GEARY ENGINEERING, INC.

MIDDLE / HIGH SCHOOL

Heating, Ventilating and Air Conditioning:

The building is heated and cooled by a water source heat pump system. The heat pump water loop temperature is heated using two high efficiency natural gas fired boilers. The loop is cooled with a cooling tower coupled to the system via a plate and frame heat exchanger. There are main loop pumps located in the mechanical room that circulate the water throughout the school to individual water source heat pumps. The heat pumps are generally located above the lay-in ceilings or in mechanical rooms and are single zone, serving a dedicated room or group of rooms. The heat pumps are controlled by individual room thermostats. The Gymnasiums, Locker Rooms and Wrestling Room are not connected to the heat pump system are are heated and ventilated only with no air conditioning. Air handling units serving the Gymnasiums and locker rooms use hot water from the boiler system for heating. Outside ventilation air for the classrooms and administration areas is brought in to the building through roof-mounted gas-fired makeup air units.

The majority of the mechanical equipment is original from when the building addition was built 30 years ago in 1994 with the exception of the hot water boilers.

Central Mechanical Equipment:

HEATING HOT WATER BOILERS: Aerco Benchmark 750. High efficiency condensing, 750 MBH input. The boilers are 7 years old, installed in 2017. The typical life expectancy of a high efficiency boiler is 15 to 20 years.

COOLING TOWER: Marley. Scheduled: 375 gpm, 95 degree EWT, 85 degree LWT, 78 degree wet bulb, 7.5 HP. The life expectancy of most cooling towers is 15 to 20 years before they should be replaced or rebuilt. The cooling tower for the school is 30 years old and has reached the end of its useful service life.

HEATING WATER PUMPS: Bell and Gossett model DB-3X base mounted end-suction. Scheduled: 80 gpm at 60 feet head, 3 HP. Installed in 2017. Variable frequency drives. The pumps are 7 years old.

HEAT PUMP LOOP PUMPS: Marathon Electric, base mounted end-suction. Scheduled: 375 gpm at 110 feet head, 15 HP. Yaskawa variable frequency drives. The pumps appear to be original.

COOLING TOWER PUMP: Aurora Pump base mounted end-suction, 375 gpm at 60 feet head, 10 HP. The pump appears to be original.

Cooling Tower

Hot Water Boiler

HW BOILER PUMP: Bell and Gossett model C63CXJCB-1205 inline type, 40 gpm at 30 feet head, ¾ HP. Installed in 2017.

HEAT PUMP LOOP HOT WATER HEAT EXCHANGER: Paul Meuller Company model AT40 F-20 plate and frame type. Scheduled: heat pump side: 375 gpm, 95 degree EWT, 85 degree LWT. Tower side: 375 gpm, 83 degree EWT, 93 degree LWT. Heat exchanger appears to be original.

WATER SOURCE HEAT PUMPS: There are three vertical heat pumps located in mechanical spaces. The rest of the heat pumps are horizontal, located above ceilings. The heat pumps are controlled by individual wall thermostats. The majority of the heat pumps are original.

HEATED MAKEUP AIR UNITS FOR VENTILATION SUPPLY: Greenheck model KSU, capacities vary. There are four gas-fired rooftop units that supply 100% outside air for ventilation to classrooms, administration and resource areas. These units are heating only. The spaces utilize an unducted open plenum return system and the outside air is ‘dumped’ into the ceiling plenums of each space where it mixes with the return air and makes its way back to the heat pump unit.

TEMPERATURE CONTROL SYSTEM: The mechanical building automation system is Johnson Controls Metasys and is the original system from 1994.

Recommendations:
With the exception of the boilers and associated pumps, the central mechanical equipment overall is at or beyond the expected useful service life. It is recommended to start replacing equipment as needed.

The cooling tower requires the most maintenance and it is essential to keep the cooling tower in proper working condition. If the cooling tower is not replaced at this time, it is recommended to have it professionally cleaned and serviced.

The heat pump units for classrooms and other spaces are at or beyond their useful service life and should be replaced as needed. Higher efficiency units are available now for replacement which would reduce energy use.

The temperature control system should be updated to the latest software.

Main Gymnasium
There are two air handling units serving the gymnasium which are heating only, located in a mechanical room. Ventilation and cooling is accomplished using outside air which is ducted into the units from roof-mounted gravity intake hoods. Air is relieved/exhausted through roof-mounted relief fans. The air handling units, coils, intake hoods and relief fans are 30 years old.

AIR HANDLING UNITS: McQuay/Snyder General air handling unit. Scheduled 9,900 cfm, 7.5 HP. Hot water coil: 57 gpm, 570 mbh total heating.

RELIEF FANS: Greenheck. Scheduled 9,000 cfm, 3 HP. Roof mounted.

GRAVITY INTAKE HOODS: Greenheck

Recommendations:
The air handling units are beyond their useful service life and should be replaced with new. Air conditioning can then be added. All the existing ductwork can be reused. New air handling units would have a heating hot water coil to utilize the existing hot water system that is already there. A split system direct expansion cooling coil would be added for air conditioning. High efficiency remote air-cooled condensers could be located on the roof above with refrigerant piping connecting to the cooling coils.

A large amount of outside ventilation air is required for the gymnasium which uses a lot of energy. It is recommended that energy recovery units be installed on the roof to replace the exhaust fans and intake hoods. Energy recovery units use the exhaust air to precool or preheat the outside air being brough in so less energy is needed to heat and cool the supply air. Energy is saved and the HVAC equipment can be downsized.

Gymnasium Air Handling Unit


Gymnasium Air Intake Hoods and Exhaust Fan

Locker Rooms/ Wrestling Room

AIR HANDLING UNIT: McQuay/Snyder General model LSL122DH. Scheduled 11,150 cfm, 15 HP. Hot water coil: 36 gpm, 362 mbh total heating. The unit appears to be original.

The air handler serves the locker rooms and support areas, and the wrestling room in the basement and is heating only. The hot water coil is sized to supply room neutral 70 degree air. A roof exhaust fan provides exhaust for the locker rooms and fresh air is made up through a wall louver, ducted to the return duct.

Recommendations:
Because the locker rooms are in a completely interior space in the lower level, air conditioning is probably not essential except for humidity control. The air handling unit is at or beyond its useful service life and will need to be replaced in the near future. At that time, it is recommended to add a direct expansion cooling coil for better humidity control. A high efficiency remote air-cooled condenser could be located on the roof above with refrigerant piping connecting to the cooling coil.
If centralized cooling is not desired for the locker rooms, the wrestling room would still benefit from air conditioning for the occupants due to the usage. In this case, a stand-alone ductless split system would make the most sense, similar to what was done in the classrooms at the elementary school. The same type of equipment could also be used in the existing weight room if air conditioning is desired in that space.

Commons

The Commons Area is served by a heat pump unit located in the weight room. A relief fan operates along with the fresh air intake damper to provide ventilation to the space. The heat pump unit and relief fan are 30 years old.

HEAT PUMP UNIT: Johnson Controls model RLXV300TR40CCBGNA3SSB. Scheduled: 11,000 cfm supply. Heat pump coil: 51 gpm, 261 MBH total cooling, 261 MBH total heating.

RELIEF FAN: Greenheck, 8,000 cfm, 2 HP.

Recommendations:
The heat pump unit serving the Commons Area is at or beyond its useful service life and will need to be replaced in the near future.

Original Gymnasium and Locker Rooms

There are two air handling units serving the original gymnasium which each sit on an upper mezzanine on either side of stage area. Each unit is heating only, equipped with a hot water coil. Supply ductwork runs along the north and south walls with duct-mounted sidewall supply grilles to serve the gymnasium space. Each unit has a low return grille in the gymnasium. Outside air is ducted directly to the units from wall louvers. There are roof-mounted relief hoods in the gymnasium for relief air.

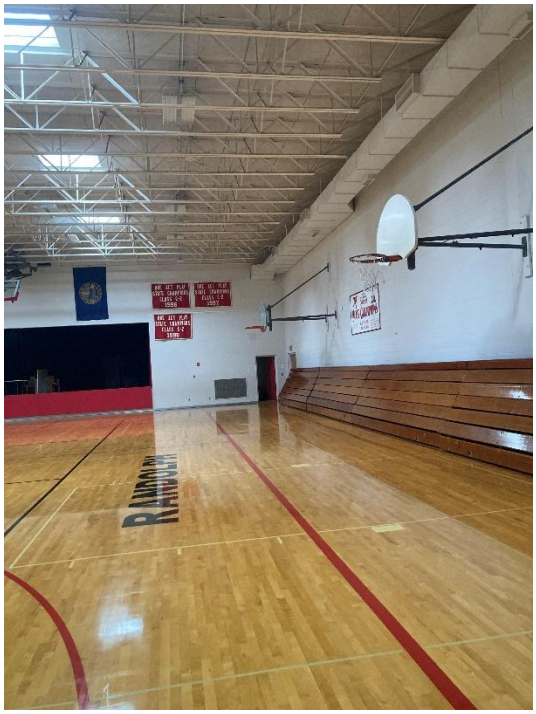
The locker rooms below the stage are heated and exhausted only. Heat is supplied by wall mounted hot water radiators.

AIR HANDLING UNITS: Dunham-Bush #HU-215. Unknown airflow and hot water capacities. Units appear to be original.

Recommendations:
The air handling units serving the original gymnasium are very old and need to be replaced. The new air handling units would have hot water heating coils and direct expansion cooling coils. The existing ductwork can be reused. High efficiency remote air-cooled condensing units would be located on the roof or on the ground. If space permits, it is recommended to include an energy recovery section in the air handing unit for preconditioning the outside ventilation air.

The locker rooms below the stage are heated and ventilated only. If this is acceptable, the system can remain as it is. It is recommended to replace the exhaust fans. If air conditioning is desired, a stand—alone ductless split system is recommended.

Original Gymnasium Air Handling Unit



Original Gymnasium Ductwork

Kitchen

The kitchen is heated and cooled with a horizontal ducted heap pump unit. There is a grease exhaust hood for the cooking equipment with a roof exhaust fan and a gas-fired roof mounted makeup air unit. There is also a hood for the dishwasher with an exhaust fan on the roof. The heat pump unit, hood, exhaust fans and makeup air unit all appear to be original from 1994.

HOOD EXHAUST FAN: Greenheck model CUBE-200-15-G. Scheduled 4,300 cfm exhaust.

DISHWASHER EXHAUST FAN: Greenheck, Scheduled: 600 cfm exhaust.

MAKEUP AIR UNIT: Greenheck model KSU-112-A-3-15. Scheduled: 3,440 cfm, 400 MBH input.

Recommendations:
The mechanical equipment serving the kitchen is at or beyond its useful service life and should be replaced as needed. At that time the hood exhaust system should be re-evaluated for compliance with current codes and the needs of the current or future cooking equipment.

Life Safety

Fire Sprinkler:
The building is equipped with a partial fire sprinkler system that serves classrooms, corridors, commons area, stairs and custodial storage areas. The remaining areas of the building are unsprinkled. The domestic water and fire sprinkler services share a common 6" building service that tees off inside the building. The fire sprinkler service is equipped with a listed backflow preventer.

Recommendation:
The existing fire sprinkler system should be expanded to include the entire building, designed and installed to meet current codes. Sprinkling the entire building will require many of the ceilings to be removed and put back.

Fire Alarm System:
The main fire alarm system is located in the main electrical room on the lower level with a remote annunciator panel located in the main vestibule.

FIRE ALARM PANEL: Notifier by Honewell fire alarm system with voice evacuation. Main panel located in basement electrical room. Remote annunciator located in main vestibule.

Recommendations:
A complete fire alarm system analysis should be performed to ensure the building is up to code.

Electrical

Electrical Service:
The electrical service consists of two services fed from a pad mounted transformer. The main service is 600 amps at 277/480 volts, 3-phase. The second service is also 600 amps at 277/480 volts, 3-phase and serves the heat pump system equipment including heat pump units, cooling tower and hydronic pumps. The main distribution panels are located in the main electrical room on the lower level and appear to be original from 1994. The main distribution panels are General Electric. It appears that the electrical service size is adequate to add air conditioning to the gymnasiums.

Lighting:
The majority of the lighting is original fluorescent lights from 1994.

Recommendations:
The existing lights throughout the building should be replaced with new energy efficient LED lights. Lighting controls should be upgraded to provide occupancy sensor controls, dimming, etc. Changing to LED and upgrading the controls will greatly reduce energy usage.

GEARY ENGINEERING, INC.

ELEMENTARY SCHOOL

Heating, Ventilating and Air Conditioning:

The building is heated using a hot water boiler system. Two hot water boilers are located in the boiler mechanical room. Hot water is circulated to individual unit ventilators in each of the classrooms as well as hot water convectors, unit heaters and fin tubes throughout the building. Air conditioning has been added to the classrooms and administration areas. The air conditioning has been added recently and consists of ductless mini-split units. Indoor wall mounted units are located in each of the classrooms and in the offices which are connected via refrigerant piping to individual outdoor condensing units.

Ventilation air is provided through the cabinet unit ventilators which each have an exterior louver for bringing in fresh air to each individual unit.

The majority of the heating and ventilation equipment appears to be original from approximately 60 years ago.

The HVAC system for the area of the gymnasium addition has been updated to serve the daycare. New furnaces and condensing units provide both heating and air conditioning to the classrooms, kitchen and office areas. The gymnasium space is still on the hot water heating system and is not air conditioned.

Central Mechanical Equipment:

HEATING HOT WATER BOILERS:
Boiler #1: Peerless 210-7-W-S Cast Iron, 1,260 MBH input, 1,008 MBH output.
Boiler #2: Peerless 210-12-W Cast Iron, 2,310 MBH input, 1,848 MBH output.
The boilers are approximately 54-60 years old. It is difficult to get parts for repair and the boilers are well beyond their useful service life.

HEATING WATER PUMPS:
Pump #1: Bell and Gossett, base mounted end-suction. Scheduled: 100 gpm at 55 feet head, 5 HP.
Pump #2: Marathon Electric, base mounted end-suction. Scheduled: 100 gpm at 55 feet head, 5 HP.
The hot water pumps appear to have been replaced at some point and are in good condition.

Hot Water Boiler

Heating Water Pumps

UNIT VENTILATORS: Unit ventilators are located in the classrooms, assembly and library areas.
Size 1: 1,000 cfm, 4 gpm, 76 MBH
Size 2: 1,250 cfm, 4 gpm, 84 MBH
Size 3: 1,000 cfm, 4 gpm, 76 MBH

Typical Classroom Unit Ventilator

DUCTLESS MINI-SPLIT SYSTEMS: Varies: Johnson Controls model DCP36, 3-ton nominal cooling. Daikin model FTX36, 3-ton nominal cooling.

Ductless Mini-split Indoor Unit

Ductless Mini-split Outdoor Units

TEMPERATURE CONTROL SYSTEM: The building utilizes the original pneumatic control system. The air compressor and head end are located in the boiler system. This system is outdated and should be removed and replaced with a digital building automation system.

Existing pneumatic temperature controls

Recommendations:
With the exception of the hot water pumps, the entire hot water boiler system is well beyond its useful service life, including the two boilers, hot water piping, classroom unit ventilators, hot water convectors, unit heaters and fin tubes. It is difficult or impossible in some cases to get parts for repair. The newer ductless split system air conditioners provide adequate cooling but are not a long-term solution. It is recommended to replace the entire HVAC system with all new.

Option 1 – Water Source Heat Pump System
A water source heat pump system would be similar to what is at the High School/Middle School. A heat pump water loop would run in the existing tunnels and above ceilings to individual heat pump units. The heat pump units would be located in the new ceiling space created by removing the existing hard lid ceilings. Conditioned air would be ducted to ceiling supply diffusers throughout the room.

The heat pump system can utilize either a geothermal well field or a boiler/cooling tower system (similar to the High School/Middle School). A geothermal well field has a higher upfront cost, but has many advantages over a boiler/cooling tower system. Boilers and cooling towers require a lot of maintenance and the controls can be complicated. They will also eventually need to be replaced. A cooling tower also needs to be located outside so there would need to be an outdoor space dedicated for it. Right now, there are tax credits available for geothermal systems that would greatly offset the cost of installation. For all these reasons, we recommend a geothermal wellfield over a boiler/cooling tower system.

Option 2 – Variable Refrigerant Flow
A variable refrigerant flow (VRF) system is similar in theory to a standard split system where an outdoor condensing unit connects to an indoor cooling coil with refrigerant piping. The difference is that a VRF system is able to connect to multiple indoor units to be all on one system working together. VRF systems obtain their high efficiency through the use of inverter compressors which can ramp up or down based on the load. This means that an inverter compressor can run at lower speeds when the heating/cooling load is small, saving energy. The recommended type of VRF system for the school is a heat recovery type. A heat recovery system allows heating and cooling at the same time and transfers the energy from one unit in cooling to be used for heating in another unit. The indoor units can be ducted forced air units, ceiling cassette units or wall mounted units (similar to what is installed in the elementary school now). For the classrooms, we would recommend either ducted units mounted above the ceilings or ceiling cassette units.

With a VRF system, the boiler/hot water system would be removed. This would free up the boiler room to possibly house the condensing units. The condensing units can be either air-cooled or water-cooled. An air-cooled system would require the condensing units to either sit outside somewhere or they could possibly be located inside the boiler room. If inside, the units would need to be ducted to the exterior. A water-cooled system would allow the units to be

located in the boiler room but would require a geothermal well system to be coupled with the condensing units.

With either Option 1 (Heat Pump System) or Option 2 (VRF) the existing classroom unit ventilators and hot water radiators would all be removed which would create more floor space. Because outside ventilation air was brought in through the unit ventilators, a new method of providing ventilation air would be required. Typically, this is accomplished with a dedicated outdoor air (DOAS) unit. The DOAS unit(s) would supply room neutral outside air to each space to satisfy the ventilation requirements. DOAS units can be heat pumps or VRF.

Life Safety

Fire Sprinkler:
The building currently is not equipped with a fire sprinkler system.

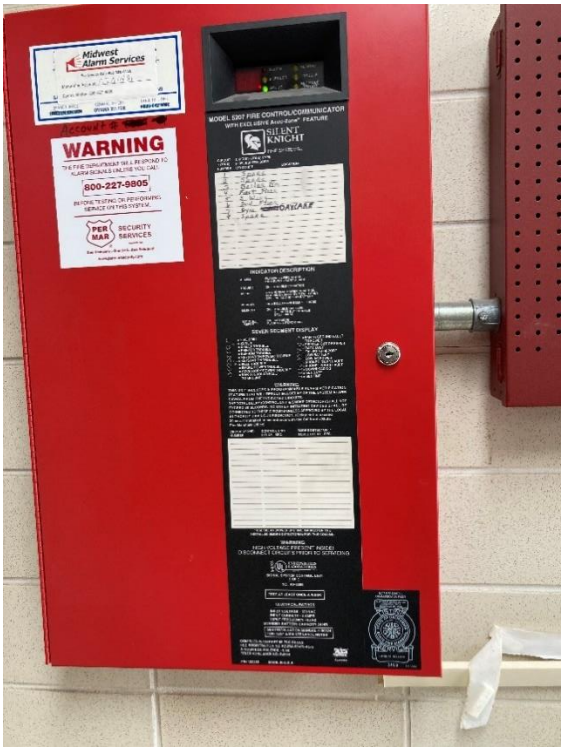
Recommendations:
A complete fire sprinkler system should be provided to protect the entire building. The new fire sprinkler system should be designed and installed to meet current codes.

It is recommended to put the fire service entrance in the corner mechanical room of the gymnasium addition.

Fire Alarm System:
The building is equipped with a standard fire alarm system without voice evacuation. The fire alarm panel is located in the main entrance corridor near the office. The fire alarm system should be updated to include voice evacuation. Many of the pull stations are mounted too high and will be required to be lowered to meet current code. A full evaluation of the fire alarm system should be done to determine code compliance.

FIRE ALARM PANEL: Silent Knight model 5207 Fire Control/Communicator, 8 zones, expandable to 16 zones.

Main Electrical Switchboard



Main Fire Alarm Panel

Electrical

Electrical Service and Distribution:

The existing electrical service is 800 amps at 120/208 volts, 3-phase. The main service panel is a Square D Company QMB fused switchboard located in the boiler room and appears to be original. When air conditioning is added to the building the 800 amp service size will likely be inadequate.

Recommendations:

A larger service and a new main panel is recommended to handle the additional air conditioning loads. Some older distribution panels may need to be replaced where replacement parts are no longer available.

Lighting:

The lights in all the corridors have been updated to new LED. The remainder of the lights are mostly fluorescent.

Recommendations:

The remaining lights throughout the building should be replaced with new energy efficient LED lights. Lighting controls should be upgraded to provide occupancy sensor controls, dimming, etc. Changing to LED and upgrading the controls will greatly reduce energy usage.

Receptacles:
The classrooms appear to be lacking in receptacles. The lack of receptacles has required the use of extension cords and power strips which is not ideal.

Recommendations:
New receptacles should be added to the classrooms. Due to the block construction, it is recommended to use surface raceway and boxes.

GEARY ENGINEERING, INC.

VOCATIONAL BUILDING

Heating, Ventilating and Air Conditioning:

The main shop building is heated only. Temperature control is difficult. Ventilation is limited and does not meet current codes.

The smaller building is also heated only, utilizing gas-fired radiant heaters and unit heaters. Temperature control is difficult. The paint spray booth has its own integral exhaust system.

Recommendations:
The equipment for the shop building needs to be replaced with new. Air conditioning should be added with a split system furnace and condensing unit. Ventilation should be evaluated to ensure proper ventilation for the shop areas.

Life Safety

Fire Sprinkler:
The building currently is not equipped with a fire sprinkler system.

Recommendations:
A complete fire sprinkler system should be provided to protect both buildings. The new fire sprinkler system should be designed and installed to meet current codes.

Fire Alarm System:
The shop building is equipped with a standard fire alarm system without voice evacuation. The fire alarm panel is located in the main entrance. The fire alarm system should be updated to include voice evacuation. A full evaluation of the fire alarm system should be done to determine code compliance.

Electrical

Electrical Service and Distribution:
Each building has a separate electrical service. The shop building has a 400 amp, 120/240V, 3-phase service. The main electrical panel appears to be fairly old but parts should still be available. The service and distribution should be adequate to serve the building in its current function.

Lighting:
The lights are all fluorescent. Lighting levels appear to be inadequate. It is recommended that all lights be replaced with new LED lights and new lighting controls.

GEARY ENGINEERING, INC.

BUS BARN

Heating, Ventilating and Air Conditioning:

The Bus Barn is not heated or cooled. The office area has a gas space heater.

Recommendations:
The gas space heater in the office is dangerous and should be removed. A ductless split system is recommended to heat and cool the office area.

Life Safety

Fire Sprinkler:
The building currently is not equipped with a fire sprinkler system. A fire sprinkler system is not required.

Fire Alarm System:
The building currently is not equipped with a fire alarm system. A fire alarm system is not required

Electrical

Electrical Service and Distribution:
The electrical service for the building appears to be adequate.

Lighting:
The lights are sparce and lighting levels are not good. It is recommended that the lights be removed and new LED lights be installed to provide adequate lighting levels.