is by others.

It is assumed no EV chargers are required since the parking is existing. If there is new parking, new EV chargers would be required per the Vermont Commercial Building Energy Standards. The number would be based on the number of additional parking spaces.

Fire Protection

The existing facility contains a fire protection entrance with a backflow preventer in the lower level of the facility. The fire protection system shall be reworked to provide a single wet system control zone for renovated town area. Existing fire protection distribution shall be re-used where applicable. New heads shall be provided on all existing piping within the renovate areas. A hydrant flow test is required to verify system pipe sizing. The fire protection piping will be sized to provide a complete NFPA 13 compliant fire protection system for the renovated space. The fire protection system shall be designed by a NICET Level III Technician experienced in design of this type of work and licensed in Vermont. The majority of the building shall be covered as Light Hazard density with 0.1 GPM/sq.ft over 1500 sq.ft with some locations such as storage rooms, mechanical rooms, workshops and kitchens covered under Ordinary Hazard Group 1 density with 0.15 GPM/sq.ft over 1500 sq.ft. An Ansul fire suppression system shall be installed under the hoods in the kitchen to provide fire protection against grease and cooking fires. Dry-type sidewall sprinkler heads will be installed to protect exterior canopies.

Fire protection piping shall be threaded-end schedule 40 steel for 2" and below. Fire protection piping 2-1/2" and above shall be schedule 10 steel with grooved fittings.

Please feel free to ask us any questions regarding this scope of work

If you any questions or require additional information, please contact our office.

Sincerely,
L.N. Consulting, Inc.

Ian Donahue, P.E.
John Askew, P.E.
George D. Martin, P.E.