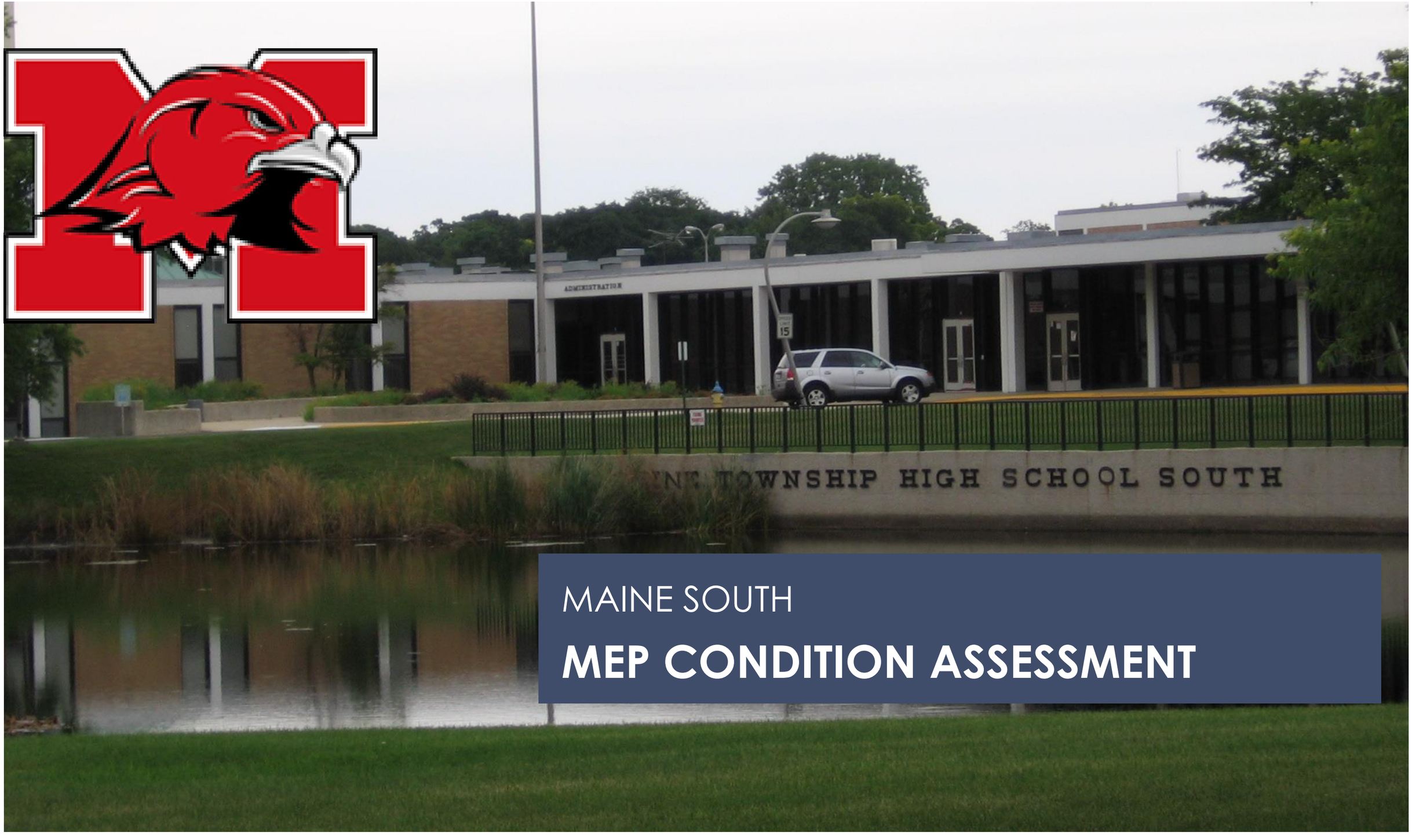


MAINE SOUTH

MEP CONDITION ASSESSMENT

MAINE SOUTH HIGH SCHOOL

This report section will overview the existing cooling and heating systems at Maine South High School. The sections will include: building cooling plant, building heating plant, mechanical ventilation systems, unit ventilators, roof top units and recommendations.

The system replacement recommendation(s) follow each equipment's existing conditions description. To determine the recommendations, our experience with similar systems and the ASHRAE median service life tables were utilized. Estimated equipment service life, according to the 2015 American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Handbook, is defined as the economic life of a system or component, or the amount of time it remains in its original service application. The remaining service life values reported in this document are based off the ASHRAE Equipment Life Expectancy Chart, as well as the ASHRAE Preventative Maintenance Guidebook, which use median years to provide an indication of expected equipment service life. Many factors effect equipment service life and with any average, some systems may have lifetimes far from average. However, these median lifetimes provide a reasonable basis for establishing the remaining useful life of existing systems.

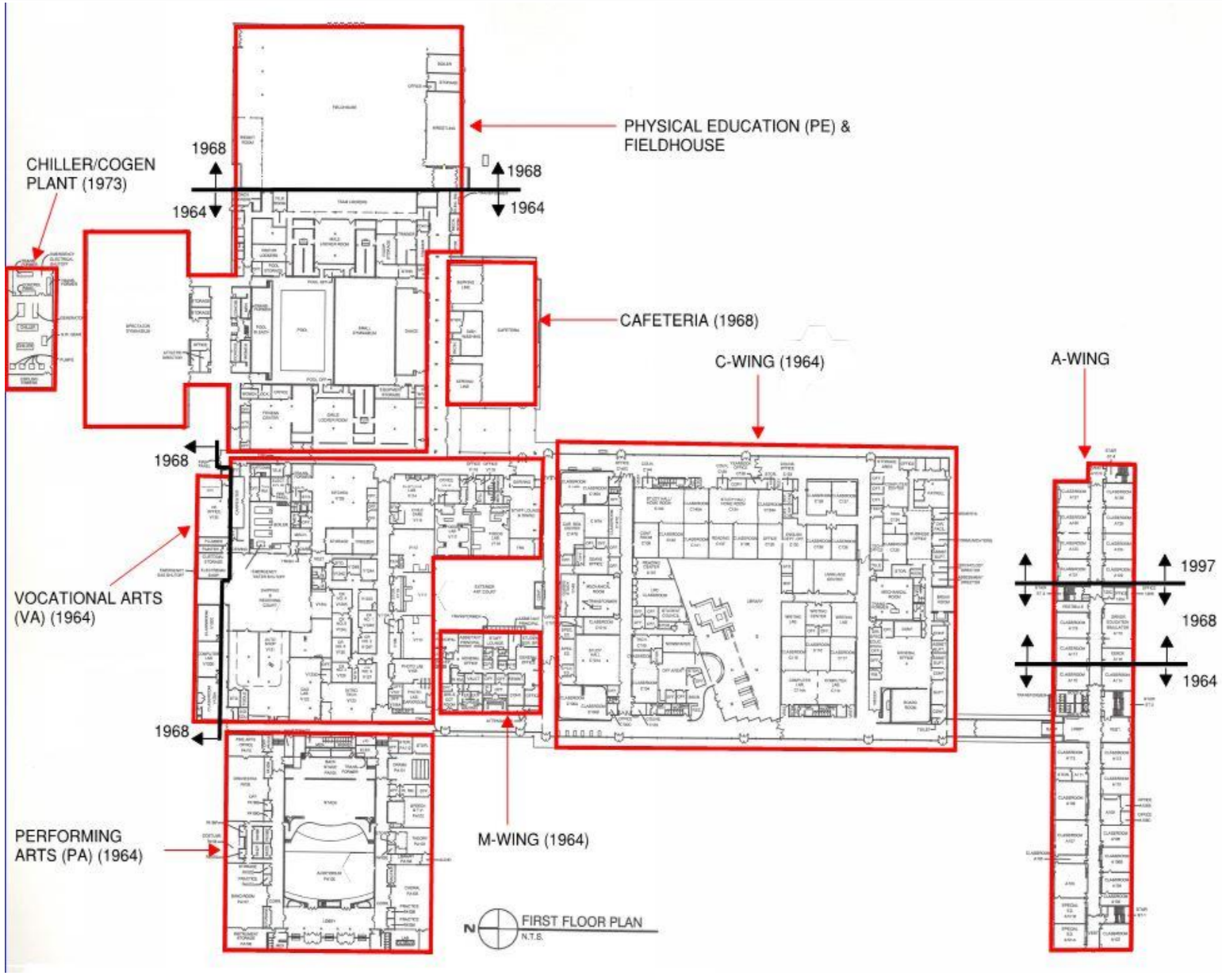
Equipment recommended for replacement is categorized into the following four groups:

1. 1 to 2 Years (2019 to 2020) – Equipment in this category should be considered for replacement within the next couple of years.
2. 3 to 5 Years (2021 to 2023) – Replacement of equipment in this category is less pressing than equipment listed in categories 1-2, but should still be considered for replacement within this timeframe.
3. 6 to 10 Years (2024 to 2028) – Replacement of equipment in this category is not an immediate need, but is still recommended for replacement within this timeframe.

On the following pages are two (2) graphics. The first graphic is a location key indicating the naming designations of various sections of the school as well as the year each addition was added. This location key will be referenced throughout the report to denote equipment locations. The second graphic displays an overview of the mechanical ventilation zones.

MAINE SOUTH – MECHANICAL VENTILATION OVERVIEW

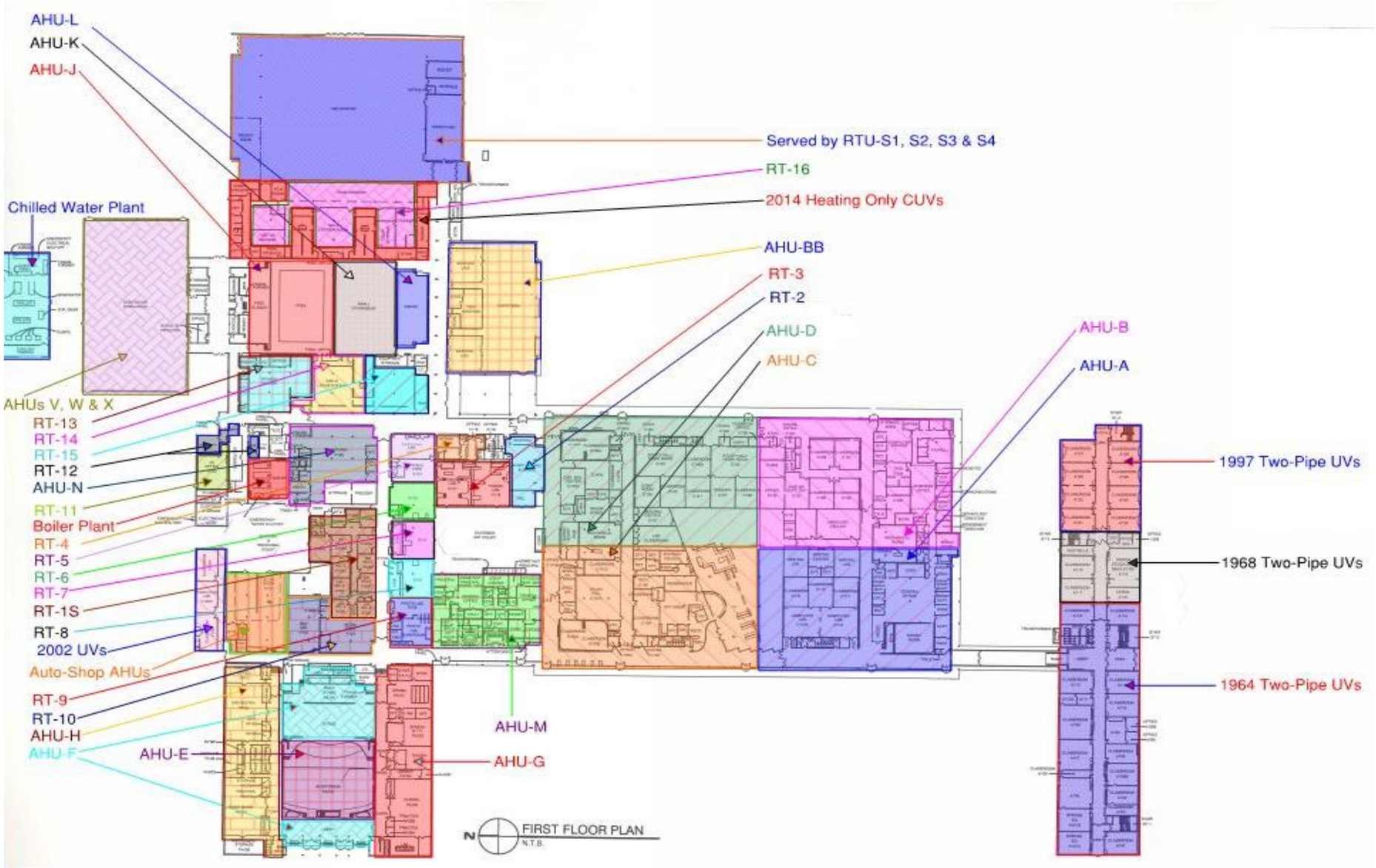
Location Key



Mechanical Assessment

HVAC Overview

MAINE SOUTH – MECHANICAL VENTILATION OVERVIEW



Mechanical Assessment

HVAC Overview

Building Chilled Water Plant

Space cooling for Maine South is provided by one (1) chilled water plant, located in a separate chiller building to the north of the spectator gymnasium as indicated in the picture to the right. The plant is made up of two (2) chillers which serve two-pipe unit ventilators (UVs) in the A-Wing as well as various air handling units (AHUs) throughout the building.

Chiller #1 is a “York” Magnetic Centrifugal Chiller installed in 2015 and rated for 550 nominal tons. This chiller is equipped with three (3) variable speed compressors. Chilled water is circulated through this chiller and out to the building by two (2) “Bell & Gossett” chilled water pumps, installed in 2015, and equipped with variable frequency drives (VFDs) to provide variable flow. The pumps are each rated for 60 HP, 150 ft. of head, and 950 GPM.

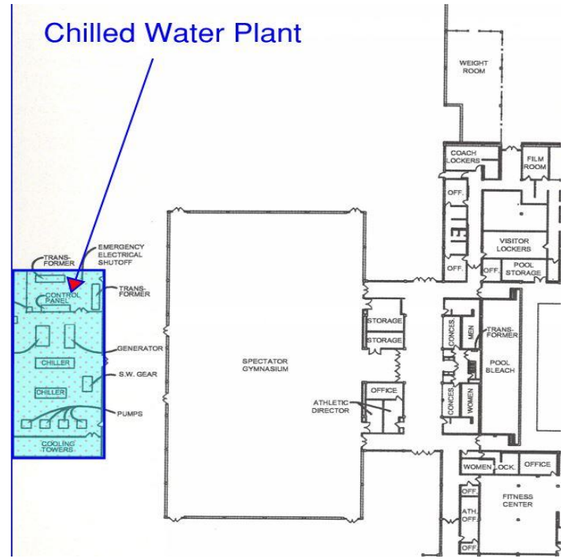
Heat rejection for Chiller #1 is provided by a dual-cell “Evapco” cooling tower located outside, adjacent to the chiller building. It is equipped with two (2) “Baldor” tower fans, each rated for 30 HP. The cooling tower and related components were recently refurbished or replaced in 2015. Condenser water for Chiller #1 is circulated by two (2) “Bell and Gossett” condenser water pumps, installed in 2015, and equipped with VFDs. Each condenser water pump is rated for 40 HP, 60 ft. of head, and 1650 GPM. Examine the table below and pictures on the right for additional details.

Table 1: Chilled Water Plant Pumps

Tag	Service	Location	Pump HP	Pump Feet of Head	Supply GPM	Fluid Medium
P-CHS1	York Chllr. & Bldg. Loop	Chiller Rm.	60	150	950	Chilled Water
P-CHS2	York Chllr. & Bldg. Loop	Chiller Rm.	60	150	950	Chilled Water
P-CT1	Cooling Tower	Chiller Rm.	40	60	1,650	Condenser Water
P-CT2	Cooling Tower	Chiller Rm.	40	60	1,650	Condenser Water

No alterations are recommended for this equipment within the scope of this report.

Building Chilled Water Plant Location



CH-1: YORK Magnetic Centrifugal Chiller

Mechanical Assessment

HVAC Overview

Building Chilled Water Plant

Chiller #2 is a “Carrier” electric screw chiller that was installed in 1998 with a nominal 200-ton rating. This chiller is connected to a centralized “Andover” building automation system (BAS). Chilled water is circulated through this chiller and out to the building by two (2) constant flow “Taco” chilled water pumps. Each chilled water pump is rated for 30 HP, 150 ft. of head, and 510 GPM.

Heat rejection for Chiller #2 is provided by the same dual-cell “Evapco” cooling tower that serves Chiller #1; however, different condenser water pumps are utilized. Condenser water for Chiller #2 is provided by two (2) constant flow “Taco” condenser water pumps each rated for 10 HP, 60 ft. of head, and 400 GPM. These pumps are believed to be from 1998 based on conversations with staff.

Two (2) natural gas “Caterpillar” generators are also located in the chiller room. The generators are each connected to a dedicated heat exchanger with pumps on the hot and cold side of the system. The purpose is to provide heat recovery from the generators which then injects supplementary heat into the hot water heating loop. The heat recovery loop and is no longer utilized and piping within the high school has been capped.

Table 1 (Continued): Chilled Water Plant Pumps

Tag	Service	Location	Pump HP	Pump Feet of Head	Supply GPM	Fluid Medium
CHP1	Carrier Chllr. & Bldg. Loop	Chiller Rm.	30	150	510	Chilled Water
CHP2	Carrier Chllr. & Bldg. Loop	Chiller Rm.	30	150	510	Chilled Water
CP-1	Cooling Tower	Chiller Rm.	10	60	400	Condenser Water
CP-2	Cooling Tower	Chiller Rm.	10	60	400	Condenser Water

5 TO 10 YEAR RECOMMENDATION

The two (2) chilled water and two (2) condenser water pumps associated with Chiller #2 are in fair condition. The ASHRAE median service life for base-mounted pumps is 25 years. These pumps are approaching their median service life; therefore, it is recommended to do a like for like replacement within 3 to 5 years. Please refer to the Pump Cost Estimates section for pricing information.

Chiller #2: Carrier Electric Chiller

Shared Dual-Cell “Evapco” Cooling Tower

Building Heating Plant

Space heating for Maine South is provided by perimeter finned tube radiators, numerous air handling units, unit ventilators, and unit heaters located throughout the building. Hot water is distributed to this equipment from one (1) boiler plant; the location of this plant is highlighted to the right. Hot water pipes are distributed from the boiler room and throughout the school via two (2) main underground tunnels; one (1) tunnel serves the PE section of the building to the east, while the other tunnel serves the remaining sections of the building; observe the graphic on the following page for underground piping distribution details. The boiler plant was completely renovated with high efficiency equipment in 2017 when ELARA worked with Maine Township High School District to provide the following:

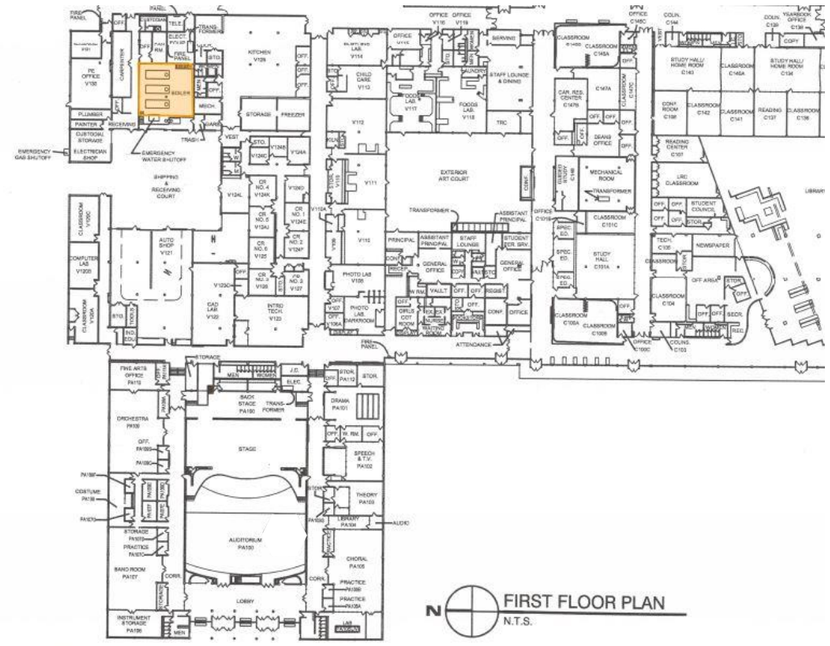
- (4) Viessmann condensing hot water boilers with 6,000 MBH input and combustion efficiencies capable of exceeding 95% efficiency
- (4) Bell & Gossett primary loop boiler pumps with 375 GPM, 25 ft. of head, and variable frequency drives (VFDs)
- (3) Bell and Gossett secondary loop boiler pumps with 750 GPM, 95 ft. of head, and VFDs
- (1) Lochinvar pool water heater rated for 567 MBH of total output
- (2) Lochinvar domestic hot water storage tanks each with 504 gallons of capacity

Table 2: Heating Plant Pumps

Tag	Service	Location	Pump HP	Pump Feet of Head	Supply GPM	Fluid Medium
BWP-S1	Primary Loop	Boiler Rm.	5	25	375	Hot Water
BWP-S2	Primary Loop	Boiler Rm.	5	25	375	Hot Water
BWP-S3	Primary Loop	Boiler Rm.	5	25	375	Hot Water
BWP-S4	Primary Loop	Boiler Rm.	5	25	375	Hot Water
HWP-S1	Secondary Loop	Boiler Rm.	25	95	750	Hot Water
HWP-S2	Secondary Loop	Boiler Rm.	25	95	750	Hot Water
HWP-S3	Secondary Loop	Boiler Rm.	25	95	750	Hot Water

No alterations are recommended for this equipment within the scope of this report.

Boiler Plant Location



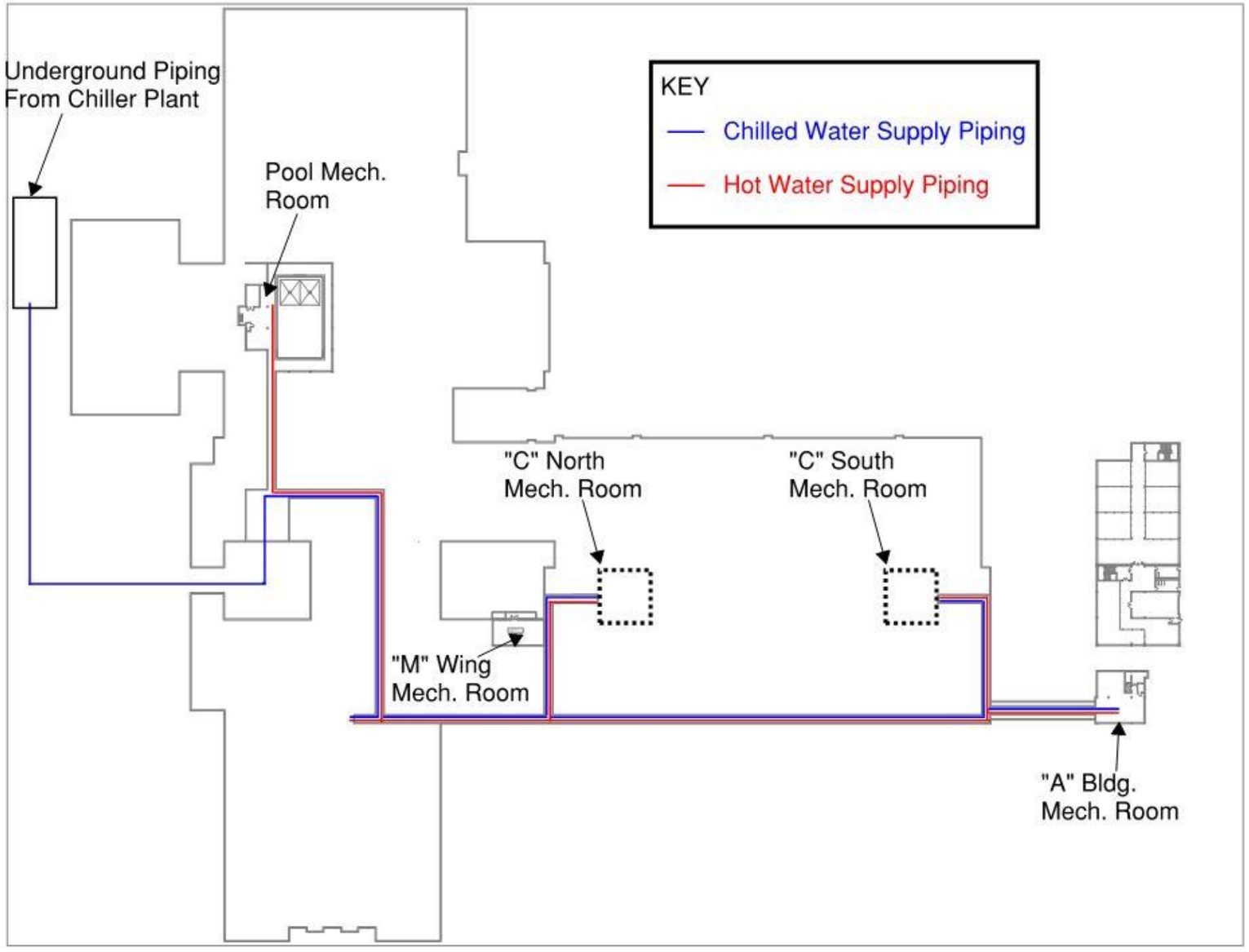
New Boiler Plant

Mechanical Assessment

HVAC Overview

Hot Water and Chilled Water Distribution

Underground tunnels deliver chilled water and hot water from the main plants to equipment throughout the building. Below is a map of the underground piping schematic as well as the major basement and ground level mechanical rooms.



Mechanical Assessment

HVAC Overview

Mechanical Ventilation Systems

Mechanical ventilation for the building is supplied by a variety of air handling units (AHUs), unit ventilators (UVs), and roof top units (RTUs). Numerous exhaust fans also serve locations throughout the building.

A-WING AIR HANDLING UNIT

While the majority of A-Wing is served by UV's, there is a small AHU serving the east section of the A-Wing basement. This AHU is from 1968 and only has hot water heating capabilities. It serves the A-wing basement, storage, and garage areas. This unit is equipped with outdoor and return air manually controlled dampers.

Table 3: A-Wing Basement AHU

Tag	Area Served	Location	Supply CFM	Supply Fan HP	Cooling Medium	Heating Medium
A-Wing AHU	Garage Storage	East A-Wing Basement	1200	0.50	None	Hot Water

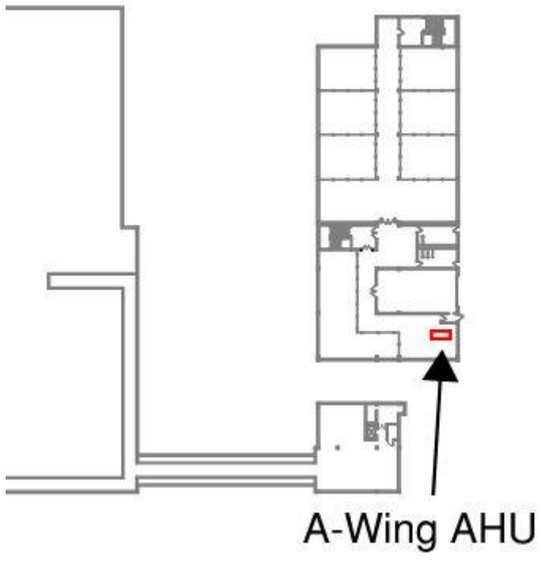
1 TO 2 YEAR RECOMMENDATION

The A-Wing basement AHU was installed in 1968 and is in poor condition due to its age.

It is recommended to replace this AHU with a like for like replacement. Please reference the AHU Cost Estimates for pricing information.

A-Wing Basement AHU

A-Wing Basement Location



C-WING AIR HANDLING UNITS

AHUs A, B, C, and D are original to the building from 1964 and serve dual-duct systems in the C-Wing. They supply constant volume air via “hot-deck” and “cold-deck” ducts; these ducts blend hot air and cold air at mixing boxes to meet room set points. Each AHU has a chilled water coil across the entire face of the unit and a hot water coil in the “hot deck” duct downstream of the supply fan; controls are provided via pneumatics. Every AHU also has an associated return fan. The C-wing air handlers are split between North and South mechanical rooms. AHUs A and B are located in the South mechanical room, while AHUs C and D are located in the North mechanical room. The map to the right can be referenced for details regarding each unit’s location and associated zone of service. The table below displays additional specifications for the C-Wing AHUs.

Table 4: C-Wing AHUs

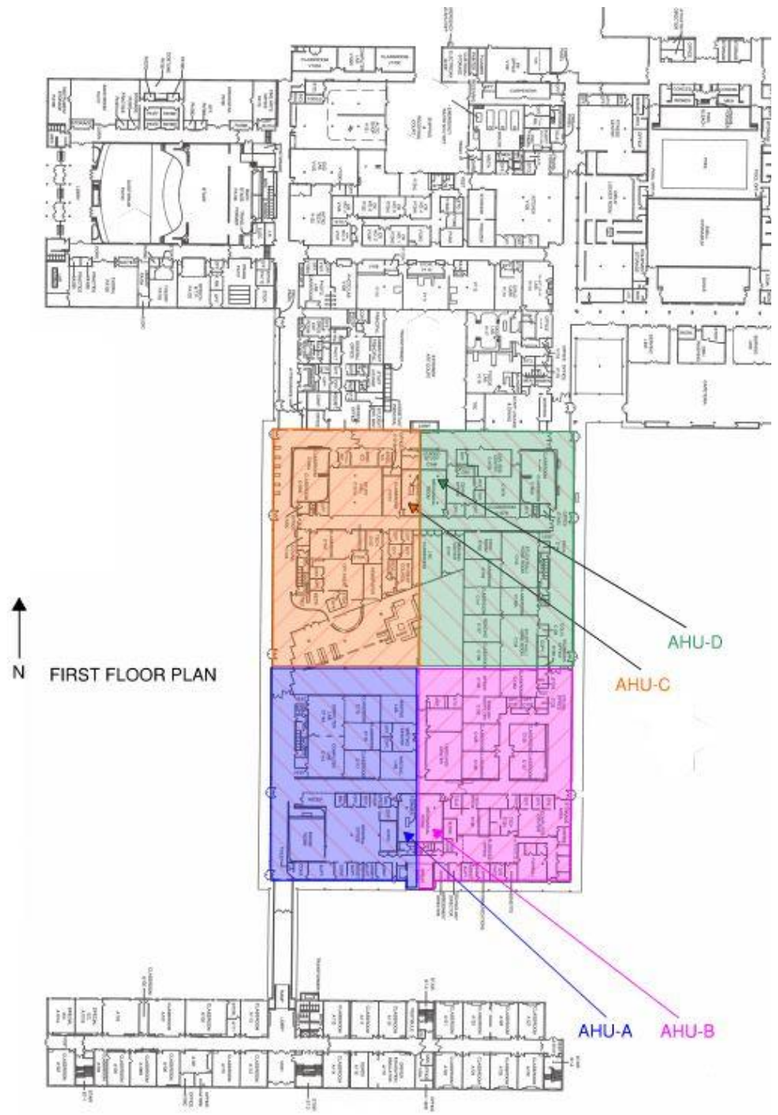
Tag	Area Served	Location	Supply CFM	Supply Fan HP	Cooling Medium	Heating Medium
AHU-A	SW C-Wing	South Mech. Rm.	33,235	50	Chilled Water	Hot Water
AHU-B	SE C-Wing	South Mech. Rm.	32,955	50	Chilled Water	Hot Water
AHU-C	NW C-Wing	North Mech. Rm.	36,040	50	Chilled Water	Hot Water
AHU-D	NE C-Wing	North Mech. Rm.	35,590	50	Chilled Water	Hot Water

1 TO 2 YEAR RECOMMENDATION

Dual-duct systems are energy intensive because *simultaneous* heating and cooling occurs at each air handler to serve “hot deck” and “cold deck” ducts, which mix to space appropriate temperatures at local mixing boxes. This type of operation is less efficient than *only* heating or *only* cooling a space. Additionally, the ASHRAE median equipment service life for built-up heavy-duty air handling units, such as those found within C-Wing, is thirty (30) years. In this case, these units have doubled the ASHRAE median service life.

Because of the age and inefficiency of the dual-duct systems present in C-Wing, it is recommended to replace the existing air handlers with variable flow AHUs that support either fan powered box terminal units or VAV box terminal units, each with hot water reheat coils. Both fan powered box and VAV systems would provide significant energy savings in comparison to the existing systems because they both provide variable fan speeds and heating or cooling to spaces *only* when necessary. Additionally, fan motor life is extended because a fan motor with a variable volume VFD can “soft-start.” A “soft-start” increases motor life because it allows the motor to slowly ramp up which reduces initial start-up shock when compared to a traditional motor start. Please reference the AHU Cost Estimates for pricing details.

C-Wing AHUs



Mechanical Assessment

HVAC Overview

PA AIR HANDLING UNITS

AHUs E, F, G, and H provide constant volume air distribution to the Performing Arts (PA) area. These air handlers are original to the building from 1964 and are each equipped with pneumatic controls and an associated return fan. AHU-E contains three (3) coils: a hot water pre-heat coil, a chilled water cooling coil, and a hot water re-heat coil. AHU-F is furnished with one (1) chilled water and two (2) duct-mounted hot water coils. AHU-G and H are both multi-zone units equipped with one (1) chilled water coil and one (1) hot water coil each. AHUs E and H are situated in the North auditorium mechanical room while AHUs F and G are in the South auditorium mechanical room. AHU-H is the only PA AHU equipped with face and bypass dampers. The color-coded picture to the right denotes each AHUs area of service. Examine the table below for additional unit details.

Table 5: PA AHUs

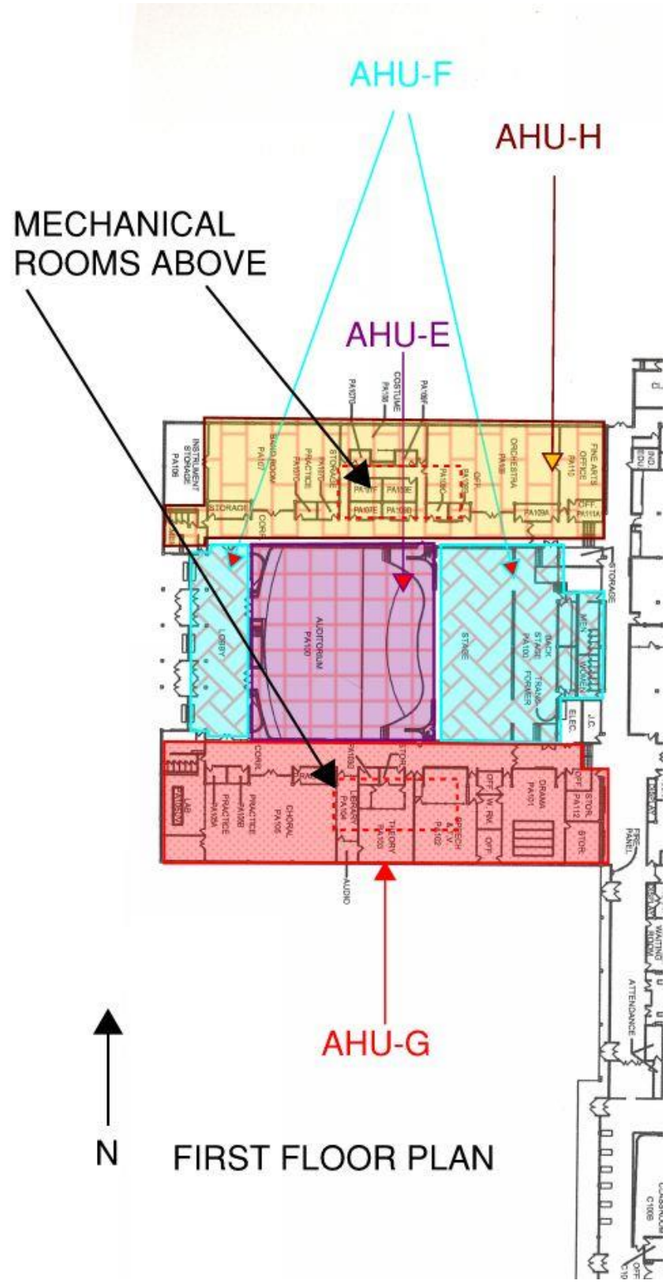
Tag	Area Served	Location	Supply CFM	Supply Fan HP	Cooling Medium	Heating Medium
AHU-E	Auditorium	North Aud. Mech.	15,000	7.5	Chilled Water	Hot Water
AHU-F	Lobby & Stage	South Aud. Mech.	6,000	3	Chilled Water	Hot Water
AHU-G	South Class Rooms	South Aud. Mech.	13,520	7.5	Chilled Water	Hot Water
AHU-H	North Class Rooms	North Aud. Mech.	10,635	7.5	Chilled Water	Hot Water

1 TO 2 YEAR RECOMMENDATION for PA AHUs E and F

Auditorium AHUs E and F are original to the building from 1964. Each unit delivers constant volume supply air and utilizes chilled water and hot water coils to condition their space. These AHUs are substantially aged, and have surpassed their ASHRAE median equipment service life of thirty (30) years. Moreover, constant volume systems are considerably less energy efficient than today's technology.

It is recommended to upgrade the AHUs referenced above with new AHUs that distribute variable volume supply directly to the zones of service. In these instances, the air handler itself acts as a VAV box providing variable supply to only one or two spaces. With a variable volume system upgrade, fan supply air is dependent on the space requirements; when demand is low, the fan reduces its speed, which results in significant energy savings both from the perspective of fan energy as well as heating and cooling energy. Please reference the AHU Cost Estimates for pricing information.

PA AHUs



1 TO 2 YEAR RECOMMENDATION for PA AHUs G and H

AHUs G, and H are constant flow multi-zone units that are original to the building. Like dual-duct systems, multi-zone systems are energy intensive because of constant flow fans and *simultaneous* heating and cooling. In a multi-zone system, air passes through a “hot deck” and “cold deck” and then mixes to an appropriate discharge air temperature at the AHU before being delivered to a zone. These types of systems are therefore energy inefficient. Furthermore, each of these AHUs is old and significantly beyond their ASHRAE median equipment service life of thirty (30) years.

It is recommended to replace the aforementioned multi-zone units with new AHUs serving VAV boxes with hot water reheat coils. Replacing constant volume systems would result in substantial energy savings due to variable flow supply, and the elimination of concurrent heating and cooling. Please reference the AHU Cost Estimates for pricing details.

AHU-G

Mechanical Assessment

HVAC Overview

PE AIR HANDLING UNITS

AHUs J, K, and L supply constant volume heating to the pool, small gymnasium, and dance room respectively. These units are each equipped with hot water heating coils, return fans, and pneumatic controls. AHUs k and L are equipped with face and bypass dampers. Installed in 1964, these AHUs are original to the building and are situated in the 2nd floor PE mechanical room. Refer to the map on the right for the zones served and the table below for additional characteristics.

Table 6: Pool, Small Gym & Dance AHUs

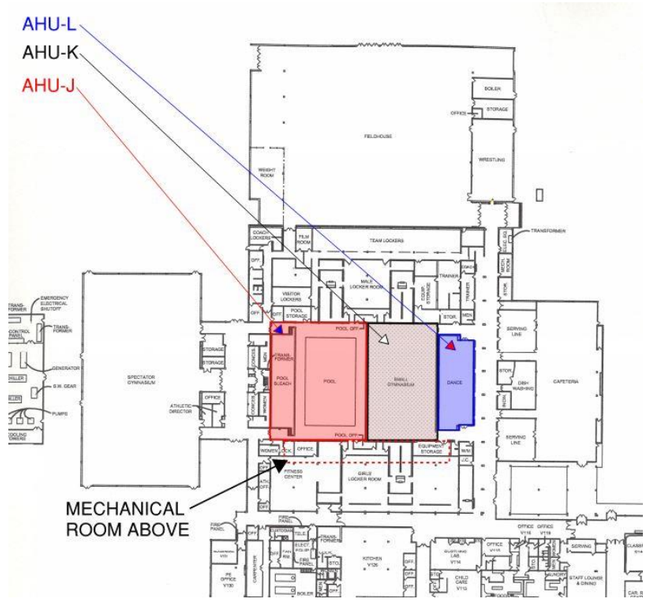
Tag	Area Served	Location	Supply CFM	Supply Fan HP	Cooling Medium	Heating Medium
AHU-J	Pool Area	PE Mech. Room	14,600	7.5	None	Hot Water
AHU-K	Small Gymnasium	PE Mech. Room	8,000	3	None	Hot Water
AHU-L	Dance Room	PE Mech. Room	3,000	1.5	None	Hot Water

1 TO 2 YEAR RECOMMENDATION for POOL UNIT AHU J

AHU-J provides heating and ventilation to the pool area and is original the building from 1964. Like AHUs J and K, it is equipped with a hot water duct mounted coil, constant volume supply air, and is in a cramped mechanical space. This unit is incapable of providing dehumidification to the pool area since it does not have any means of cooling. Excessive moisture in air can, over time, provide an ideal environment for molds to grow which can cause health-risks and potential damage to the structure of interior walls. AHU-J is also significantly aged and has far exceeded the ASHRAE median equipment service life of thirty (30) years.

It is recommended to update this unit to a variable flow, pool dehumidification unit. The advantages of a pool dehumidification unit include providing cool dry air during the summer and warm dry air during the winter. This is particularly important with a pool air handling unit since pool spaces have high humidity levels throughout the year. This unit would address issues relating to moisture content in the pool air and noticeably improve comfort. Please reference the AHU Cost Estimates for pricing information.

Pool, Small Gym, and Dance AHUs



1 TO 2 YEAR RECOMMENDATION for DANCE AND SMALL GYMNASIUM AHUs L and K

These AHUs supply constant volume air and are original to the building from 1964. They are equipped with hot water coils, and are in a tight and restrictive mechanical space above the areas which they serve. Due to age and condition and challenging the ASHRAE median equipment service life of thirty (30) years, they are recommended for upgrade.

Due to the limited mechanical space available, it is recommended to replace these units with cooling only, variable volume packaged roof top units that are equipped with duct-mounted hot water heating coils. In comparison to the existing constant volume AHUs, the new variable volume roof top units would provide notable savings and increased comfort due to cooling capabilities. Please reference the AHU Cost Estimates for pricing details.

M-WING AIR HANDLING UNIT

AHU-M is a constant volume, multi-zone unit that is original from 1964. It is equipped with chilled water and hot water coils to supply M-Wing with conditioned air; an associated return fan returns air back to the unit. AHU-M is pneumatically controlled and located in the lower level courtyard basement. This unit has recently experienced significant water damage. Examine the graphic to the right for AHU-M's area of service and note the table below for more details.

Table 7: M-Wing AHU

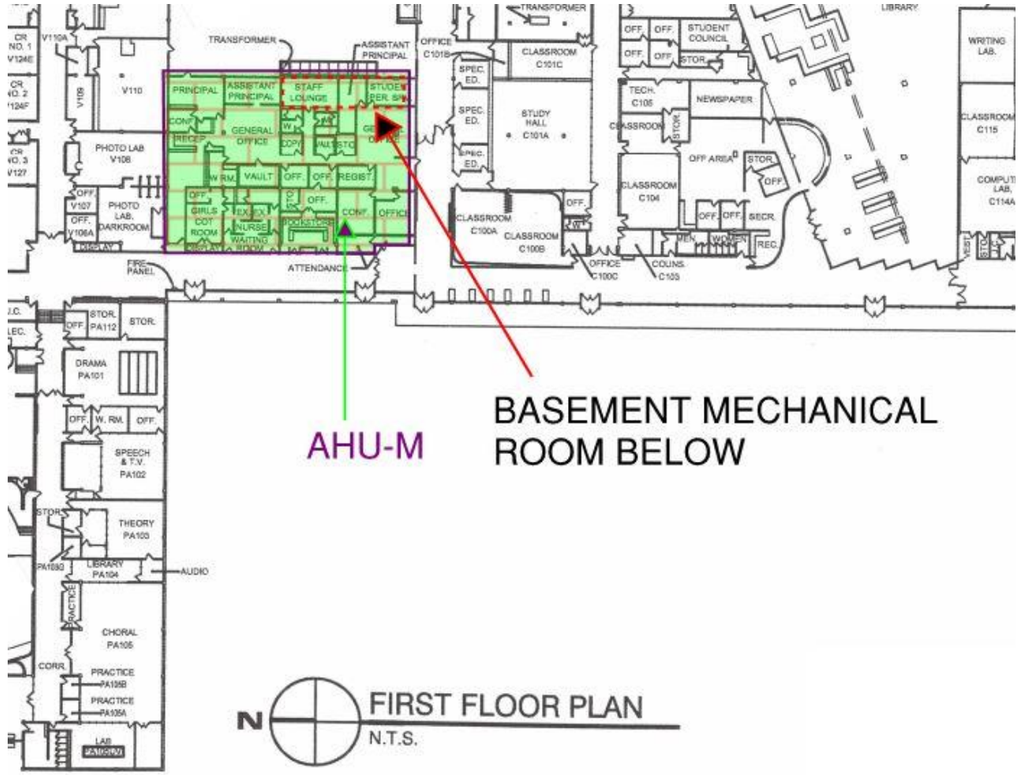
Tag	Area Served	Location	Supply CFM	Supply Fan HP	Cooling Medium	Heating Medium
AHU-M	7 Zones: M-Wing	L.L. Basement	12,000	7.5	Chilled Water	Hot Water

1 TO 2 YEAR RECOMMENDATION for AHU-M

AHU-M is constant flow multi-zone units that is original to the building. Like dual-duct systems, multi-zone systems are energy intensive because of constant flow fans and *simultaneous* heating and cooling. In a multi-zone system, air passes through a "hot deck" and "cold deck" and then mixes to an appropriate discharge air temperature at the AHU before being delivered to a zone. These types of systems are therefore energy inefficient. Furthermore, AHU-M is old and significantly beyond the ASHRAE median equipment service life of thirty (30) years. AHU-M specifically has also suffered significant water damage within the last year that has further deteriorated its condition.

It is recommended to replace AHU-M with a new AHU that serves VAV boxes with hot water reheat coils. Replacing constant volume systems would result in substantial energy savings due to variable flow supply, and the elimination of concurrent heating and cooling. Please reference the AHU Cost Recommendations section for pricing information.

M-Wing AHU



KITCHEN AIR HANDLING UNIT

AHU-N is a pneumatically controlled air handler original to the building from 1964 located in the kitchen mechanical room. AHU-N supplies a constant volume of 100% outside air to the kitchen areas and is outfitted with four (4) heating coils: one (1) hot water preheat coil, two (2) hot water reheat coils, and one (1) electric reheat coil, and face and bypass dampers. Examine the floor plan to the right for zoning details and the table below for supplementary unit specifications.

Table 8: Kitchen Area AHU

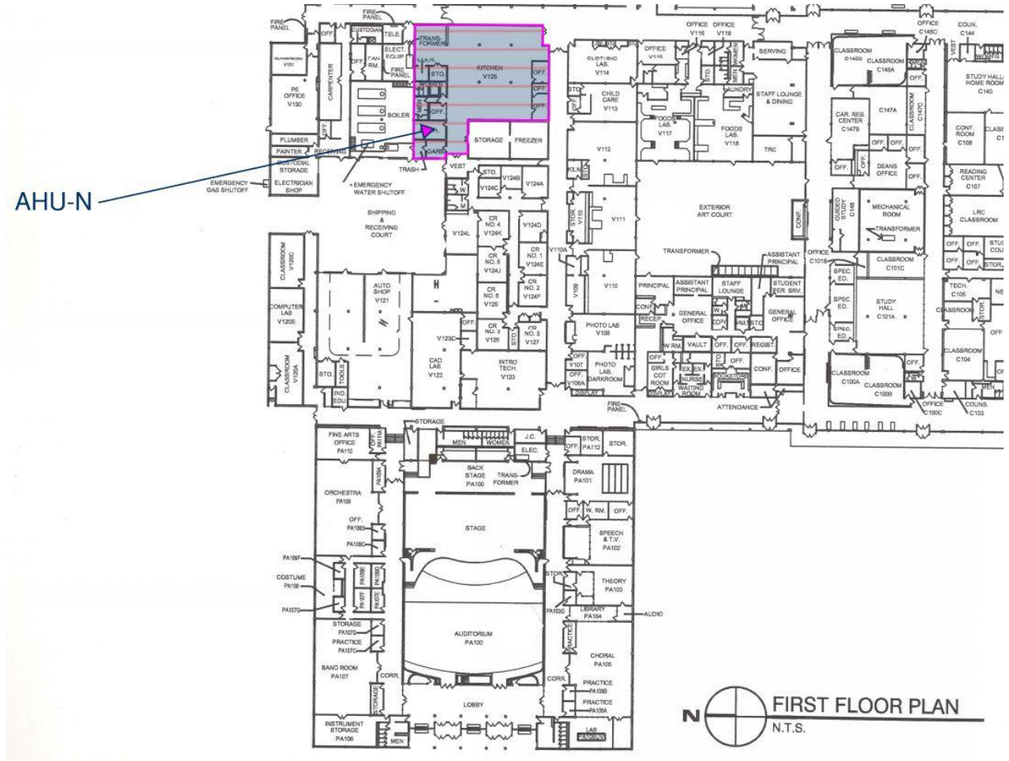
Tag	Area Served	Location	Supply CFM	Supply Fan HP	Cooling Medium	Heating Medium
AHU-N	Kitchen Areas	Kitchen Mech. Rm.	19,900	7.5	None	Hot Water and Electric

1 TO 2 YEAR RECOMMENDATION for AHU-N

Kitchen AHU-N is original to the building from 1964. This unit delivers constant volume supply air and utilizes chilled water and hot water coils to condition the kitchen. AHU-N has surpassed its ASHRAE median equipment service life of thirty (30) years and is substantially aged. Additionally, constant volume systems are considerably less energy efficient than today's technology.

It is recommended to upgrade the AHU-N with a new AHU that distributes variable volume supply directly to the zones of service. In this case, the air handler itself acts as a VAV box providing variable supply to only one or two spaces. With a variable volume system upgrade, fan supply air is dependent on the space requirements; when demand is low, the fan reduces its speed, which results in significant energy savings both from the perspective of fan energy as well as heating and cooling energy. Please reference the AHU Cost Estimates for pricing information.

Kitchen Area AHU



SPECTATOR GYM AIR HANDLING UNITS

AHUs V, W, and X are suspended from the ceiling of the spectator gym and are original from 1964, their location is shown on the right. They supply heating via hot water coils to the spectator gymnasium. These units are pneumatically controlled and are equipped with outside air, return air, valve control, and face and bypass dampers. The image on the right indicates the service area of these units and the table below provides further details.

Table 9: Spectator Gym AHUs

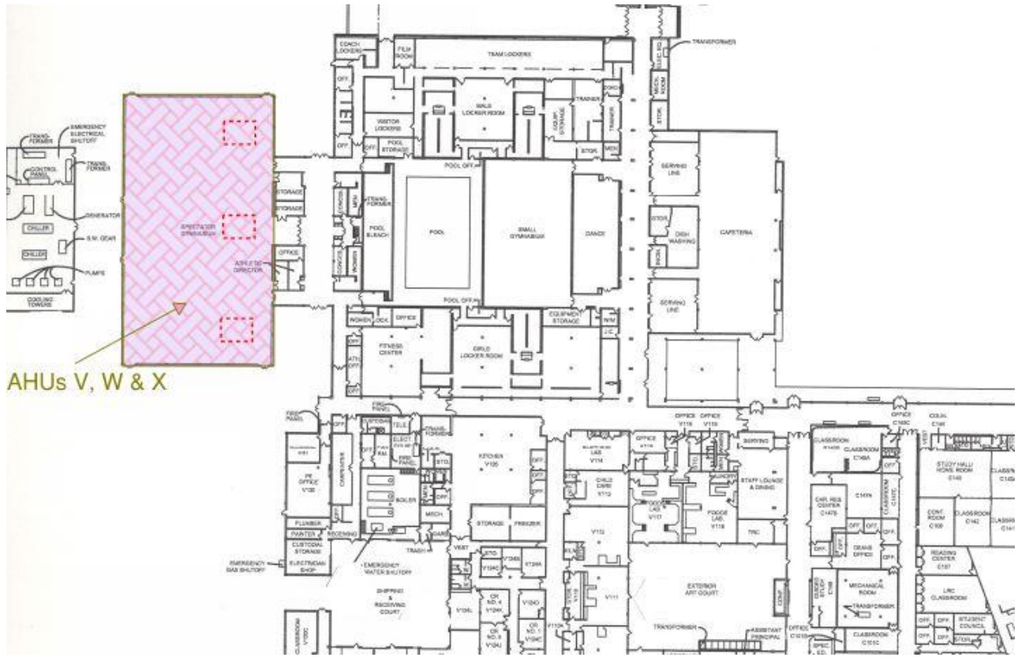
Tag	Area Served	Location	Supply CFM	Supply Fan HP	Cooling Medium	Heating Medium
AHU-V	Spectator Gym	Spec Gym	5,500	2	None	Hot Water
AHU-W	Spectator Gym	Spec Gym	5,500	2	None	Hot Water
AHU-X	Spectator Gym	Spec Gym	5,500	2	None	Hot Water

1 TO 2 YEAR RECOMMENDATION for SPECTATOR GYM AHUs V, W, and X

The spectator gym AHUs are original to the building from 1964 and provide constant volume air with heating only via hot water coils. Since these units are hung from the ceiling, they are difficult to service. According to ASHRAE, the median service life of a packaged medium-duty air handling unit is 25 years. Impressively, these units have doubled the ASHRAE median equipment service life average; however, they are in a poor condition.

It is recommended to update these units with more accessible, variable speed, packaged roof top units equipped with hot water heating and cooling capabilities. With the transition to variable flow, improved serviceability, and cooling capabilities, considerable savings and comfort improvements would be achieved. Please reference the AHU Cost Estimates for pricing information.

Spectator Gym AHUs



CAFETERIA AIR HANDLING UNIT

AHU-BB was installed in 1968 and is located in the mechanical room near the cafeteria. It conditions the cafeteria with 100% outside air at constant volume via one (1) hot water preheat coil, one (1) DX cooling coil with an associated condensing unit installed in 2002 on the roof, and three (3) hot water reheat coils placed in main duct branches. AHU-BB is equipped with face and bypass dampers. Consult the graphic on the right for its area of service and the table below for added specifications.

Table 10: Cafeteria AHU

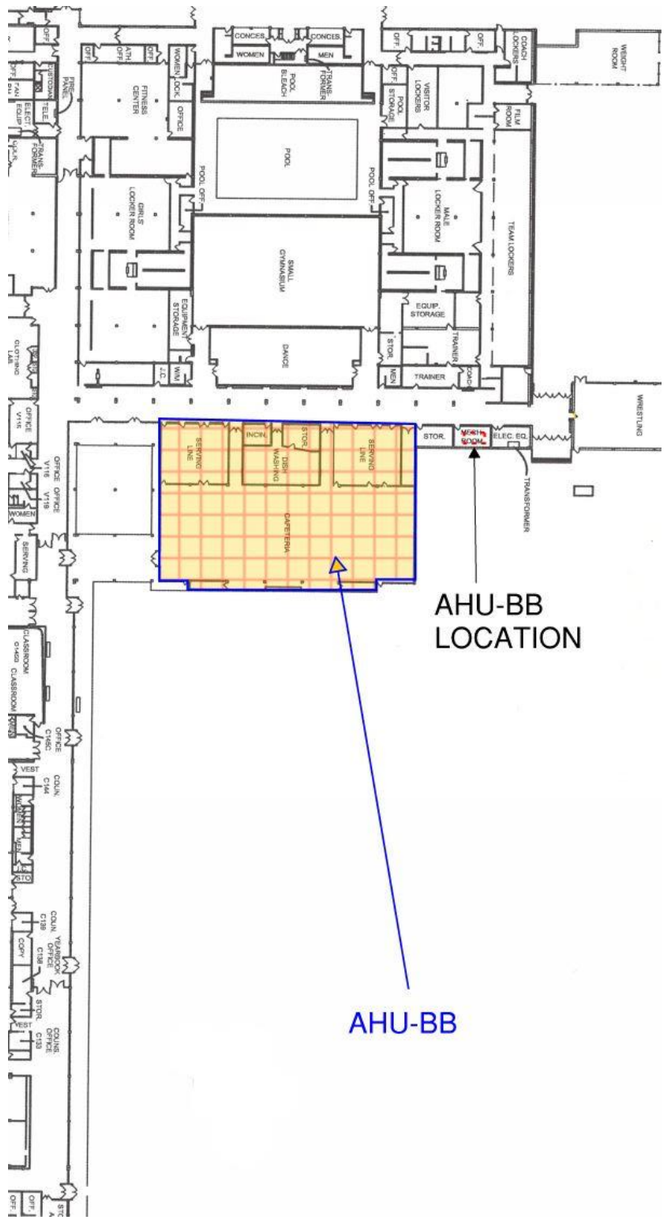
Tag	Area Served	Location	Supply CFM	Supply Fan HP	Cooling Medium	Heating Medium
AHU-BB	Cafeteria	Mechanical Room Near Cafeteria	20,000	10	DX	Hot Water

1 TO 2 YEAR RECOMMENDATION for AHU-BB

Cafeteria AHU-BB is original to the building from 1964. This unit delivers constant volume supply air and utilizes chilled water and hot water coils to condition the Cafeteria. AHU-BB has surpassed its ASHRAE median equipment service life of thirty (30) years and is substantially aged. Additionally, constant volume systems are considerably less energy efficient than today's technology.

It is recommended to upgrade the AHU-BB with a new AHU that distributes variable volume supply directly to the zones of service. In this case, the air handler itself acts as a VAV box providing variable supply to only one or two spaces. With a variable volume system upgrade, fan supply air is dependent on the space requirements; when demand is low, the fan reduces its speed, which results in significant energy savings both from the perspective of fan energy as well as heating and cooling energy. Please reference the AHU Cost Estimates for pricing details.

Cafeteria AHU

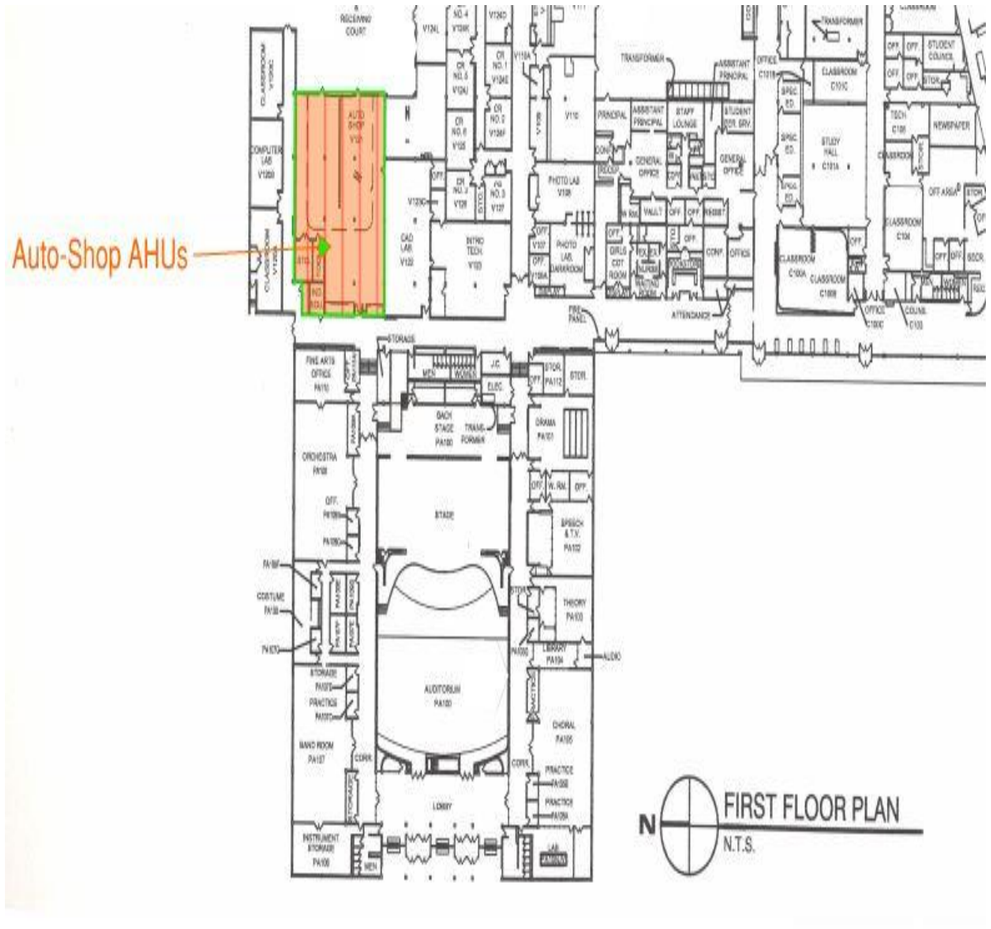


AUTO SHOP AIR HANDLING UNITS

Two (2) AHUs equipped with chilled water and hot water coils deliver constant volume air to the auto shop area. These units were installed in 2002 and are outfitted with return air and outdoor air dampers. The picture on the right shows one (1) of the auto shop AHUs, and the picture below displays the zone both units serve.

No alterations are recommended for this equipment within the scope of this report.

Auto Shop AHUs Zone



Auto Shop AHU

UNIT VENTILATORS (UVs)

Two-pipe unit ventilators serve all the classrooms in the A-Wing. In 1997 a majority of the A-Wing UVs were updated with East A-Wing addition. There are a few offices in the A-Wing that have not been updated since mid 1960s. The two-pipe UVs provide either heating or cooling depending on the season. This type of two-pipe system is referred to as a dual temperature system. All UVs are supplied hot water from the boiler plant and chilled water from the chilled water plant.

In 2002, the north section of the VA wing was outfitted with UVs with hot water coils, DX cooling coils and four (4) associated condensing units on the roof.

In 2014, there were new hot water heating ceiling unit ventilators installed for the athletic offices areas. Refer to the graphic to the right for an overview on UV zones.

During the 2017 Boiler Replacement Project, four (4) new pumps were installed in the A-Wing basement. The first two (2) “Bell & Gossett” pumps are variable flow and distribute hot water to finned tube radiators located in the A-Wing walkway, stairwells, and other A-Wing perimeter locations. These pumps are each 2 HP, provide 45 ft. of head, and supply 80 GPM.

The second two (2) pumps are dual temp pumps that distribute hot and chilled water throughout the A-Wing UVs. These pumps are “Bell & Gossett” variable flow, and have 15 HP, 55 ft. of head and 670 GPM during cooling and 340 GPM during heating. Changeover occurs in the A-Wing basement via control valves separating heating and cooling water.

6 TO 10 YEAR RECOMMENDATIONS for UVs

The A-Wing unit ventilators are from 1997 and are reportedly difficult to accurately control space temperatures. Noise can also be an issue, and some UVs allow for rain infiltration inside of the classrooms.

Two options are recommended for UV replacement: Option 1 is to replace the UVs with vertical air change UVs. This would provide increased comfort control, reliability and efficiency. Option 2 is to install a variable flow, dedicated outdoor air unit (DOAS) on the roof that serves local fan coil units with hot water heating and chilled water cooling coils. This system provides optimum temperature control and yields long term energy savings due to its variable volume supply. Please reference the UV Cost Estimates section for pricing details per option.

Unit Ventilator Zones

Mechanical Assessment

HVAC Overview

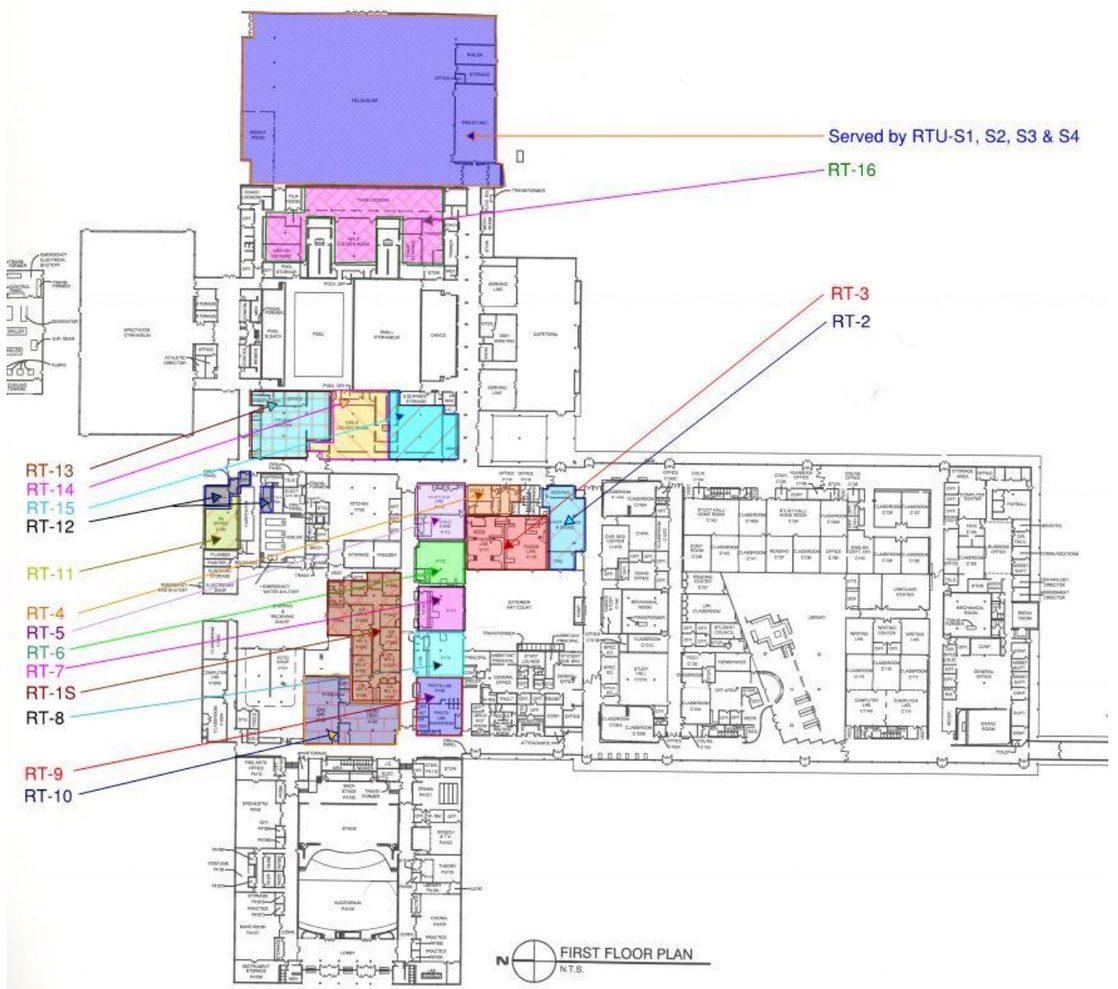
ROOF TOP UNITS (RTUs)

The VA and PE sections of the building are served by various RTUs. There is a total of fifteen (15) RTUs that were installed in 2014 and serve the VA section. RTUs 2-13 have DX cooling with an associated roof mounted condensing unit. RTUs 14, 15, and 16 were not installed with cooling capabilities. All the RTUs referenced above, besides RTU-3 and RTU-10, are equipped with duct-mounted hot water coils for space heating. Of the referenced RTUs above, RTUs 2, 3, 5 and 10 have variable air volume (VAV) boxes in the in the zones served to provide a more efficient delivery of conditioned air. RTUs 6 – 8 and 14 – 16 are equipped with an enthalpy recovery wheel that allows for heat recovery from the exhaust air airstream; this heat is then used to precondition incoming outside air to the units. RTU-1S is a 2013 unit that is equipped with DX cooling and duct mounted hot water coils. RTU-1S serves the special needs department. There are also four (4) RTUs serving the PE portion of the building. These RTUs (S1 – S4) were installed in 2017 and are furnished with gas heating and DX cooling.

All the RTUs mentioned above are on the front-end “Andover” building automation system (BAS). Refer to the picture on the right and the spreadsheet on the following page for an overview of RTU details.

No alterations are recommended for the roof top units serving Maine South as they all have at least ten (10) years of expected service life remaining.

Roof Top Unit Zones



Mechanical Assessment

HVAC Overview

Roof Top Unit Details

Year Installed	Reference Tag	Make	Roof Location	Areas Served	Heating	Cooling	Tonnage
2014	RT-2	AAON	VA	Staff Lounge & Dining Area	Duct Mounted Hot Water Heating	DX	11
2014	RT-3	AAON	VA	Food Lab V117 & V118		DX	20
2014	RT-4	Carrier	VA	Offices V115, V116, & V119	Duct Mounted Hot Water Heating	DX	3
2014	RT-5	AAON	VA	V113, V114 & Office	Duct Mounted Hot Water Heating	DX	11
2014	RT-6	AAON	VA	V112	Duct Mounted Hot Water Heating	DX	7
2014	RT-7	AAON	VA	V111	Duct Mounted Hot Water Heating	DX	7
2014	RT-8	AAON	VA	V109 & V110	Duct Mounted Hot Water Heating	DX	7
2014	RT-9	AAON	VA	V106 to V108	Duct Mounted Hot Water Heating	DX	11
2014	RT-10	AAON	VA	V122 & V123		DX	15
2014	RT-11	Carrier	VA	V130	Duct Mounted Hot Water Heating	DX	3
2014	RT-12	Carrier	VA	V131 & Adjacent Offices	Duct Mounted Hot Water Heating	DX	3
2014	RT-13	Carrier	VA	Fitness Center & Adjacent Offices	Duct Mounted Hot Water Heating	DX	3
2014	RT-14	Greencheck	PE	Girl's Locker Rm.	Duct Mounted Hot Water Heating, Variable Speed Enthalpy Wheel	Variable Speed Enthalpy Wheel	-
2014	RT-15	Greencheck	VA	Girl's Locker Rm.	Duct Mounted Hot Water Heating, Variable Speed Enthalpy Wheel	Variable Speed Enthalpy Wheel	-
2014	RT-16	Greencheck	PE	Team/Visitor Locker Rms.	Duct Mounted Hot Water Heating, Variable Speed Enthalpy Wheel	Variable Speed Enthalpy Wheel	-
2013	RT-1S	Carrier	VA	Classrooms V124 to V127	Duct Mounted Hot Water Heating	DX	20
2017	RTU-S1	Valent	PE	Fieldhouse	Natural Gas	DX	14
2017	RTU-S2	Valent	PE	Fieldhouse	Natural Gas	DX	14
2017	RTU-S3	Valent	PE	Fieldhouse	Natural Gas	DX	34
2017	RTU-S4	Valent	PE	Fieldhouse	Natural Gas	DX	34

Cost Estimates

The cost estimate tables below for recommended replacements encompass any associated mechanical, electrical, plumbing, controls, equipment, contracting, demolition, and installation costs. The anticipated start year for replacements is 2019. It should be noted that two costs will be shown for future recommendations. For example, if an item is recommended for replacement from 2019 – 2020 then the 2019 costs *and* the 2020 inflated costs would be shown. A 3% inflation amount was added for each year. Cost estimates were determined by referencing our experience with similar systems and the areas (ft^2) served by these systems. Cost estimates are as follows:

AIR HANDLING UNITS (1 TO 2 YEARS)

AHU	Location	Service	Existing System Type	Recommended System Type	2019 Cost	2020 Cost
A	C-South	C-South	Dual Duct	Fan Powered Box or VAV	$ 1,100,000	$ 1,133,000
B	C-South	C-South	Dual Duct	Fan Powered Box or VAV	$ 1,100,000	$ 1,133,000
C	C-North	C-North	Dual Duct	Fan Powered Box or VAV	$ 1,100,000	$ 1,133,000
D	C-North	C-North	Dual Duct	Fan Powered Box or VAV	$ 1,100,000	$ 1,133,000
E	N. Aud.	Auditorium	Single Zone	VAV AHU	$ 300,000	$ 309,000
F	S. Aud.	Auditorium Lobby and Stage	Two Zone	Two Zone VAV	$ 225,000	$ 231,750
G	S. Aud.	Auditorium S. Classrooms and Backstage	Multizone	VAV	$ 525,000	$ 540,750
H	N. Aud.	Auditorium N. Classrooms	Multizone	VAV	$ 450,000	$ 463,500
J	PE Mech	Pool	Two Zone	Roof Mtd Pool Dehumidification Unit	$ 550,000	$ 566,500
K	PE Mech	Small Gym	Single Zone	RTU	$ 225,000	$ 231,750
L	PE Mech	Dance Gym	Single Zone	RTU	$ 90,000	$ 92,700
M	M-Wing	M-Wing	Multizone	VAV	$ 325,000	$ 334,750
N	Kitchen	Kitchen	Three Zone	VAV	$ 225,000	$ 231,750
V	Spec Gym	Spec Gym	Single Zone	RTU	$ 225,000	$ 231,750
W	Spec Gym	Spec Gym	Single Zone	RTU	$ 225,000	$ 231,750
X	Spec Gym	Spec Gym	Single Zone	RTU	$ 225,000	$ 231,750
BB	Cafeteria	Cafeteria	Three Zone	VAV	$ 450,000	$ 463,500
A-Wing	A-Wing	Garage and Storage	Single Zone	Like for Like Replacement	$ 75,000	$ 77,250
				Totals:	**$ 8,515,000**	**$ 8,770,450**

A-WING UNIT VENTILATORS (6 TO 10 YEARS)

UV	Location	Service	Existing System Type	Recommended System Type	2024 Cost	2028 Cost
UV	A-Wing	A-Wing	UV	FCU-DOAS	**$ 5,250,000**	**$ 5,908,921**
OR						
UV	A-Wing	A-Wing	UV	Change Air Vertical Unit Ventilator	**$ 2,200,000**	**$ 2,476,119**

EXHAUST FANS (6 TO 10 YEARS)

According to ASHRAE, the median useful service life for indoor centrifugal exhaust fans is twenty-five (25) years and the median useful service life for roof mounted exhaust fans is twenty (20) years. According to the existing engineering drawings that we have on file there are approximately 105 exhaust fans that have already, or will exceed their ASHRAE recommended service life within the next ten years. Therefore, it is recommended to upgrade these exhaust fans with a like for like replacement within the 6 to 10-year timeframe. The approximate costs are as follows:

- **2024 Cost: $ 266,000**
- **2028 Cost: $ 308,000**

CHILLER #2 “Carrier” PUMPS: (3 TO 5 YEARS)

Tag	Service	Recommended Replacement Type	2021 Cost	2023 Cost
CHP1	Carrier Chiller & Bldg. Loop	Like For Like	$ 25,000	$ 26,523
CHP2	Carrier Chiller & Bldg. Loop	Like For Like	$ 25,000	$ 26,523
CP-1	Cooling Tower	Like For Like	$ 8,000	$ 8,487
CP-2	Cooling Tower	Like For Like	$ 8,000	$ 8,487
		Totals:	**$ 66,000**	**$ 70,019**

TOTAL MECHANICAL COST ESTIMATES

Category	Recommended Replacement Timeframe	Equipment Type	2019 Cost	2021 Cost	2024 Cost
Mechanical	2019 - 2020	Air Handlers	$ 8,515,000		
	2024 - 2028	Unit Vents			$ 2,200,000
	2024 - 2028	Exhaust Fans			$ 266,000
	2021 - 2023	Pumps		$ 66,000	
		TOTALS:	**$ 8,515,000**	**$ 66,000**	**$ 2,466,000**

Note: The Unit Ventilator cost above was for the Change Air Vertical Unit Ventilator. The alternate cost for the Unit Ventilator replacements are shown on the previous page.

MAINE SOUTH HIGH SCHOOL

This report section will review the existing electrical systems at Maine South High School. Subsections will include: primary distribution, secondary distribution, receptacle and lighting panelboards, lighting systems, and fire alarm.

Once the existing systems are described, we will present recommendations for the upgrade of each system, if required, along with an estimated cost of replacement. These recommendations are based on our understanding of the current local electrical and life-safety codes, as well as observation of what similar facilities have implemented in recent projects. The recommendations are not to be used in place of a fully-designed system. Detailed designs for replacement may be further evaluated at a later date.

Determinations are made regarding service life by visually evaluating the equipment, determining the availability of replacement parts, and comparing the known age of the equipment to what the average service life may be for a similar unit. There is no exact standard for what the service life is of a given piece of electrical equipment due to the myriad of environmental and maintenance factors that can impact the health of elements like copper busses, switches, transformers, enclosures, and the like. Our understanding of service life is then based around the observed average age of similar equipment when it was replaced.

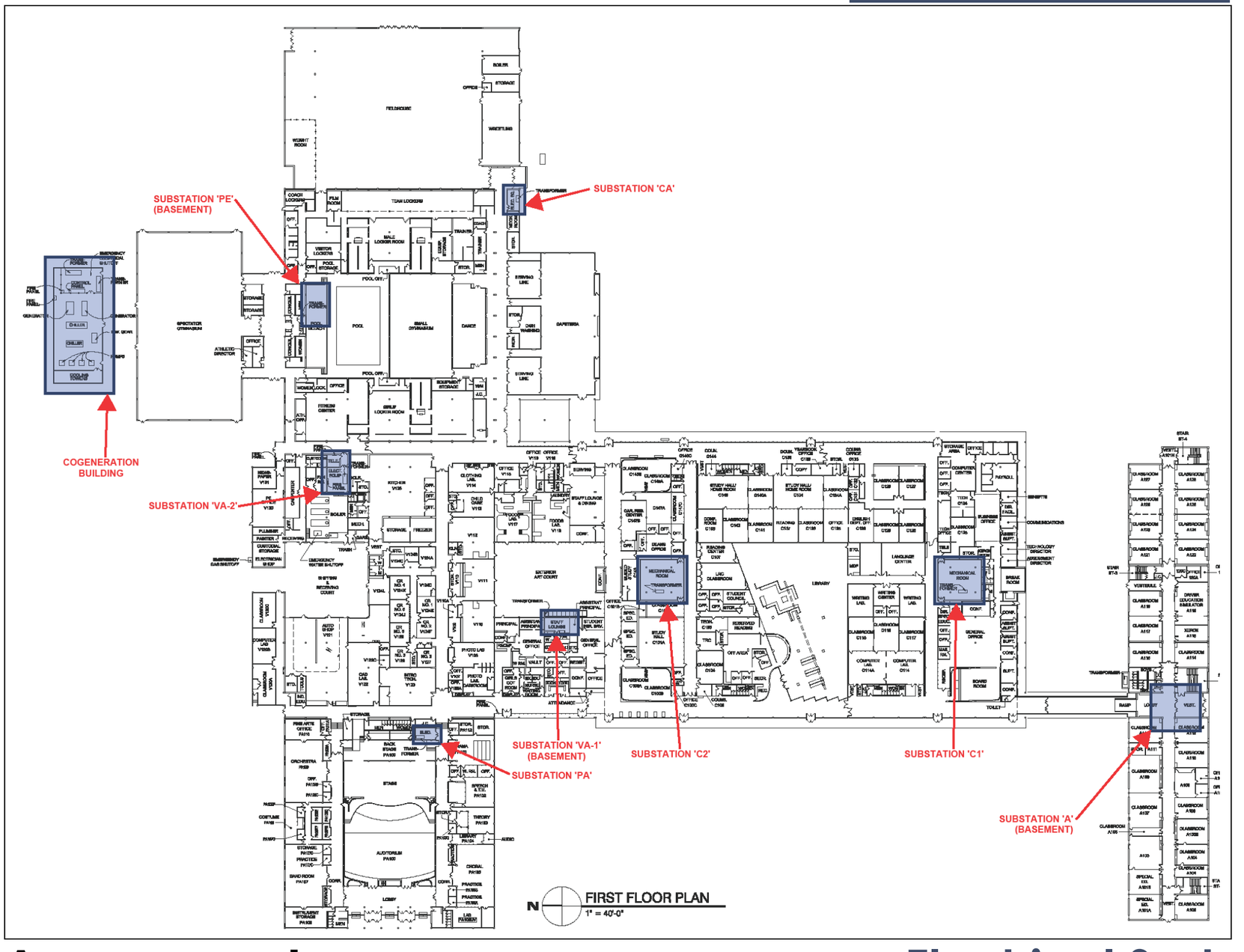
Recommendations will be presented in two groups:

1. Health Life Safety (2019) – These items are considered the most critical to maintain the health of the existing electrical system, or in some cases the most beneficial to occupants. Recommendations in this category often address safety risks for building occupants or maintenance personnel.
2. 1 to 2 Years (2019 to 2020) – Equipment in this category should be considered for replacement within the next couple of years or routine maintenance should be performed as soon as possible.
3. 3-5 year (2021-2023): These items typically represent equipment or systems that should be upgraded for compliance with electrical codes, or certain equipment that may be aged beyond the anticipated service life, but is not expected to be a significant safety risk.

On the next page is a map indicating the naming designations of various substations of the school. These names will be referenced throughout this report.

MAINE SOUTH – ELECTRICAL SYSTEMS OVERVIEW

Location Key



Electrical Assessment

Electrical Systems Overview

Building Primary Electrical Distribution

The primary electrical distribution system for Maine South is provided by an outdoor overhead medium-voltage service from ComEd, with a step-down to 4160V via an outdoor transformer. This service enters an outdoor metal-clad switchgear, which divides the service into four feeder lines. Two feeders enter the building's main electrical room, located in the vocational arts section of the school, and connect to an indoor metal-clad switchgear adjacent to substation 'VA-2'. The third feeder routes to the Cogeneration building substation, detached from the main school, to supply HVAC and other mechanical equipment. The fourth feeder routes to the cogeneration generator switchboard.

The building's substations and cogeneration building are described in detail in the following sections.

Substation VA-2 4160V Switch

Cogeneration Building 4160V Switches

Electrical Assessment

Electrical Systems Overview

SUBSTATION VA-2

The indoor switchgear adjacent to substation 'VA-2' consists of (2) load break, metal-clad 4160V switches manufactured by S&C which feed a total of (8) substations.

Switch 1 feeds the following substations: VA-2, PE, PA, VA

Switch 2 feeds the following substations: C-2, C-1, A

The first section of the VA-2 substation consists of a 4160V load break switch manufactured by I-T-E circuit breaker company, the second section contains a 500 KVA transformer to step the voltage down to 120/208V. The third section has a 1600A circuit breaker for the building's distribution load, as well as a 100A circuit breaker emergency panelboard. The fourth section has a board containing normal power distribution circuit breakers. The entire board is manufactured by I-T-E circuit breaker company. The substation is original to the building, and the equipment is past its expected lifespan.

The VA-2 substation room consists of (3) panelboards for power and lighting, and (1) panelboard for emergency lighting and power. The lighting and emergency panelboards have lighting contactors for controlling lights. These panelboards are original to the building, and they are past their expected lifespan.

1 TO 2 YEAR RECOMMENDATION FOR SUBSTATION VA-2

We recommend to exercise the existing 4160V switches to verify proper operation and reduce risk of becoming stuck in a certain position at an inopportune time. Additionally, we recommend annual thermal inspections of the substation, switches, distribution panels, and other equipment in order to more easily identify problematic areas of unwanted heat buildup in the system.

3 TO 5 YEAR RECOMMENDATION FOR SUBSTATION VA-2

Substation VA-2 is original to the building from 1964. The unit is significantly aged and was manufactured by a company that no longer formally exists. Due to the inherent reliability issues of the unit being beyond its expected lifespan along with the difficulty of obtaining relevant parts, it is recommended to replace this substation in the coming years. If the substation is fed by cloth-insulated wiring, it should be replaced with an equivalent thermoplastic-insulated wire during the substation replacement.

A like-for-like replacement can be implemented by custom switchboard manufacturers, replacing the primary switch, 500 KVA transformer, circuit breakers, and distribution board in a package of the same size as the existing. The incoming and outgoing feeders may remain as they currently are.

OSHA 2015 regulations require the application of an arc flash label that provides information on arc flash protection boundary, incident energy, working distance, PPE class, and available short circuit information. It is recommended to perform an arc flash and coordination study at the same time the switchboards are replaced.

The panelboards fed from substation VA-2 are also original to the building and are due for a replacement. The panels may be furnished by either a reputable manufacturer, or a custom switchboard manufacturer. The existing panel feeders and branch circuits may remain as existing.

Any panelboards fed via cloth-insulated wiring should be re-fed with equivalent thermoplastic-insulated wire as replacements occur.

VA-2 Distribution Panels

Substation VA-2

SUBSTATION PE

The first section of the PE substation consists of a 4160V load break switch manufactured by I-T-E circuit breaker company, the second section contains a 500 KVA transformer to step the voltage down to 120/208V. The third section has a 1600A circuit breaker for the building's distribution load, as well as a 100A circuit breaker emergency panelboard. The fourth section has a board containing normal power distribution circuit breakers. The entire board is manufactured by I-T-E circuit breaker company. The substation is original to the building, and the equipment is past its expected lifespan.

The PE substation room consists of (5) panelboards for power and lighting, and (2) panelboard for emergency lighting and power. The lighting and emergency panelboards have lighting contactors for controlling lights. These panelboards are original to the building, and they are past their expected lifespan.

1 TO 2 YEAR RECOMMENDATION FOR SUBSTATION PE

We recommend to exercise the existing 4160V switches to verify proper operation and reduce risk of becoming stuck in a certain position at an inopportune time. Additionally, we recommend annual thermal inspections of the substation, switches, distribution panels, and other equipment in order to more easily identify problematic areas of unwanted heat buildup in the system.

3 TO 5 YEAR RECOMMENDATION FOR SUBSTATION PE

Substation PE is original to the building from 1964. The unit is significantly aged and was manufactured by a company that no longer formally exists. Due to the inherent reliability issues of the unit being beyond its expected lifespan along with the difficulty of obtaining relevant parts, it is recommended to replace this substation in the coming years. If the substation is fed by cloth-insulated wiring, it should be replaced with an equivalent thermoplastic-insulated wire during the substation replacement.

A like-for-like replacement can be implemented by custom switchboard manufacturers, replacing the primary switch, 500 KVA transformer, circuit breakers, and distribution board in a package of the same size as the existing. The incoming and outgoing feeders may remain as they currently are.

OSHA 2015 regulations require the application of an arc flash label that provides information on arc flash protection boundary, incident energy, working distance, PPE class, and available short circuit information. It is recommended to perform an arc flash and coordination study at the same time the switchboards are replaced.

The panelboards fed from substation PE are also original to the building and are due for a replacement. The panels may be furnished by either a reputable manufacturer, or a custom switchboard manufacturer. The existing panel feeders and branch circuits may remain as existing.

Any panelboards fed via cloth-insulated wiring should be re-fed with equivalent thermoplastic-insulated wire as replacements occur.

Substation PE and Distribution Panels

SUBSTATION CA

The first section of the CA substation consists of a 4160V load break switch manufactured by I-T-E circuit breaker company, the second section contains a 500 KVA transformer to step the voltage down to 120/208V. The third section has a 1600A circuit breaker for the building's distribution load, as well as a 100A circuit breaker emergency panelboard. The fourth section has a board containing normal power distribution circuit breakers. The entire board is manufactured by I-T-E circuit breaker company. The substation is original to the building, and the equipment is past its expected lifespan.

The CA substation room consists of (2) panelboards for power and lighting, and (1) panelboard for emergency lighting and power. The lighting and emergency panelboards have lighting contactors for controlling lights. These panelboards are original to the building, and they are past their expected lifespan.

1 TO 2 YEAR RECOMMENDATION FOR SUBSTATION CA

We recommend to exercise the existing 4160V switches to verify proper operation and reduce risk of becoming stuck in a certain position at an inopportune time. Additionally, we recommend annual thermal inspections of the substation, switches, distribution panels, and other equipment in order to more easily identify problematic areas of unwanted heat buildup in the system.

3 TO 5 YEAR RECOMMENDATION FOR SUBSTATION CA

Substation CA is original to the building from 1964. The unit is significantly aged and was manufactured by a company that no longer formally exists. Due to the inherent reliability issues of the unit being beyond its expected lifespan along with the difficulty of obtaining relevant parts, it is recommended to replace this substation in the coming years. If the substation is fed by cloth-insulated wiring, it should be replaced with an equivalent thermoplastic-insulated wire during the substation replacement.

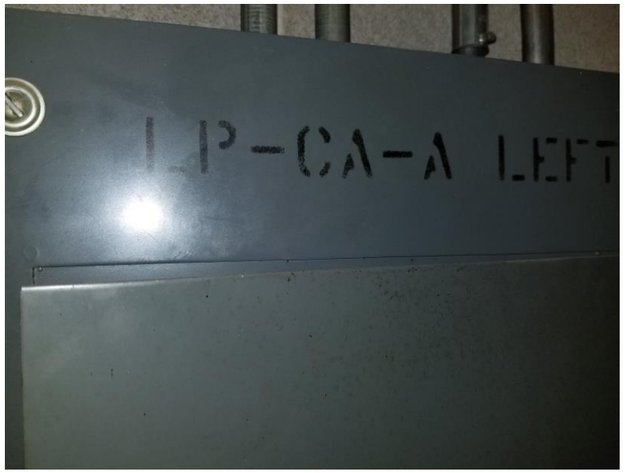
A like-for-like replacement can be implemented by custom switchboard manufacturers, replacing the primary switch, 500 KVA transformer, circuit breakers, and distribution board in a package of the same size as the existing. The incoming and outgoing feeders may remain as they currently are.

OSHA 2015 regulations require the application of an arc flash label that provides information on arc flash protection boundary, incident energy, working distance, PPE class, and available short circuit information. It is recommended to perform an arc flash and coordination study at the same time the switchboards are replaced.

The panelboards fed from substation CA are also original to the building and are due for a replacement. The panels may be furnished by either a reputable manufacturer, or a custom switchboard manufacturer. The existing panel feeders and branch circuits may remain as existing.

Any panelboards fed via cloth-insulated wiring should be re-fed with equivalent thermoplastic-insulated wire as replacements occur.

Substation CA Distribution Panels



Substation CA

SUBSTATION VA-1

The first section of the VA-1 substation consists of a 4160V load break switch manufactured by I-T-E circuit breaker company, the second section contains a 500 KVA transformer to step the voltage down to 120/208V. The third section has a 1600A circuit breaker for the building's distribution load. The fourth section has a board containing normal power distribution circuit breakers. The entire board is manufactured by I-T-E circuit breaker company. The substation is original to the building, and the equipment is past its expected lifespan.

The VA-1 substation room consists of (2) panelboards for power and lighting. The lighting panelboards have lighting contactors for controlling lights. These panelboards are original to the building, and they are past their expected lifespan.

In the summer of 2017, the substation experienced water penetration due to improper sealing on the entrance door. Because the substation is below-grade and the entrance leads outside, rainfall was able to flood the room and damage the equipment. The substation was repaired in-place. The substation's 4160 V compartment door is bent and not properly closed, which further amplifies the risk for water penetration.

1 TO 2 YEAR RECOMMENDATION FOR SUBSTATION VA-1

We recommend to exercise the existing 4160V switches to verify proper operation and reduce risk of becoming stuck in a certain position at an inopportune time. Additionally, we recommend annual thermal inspections of the substation, switches, distribution panels, and other equipment in order to more easily identify problematic areas of unwanted heat buildup in the system.

3 TO 5 YEAR RECOMMENDATION FOR SUBSTATION VA-1

Substation VA-1 is original to the building from 1964. The unit is significantly aged and was manufactured by a company that no longer formally exists. Due to the inherent reliability issues of the unit being beyond its expected lifespan along with the difficulty of obtaining relevant parts, it is recommended to replace this substation in the coming years. If the substation is fed by cloth-insulated wiring, it should be replaced with an equivalent thermoplastic-insulated wire during the substation replacement.

A like-for-like replacement can be implemented by custom switchboard manufacturers, replacing the primary switch, 500 KVA transformer, circuit breakers, and distribution board in a package of the same size as the existing. The incoming and outgoing feeders may remain as they currently are.

OSHA 2015 regulations require the application of an arc flash label that provides information on arc flash protection boundary, incident energy, working distance, PPE class, and available short circuit information. It is recommended to perform an arc flash and coordination study at the same time the switchboards are replaced.

The panelboards fed from substation VA-1 are also original to the building and are due for a replacement. The panels may be furnished by either a reputable manufacturer, or a custom switchboard manufacturer. The existing panel feeders and branch circuits may remain as existing.

Any panelboards fed via cloth-insulated wiring should be re-fed with equivalent thermoplastic-insulated wire as replacements occur.

Substation VA-1

Substation VA-1 Distribution Panels

SUBSTATION C-1

The first section of the C-1 substation consists of a 4160V load break switch manufactured by I-T-E circuit breaker company, the second section contains a 500 KVA transformer to step the voltage down to 120/208V. The third section has a 1600A circuit breaker for the building's distribution load, as well as a 100A circuit breaker emergency panelboard. The fourth section has a board containing normal power distribution circuit breakers. The entire board is manufactured by I-T-E circuit breaker company. The substation is original to the building, and the equipment is past its expected lifespan.

The C-1 substation room consists of (5) panelboards for power and lighting, and (3) panelboard for emergency lighting and power. The lighting and emergency panelboards have lighting contactors for controlling lights. These panelboards are original to the building, and they are past their expected lifespan.

1 TO 2 YEAR RECOMMENDATION FOR SUBSTATION C-1

We recommend to exercise the existing 4160V switches to verify proper operation and reduce risk of becoming stuck in a certain position at an inopportune time. Additionally, we recommend annual thermal inspections of the substation, switches, distribution panels, and other equipment in order to more easily identify problematic areas of unwanted heat buildup in the system.

3 TO 5 YEAR RECOMMENDATION FOR SUBSTATION C-1

Substation C-1 is original to the building from 1964. The unit is significantly aged and was manufactured by a company that no longer formally exists. Due to the inherent reliability issues of the unit being beyond its expected lifespan along with the difficulty of obtaining relevant parts, it is recommended to replace this substation in the coming years. If the substation is fed by cloth-insulated wiring, it should be replaced with an equivalent thermoplastic-insulated wire during the substation replacement.

A like-for-like replacement can be implemented by custom switchboard manufacturers, replacing the primary switch, 500 KVA transformer, circuit breakers, and distribution board in a package of the same size as the existing. The incoming and outgoing feeders may remain as they currently are.

OSHA 2015 regulations require the application of an arc flash label that provides information on arc flash protection boundary, incident energy, working distance, PPE class, and available short circuit information. It is recommended to perform an arc flash and coordination study at the same time the switchboards are replaced.

The panelboards fed from substation C-1 are also original to the building and are due for a replacement. The panels may be furnished by either a reputable manufacturer, or a custom switchboard manufacturer. The existing panel feeders and branch circuits may remain as existing.

Any panelboards fed via cloth-insulated wiring should be re-fed with equivalent thermoplastic-insulated wire as replacements occur.

Substation C-1

Substation C-1 Distribution Panels

SUBSTATION C-2

The first section of the C-2 substation consists of a 4160V load break switch manufactured by I-T-E circuit breaker company, the second section contains a 500 KVA transformer to step the voltage down to 120/208V. The third section has a 1600A circuit breaker for the building's distribution load, as well as a 100A circuit breaker emergency panelboard. The fourth section has a board containing normal power distribution circuit breakers. The entire board is manufactured by I-T-E circuit breaker company. The substation is original to the building, and the equipment is past its expected lifespan.

The C-2 substation room consists of (8) panelboards for power and lighting, and (2) panelboard for emergency lighting and power. The lighting and emergency panelboards have lighting contactors for controlling lights. These panelboards are original to the building, and they are past their expected lifespan.

1 TO 2 YEAR RECOMMENDATION FOR SUBSTATION C-2

We recommend to exercise the existing 4160V switches to verify proper operation and reduce risk of becoming stuck in a certain position at an inopportune time. Additionally, we recommend annual thermal inspections of the substation, switches, distribution panels, and other equipment in order to more easily identify problematic areas of unwanted heat buildup in the system.

3 TO 5 YEAR RECOMMENDATION FOR SUBSTATION C-2

Substation C-2 is original to the building from 1964. The unit is significantly aged and was manufactured by a company that no longer formally exists. Due to the inherent reliability issues of the unit being beyond its expected lifespan along with the difficulty of obtaining relevant parts, it is recommended to replace this substation in the coming years. If the substation is fed by cloth-insulated wiring, it should be replaced with an equivalent thermoplastic-insulated wire during the substation replacement.

A like-for-like replacement can be implemented by custom switchboard manufacturers, replacing the primary switch, 500 KVA transformer, circuit breakers, and distribution board in a package of the same size as the existing. The incoming and outgoing feeders may remain as they currently are.

OSHA 2015 regulations require the application of an arc flash label that provides information on arc flash protection boundary, incident energy, working distance, PPE class, and available short circuit information. It is recommended to perform an arc flash and coordination study at the same time the switchboards are replaced.

The panelboards fed from substation C-2 are also original to the building and are due for a replacement. The panels may be furnished by either a reputable manufacturer, or a custom switchboard manufacturer. The existing panel feeders and branch circuits may remain as existing.

Any panelboards fed via cloth-insulated wiring should be re-fed with equivalent thermoplastic-insulated wire as replacements occur.

Substation C-2

Substation C-2 Distribution Panels

SUBSTATION PA

The first section of the PA-2 substation consists of a 4160V load break switch manufactured by I-T-E circuit breaker company, the second section contains a 500 KVA transformer to step the voltage down to 120/208V. The third section has a 1600A circuit breaker for the building's distribution load, as well as a 150A circuit breaker emergency panelboard. The fourth section has a board containing normal power distribution circuit breakers. The entire board is manufactured by I-T-E circuit breaker company. The substation is original to the building, and the equipment is past its expected lifespan.

The PA-2 substation room consists of (5) panelboards for power and lighting, and (2) panelboard for emergency lighting. The lighting and emergency panelboards have lighting contactors for controlling lights. The room also contains dimming panels for the building lights. These panelboards are original to the building, and they are past their expected lifespan.

1 TO 2 YEAR RECOMMENDATION FOR SUBSTATION PA

We recommend to exercise the existing 4160V switches to verify proper operation and reduce risk of becoming stuck in a certain position at an inopportune time. Additionally, we recommend annual thermal inspections of the substation, switches, distribution panels, and other equipment in order to more easily identify problematic areas of unwanted heat buildup in the system.

3 TO 5 YEAR RECOMMENDATION FOR SUBSTATION PA

Substation PA is original to the building from 1964. The unit is significantly aged and was manufactured by a company that no longer formally exists. Due to the inherent reliability issues of the unit being beyond its expected lifespan along with the difficulty of obtaining relevant parts, it is recommended to replace this substation in the coming years. If the substation is fed by cloth-insulated wiring, it should be replaced with an equivalent thermoplastic-insulated wire during the substation replacement.

A like-for-like replacement can be implemented by custom switchboard manufacturers, replacing the primary switch, 500 KVA transformer, circuit breakers, and distribution board in a package of the same size as the existing. The incoming and outgoing feeders may remain as they currently are.

OSHA 2015 regulations require the application of an arc flash label that provides information on arc flash protection boundary, incident energy, working distance, PPE class, and available short circuit information. It is recommended to perform an arc flash and coordination study at the same time the switchboards are replaced.

The panelboards fed from substation PA are also original to the building and are due for a replacement. The panels may be furnished by either a reputable manufacturer, or a custom switchboard manufacturer. The existing panel feeders and branch circuits may remain as existing.

Any panelboards fed via cloth-insulated wiring should be re-fed with equivalent thermoplastic-insulated wire as replacements occur.

Substation PA

Substation PA Distribution Panels

SUBSTATION A

The first section of the A substation consists of a 4160V load break switch manufactured by I-T-E circuit breaker company, the second section contains a 500 KVA transformer to step the voltage down to 120/208V. The third section has a 1600A circuit breaker for the building's distribution load, as well as a 100A circuit breaker emergency panelboard. The fourth section has a board containing normal power distribution circuit breakers. The entire board is manufactured by I-T-E circuit breaker company. The substation is original to the building, and the equipment is past its expected lifespan.

The A substation room consists of (3) panelboards for power and lighting, and (1) panelboard for emergency lighting. The lighting and emergency panelboards have lighting contactors for controlling lights. These panelboards are original to the building, and they are past their expected lifespan.

1 TO 2 YEAR RECOMMENDATION FOR SUBSTATION A

We recommend to exercise the existing 4160V switches to verify proper operation and reduce risk of becoming stuck in a certain position at an inopportune time. Additionally, we recommend annual thermal inspections of the substation, switches, distribution panels, and other equipment in order to more easily identify problematic areas of unwanted heat buildup in the system.

3 TO 5 YEAR RECOMMENDATION FOR SUBSTATION A

Substation A is original to the building from 1964. The unit is significantly aged and was manufactured by a company that no longer formally exists. Due to the inherent reliability issues of the unit being beyond its expected lifespan along with the difficulty of obtaining relevant parts, it is recommended to replace this substation in the coming years. If the substation is fed by cloth-insulated wiring, it should be replaced with an equivalent thermoplastic-insulated wire during the substation replacement.

A like-for-like replacement can be implemented by custom switchboard manufacturers, replacing the primary switch, 500 KVA transformer, circuit breakers, and distribution board in a package of the same size as the existing. The incoming and outgoing feeders may remain as they currently are.

OSHA 2015 regulations require the application of an arc flash label that provides information on arc flash protection boundary, incident energy, working distance, PPE class, and available short circuit information. It is recommended to perform an arc flash and coordination study at the same time the switchboards are replaced.

The panelboards fed from substation A are also original to the building and are due for a replacement. The panels may be furnished by either a reputable manufacturer, or a custom switchboard manufacturer. The existing panel feeders and branch circuits may remain as existing.

If the substation is fed by cloth-insulated wiring, it should be replaced with an equivalent thermoplastic-insulated wire during the substation replacement.

Substation A

Substation A Distribution Panels

Electrical Assessment

Electrical Systems Overview

GENERATOR

The existing (2) cogeneration units are Caterpillar natural gas machines capable of supplying up to 800kW when they are used simultaneously. The output is at 4160V. The generator outputs connect to a three-section board, two sections are for input of power to the board from each generator, the final section is used for a tie breaker to output the combined power from the units and feed power back to the grid via outdoor switchgear, located where the electrical service lands at the building. The generators are capable of powering the entire school upon loss of utility power.

We recommend to maintain a regular, weekly test of each generator unit. Per NFPA guidelines, the testing of life-safety generators is required to be performed at least once a week to ensure proper operation in a true emergency situation. The weekly test should last around a half-hour and can be performed on a load bank. We also recommend a yearly preventative maintenance procedure for the machines and switchboards, including the exercising of primary switches.

COGENERATION BUILDING

This building consists of chillers, (2) cogeneration units, (2) substations, distribution panelboards, and a motor control center.

The switchgear room adjacent to the generators receives the outdoor 4160V load-break switch feeder. There are two additional 4160V load-break metal-clad switches that exist in the room, both of which feed to local 500KVA transformers. One of these transformers supplies a 480V, 3P chiller distribution panel, 'DPCH', and the other transformer feeds a second 480V, 3P panel with local mechanical equipment and a motor control center connected.

1 TO 2 YEAR RECOMMENDATION FOR COGENERATION BUILDING

We recommend to exercise the existing 4160V switches to verify proper operation and reduce risk of becoming stuck in a certain position at an inopportune time. Additionally, we recommend annual thermal inspections of the substation, switches, distribution panels, and other equipment in order to more easily identify problematic areas of unwanted heat buildup in the system.

3 TO 5 YEAR RECOMMENDATION FOR COGENERATION BUILDING

OSHA 2015 regulations require the application of an arc flash label that provides information on arc flash protection boundary, incident energy, working distance, PPE class, and available short circuit information. It is recommended to perform an arc flash study and apply the labels as soon as possible to comply.

If any equipment is fed by cloth-insulated wiring, it should be replaced with an equivalent thermoplastic-insulated wire in a timely manner to mitigate risks associated with older insulation such as brittleness, overheating, and potential exposure to asbestos.

Cogeneration Unit

Chiller Distribution Equipment

Electrical Assessment

Electrical Systems Overview

LIGHTING

The lighting system within the building consists primarily of T8 fluorescent fixtures within the corridors, classrooms, common spaces, and offices. Some of the light fixtures through the building are not working or not in good physical condition. Control is performed mostly through toggle switches, though some corridors and rooms contain occupancy sensors.

Many mechanical spaces within the building, including all substation rooms, use screw-in lamp types which house either CFL lamps, metal halide lamps, or LED retrofit lamps. The spaces renovated during the summer of 2017 have new LED lighting fixtures installed. There is no automatic lighting control system found throughout the building.

EMERGENCY AND EXIT LIGHTING

The building uses individual battery back-up for most of the emergency and exit lighting, the only exceptions being very old fixtures. The existing exit signs house mostly incandescent and fluorescent lamps, and the emergency lights vary between incandescent, halogen, and LED units. The emergency lights are typically either wall or ceiling-mount with two light heads.

1 TO 2 YEAR RECOMMENDATIONS FOR LIGHTING SYSTEM

The primary recommendation for the lighting system is the conversion of all fixtures, including emergency and exit lighting, to LED. LED technology carries significant benefits and cost-savings in energy usage and maintenance that in many cases will turn into a payback to the facility over time.

Another lighting recommendation is an overhaul of the control system to implement more modern technologies such as daylight harvesting in corridors and exterior areas, occupancy sensing in offices and other interior rooms, and more precise zoned controls. The new controls will offer additional energy savings for the school, and provide an extra level of precision for staff to customize the light output for the facility.

FIRE ALARM

The building contains a Simplex fire alarm system, consisting of audio, visual, heat detector, smoke detector, duct smoke detectors, and pull station devices. The system is heavily outdated, and the equipment is beyond its typical life expectancy. In addition, the building is not sprinklered, with the exception of a portion of the A wing building.

The design process is underway for a complete replacement of the existing fire alarm system, to be implemented in 2018. This replacement serves as a modernization project, as the existing fire alarm control panel is outdated and incompatible with certain newer fire alarm technologies that are beneficial in a school setting such as voice communication.

Fire Alarm Panel

Exit/Emergency Light

Electrical Assessment

Electrical Systems Overview

Cost Estimates

Cost estimates for recommended replacements encompass any associated demolition, general contracting, installation, and equipment costs. It should be noted that two costs will be shown for future recommendations. For example, if an item is recommended for replacement from 2019 – 2020 then the 2019 costs *and* the 2020 inflated costs would be shown. Inflation was accounted for by adding a 3% increase per year. Cost estimates were determined by referencing our experience with similar systems and the areas served by these systems. Cost estimates are as follows:

SUBSTATIONS - UNIT SUBSTATION REPLACEMENT ONLY (3 TO 5 YEARS)

Substation	Location/Service	Normal Power Panels	EM Power Panels	2021 Cost	2023 Cost
VA-2	Vocational Arts	3	1	$109,273	$115,927
PE	Physical Education	5	2	$109,273	$115,927
CA	Cafeteria	2	1	$109,273	$115,927
VA-1	Vocational Arts	2	0	$109,273	$115,927
C-1	C-Wing	5	3	$109,273	$115,927
C-2	C-Wing	8	2	$109,273	$115,927
PA	Performing Arts	5	2	$109,273	$115,927
A	A-Wing	3	1	$109,273	$115,927
			Totals:	**$874,182**	**$927,416**

CLOTH WIRING REPLACEMENT

The cost to install new conduit and thermoplastic-insulated wiring in place of cloth wiring, on an average per-linear-foot basis and including labor, is estimated to be as follows:

Ampacity	Cost (per linear foot)
65	$22.75
100	$35
150	$52.5
200	$70
400	$140
600	$210
800	$280
1000	$350
1200	$420

SUBSTATIONS - DISTRIBUTION PANELBOARD REPLACEMENT ONLY (3 TO 5 YEARS)

Substation	Location/Service	Normal Power Panels	EM Power Panels	2021 Cost	2023 Cost
VA-2	Vocational Arts	3	1	$17,484	$18,548
PE	Physical Education	5	2	$30,596	$32,460
CA	Cafeteria	2	1	$13,113	$13,911
VA-1	Vocational Arts	2	0	$8,742	$9,274
C-1	C-Wing	5	3	$34,967	$37,097
C-2	C-Wing	8	2	$43,709	$46,371
PA	Performing Arts	5	2	$30,596	$32,460
A	A-Wing	3	1	$17,484	$18,548
			Totals:	**$196,691**	**$208,669**

THERMAL INSPECTIONS (1 TO 2 YEARS)

The estimated cost for complete thermal inspections in the facility is **$25,000** in 2019 dollars.

ARC FLASH STUDY (3 TO 5 YEARS)

The cumulative approximate cost for the arc fault and coordination study for the school's substations is **$25,000** in 2019 dollars. This is assuming that the study is done concurrent with each substation replacement.

EXERCISING OF SWITCHES AND OTHER PREVENTATIVE MAINTENANCE (1 TO 2 YEARS)

The cost to perform maintenance as described in this report is approximately **$10,000** in 2019 dollars.

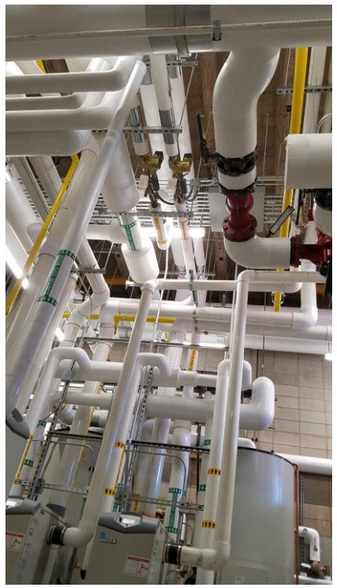
LIGHTING (1 TO 3 YEARS)

The cost to replace lighting is variable depending on the type and number of fixtures selected, as well as the level of control desired in the new system. We consider a square-foot cost of $\$10/ft^2$ to replace the existing system with new LED fixtures. Modern controls are included as well, consisting of daylight harvesting in corridors and exterior areas, occupancy sensing and dimming in interior classrooms and offices, and basic zoned control. Since the school is about **480,000** ft^2, the total cost of the retrofit is estimated to be **$4,800,000** in 2019 dollars.

TOTAL ELECTRICAL COST ESTIMATES

Category	Recommended Implementation Timeframe	Equipment Type	2019 Cost	2020 Cost	2021 Cost
Electrical	2021 - 2023	Unit Substation Replacement			$ 874,182
	2021 - 2023	Distribution Panelboard Replacement			$ 196,691
	2019	Thermal Inspections	$ 25,000		
	2021 - 2023	Arc Flash Study			$ 26,523
	2019	Switch Exercise & Other Preventative Maintenance	$ 10,000		
	2019 - 2021	LED Lighting & Controls	$ 1,600,000	$ 1,648,000	$ 1,697,440
		TOTALS:	**$ 1,635,000**	**$ 1,648,000**	**$ 2,794,836**

Note: The cost to install new conduit and thermoplastic-insulated wiring was not included in this table; this is shown on page 32.



MAINE SOUTH HIGH SCHOOL

This report section will overview the existing plumbing systems at Maine South High School. The sections will include: domestic cold water distribution, domestic hot water distribution, domestic hot water recirculation, domestic hot water generation, and recommendations.

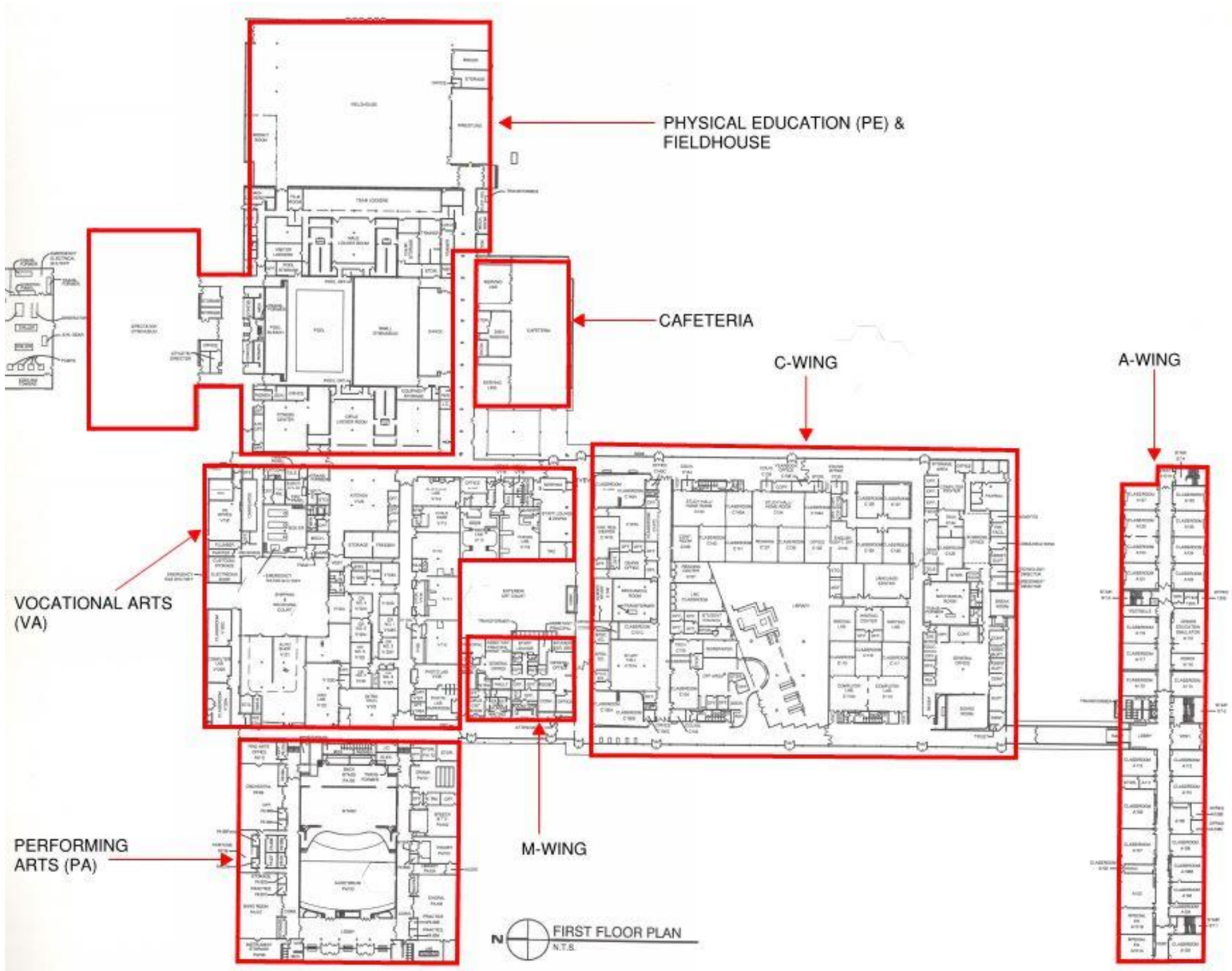
The system replacement recommendation(s) follow each equipment's existing conditions description. To determine the recommendations, our experience with similar systems and the ASHRAE median service life tables were utilized. Estimated equipment service life, according to the 2015 American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Handbook, is defined as the economic life of a system or component, or the amount of time it remains in its original service application. The remaining service life values reported in this document are based off the ASHRAE Equipment Life Expectancy Chart, as well as the ASHRAE Preventative Maintenance Guidebook, which use median years to provide an indication of expected equipment service life. Many factors effect equipment service life and with any average, some systems may have lifetimes far from average. However, these median lifetimes provide a reasonable basis for establishing the remaining useful life of existing systems.

Equipment recommended for replacement is categorized into the following four groups:

1. Health Life Safety (2019) – Equipment or systems in this category present health, life, or safety risks to building occupants and may not be up to current code standards. Systems in this category are recommended to be replaced as soon as possible.
2. 1 to 2 Years (2019 to 2020) – Equipment in this category should be considered for replacement within the next couple of years.

On the following pages are two (2) floor plan graphics. The first graphic is a location key indicating the naming designations of various sections of the school and will be referenced throughout the report. The second graphic displays an overview of floor plan layouts at Maine South served by plumbing systems. These plumbing systems will be discussed in further detail in the report.

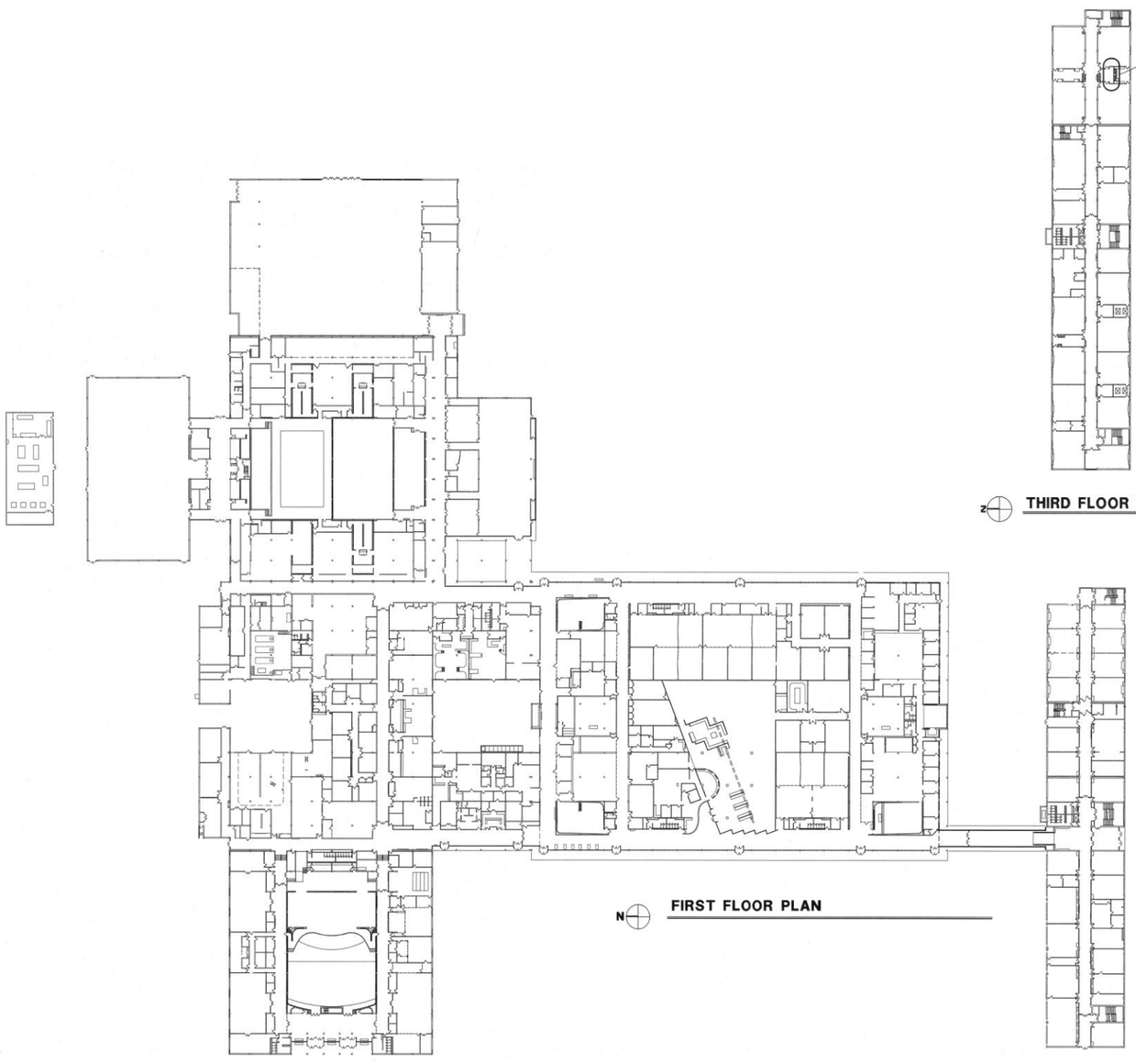
MAINE SOUTH – LOCATION KEY FOR NAMING DESIGNATIONS OF AREAS OF SCHOOL



Plumbing Assessment

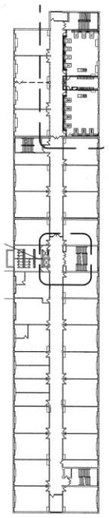
Plumbing Overview

MAINE SOUTH – FLOOR PLAN OVERVIEW FOR PLUMBING SYSTEMS

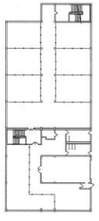


FIRST FLOOR PLAN

THIRD FLOOR PLAN



SECOND FLOOR PLAN



BASEMENT PLAN

Plumbing Assessment

Plumbing Overview

Domestic Hot Water Plant

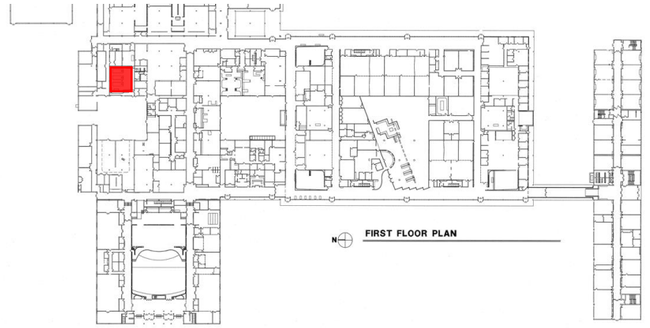
Domestic hot water for Maine South is provided by one (1) domestic hot water plant. The plant is located in the main building mechanical boiler room (replaced in 2017).

DOMESTIC HOT WATER PLANT

The domestic hot water plant in the main building mechanical boiler room is comprised of three (3) 800-MBH high-efficiency gas-fired domestic water heaters and two (2) 500-gallon hot water storage tank. The water heaters and storage tank and localized piping were replaced in 2017. This plant serves entire building's domestic hot water load, including the cafeteria conveyor dishwasher. The pictures on the right show the equipment and location of the domestic hot water plant.

No alterations are recommended for this equipment within the scope of this report.

Domestic Hot Water Plant Location



Domestic Hot Water Plant

Plumbing Assessment

Plumbing Overview

Domestic Cold Water and Hot Water Distribution and Recirculation

The existing original domestic water is galvanized piping. The existing original isolation valves are stem-operated valves. Hot water return piping is without adequate balancing.

DOMESTIC COLD WATER AND HOT WATER DISTRIBUTION AND RECIRCULATION

The existing original domestic cold and hot water piping is galvanized piping in various levels of failure. Galvanized piping in domestic water systems corrodes overtime and generates corrosion and rust debris. Corroded pipe walls and pipe debris settle in piping creating restrictions and impacting function of isolation valves, balancing valves, check valves, faucet aerators, shower-head flow restrictors, etc. The debris materials settle at horizontal sections of pipe and piping at/near fixtures because the pipe diameter is smaller and the debris carried with water flow.

Pipe fails via mechanisms such as pitting, pin-hole leaks, and loss of pipe thickness at threaded fittings. Also, failure of threaded fittings can result in significant leak and release a high flow rate via open pipe fitting. The threading process itself cuts away pipe wall and significantly reduces pipe wall thickness and then further corrosion over time occurs.

The existing original isolation valves may or may not properly operate when isolation is necessary for repair or remodel work.

The existing hot water recirculation path is impacted by corrosion, failed isolation valves, failed check valves, and failed balancing valves. Additionally, Maine West High School, it was observed that the original hot water return branch piping is without any check valves and without any balancing valves. Therefore, the ability to balancing the hot water delivery and return pipe paths is not possible. Balancing the pipe paths permits adjustment of the shorter pipe runs to be equivalent to longer pipe runs. Without the ability to balance, the shorter pipe runs (i.e. path of least resistance) flows easy – while the longer pipe runs do not flow any recirculation flow to maintain hot water through the longer circuits (i.e. paths).

1 TO 2 YEAR RECOMMENDATION

Due to the fact that the piping is a) galvanized, b) corroding and generating rust/debris, especially on a water shut-downs, c) isolation valves failed/failing, d) check valves fowled/failed/failing or not present, e) balancing valves fowled/failed/failing or not present, and f) the resultant impact on the ability to balance the hot water recirculation the domestic cold water and hot water piping is recommended to be replaced. If replacement is necessary to be phased, the immediate focus should be on replacement of common horizontal piping, isolation valves, check valves, and balancing valves.

Sample of Existing Galvanized Piping

Plumbing Assessment

Plumbing Overview

Thermostatic Mixing Valves

Thermostatic mixing valves are intended to limit hot temperature downstream of the valve. Per Code for this project, lavatories and showers require a thermostatic mixing valve either upstream of a group of fixtures or at each fixture.

THERMOSTATIC MIXING VALVES

Thermostatic mixing valves are generally present at showers either with an upstream master mixing thermostatic mixing valve or at the shower valve body. Some components such as temperature gauges are non-functional due to age.

Thermostatic mixing valves are generally not present at existing original lavatory installations.

Thermostatic mixing valves are not present at existing home-economics sinks.

HEALTH LIFE SAFETY RECOMMENDATION

For basic scald protection, thermostatic mixing valves are required and shall be immediately implemented.

Existing thermostatic mixing valves in need of repair shall be repaired/replaced as part of necessary regular maintenance program.

Existing Lavatories without TMV's

Home-Economic Sinks

Plumbing Assessment

Plumbing Overview

Backflow Preventers

Backflow preventers limit unintended backflow of water distribution. These are present upstream of mechanical equipment water make-up connections, irrigation water piping, etc.

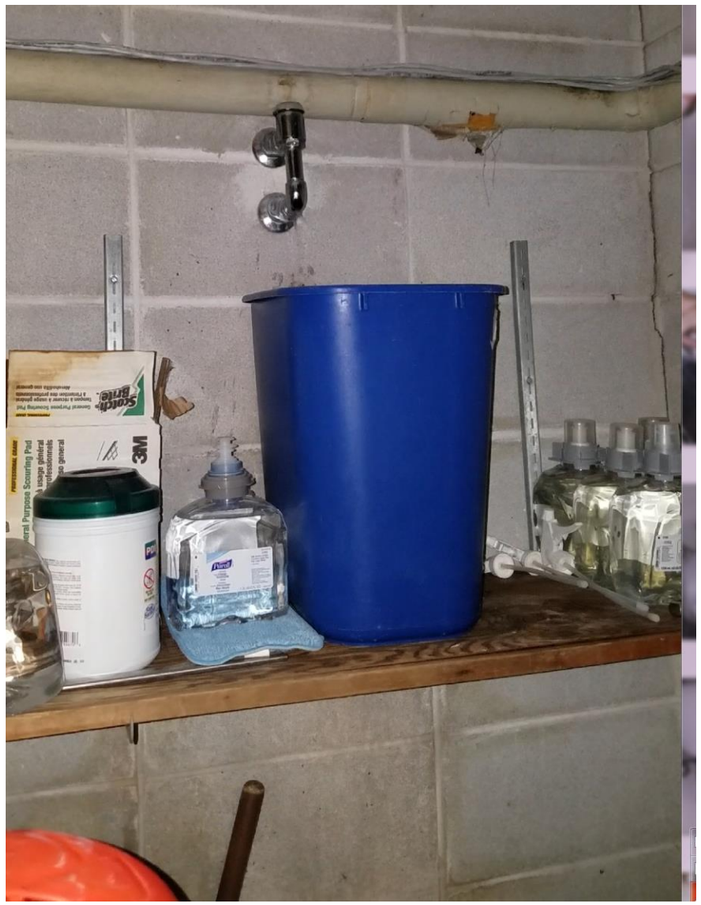
BACKFLOW PREVENTERS

A failed mop basin vacuum breaker at third floor (east side) of academic wing was observed.

HEALTH LIFE SAFETY RECOMMENDATION

For backflow prevention purposes and to protect the domestic water distribution system, failing/failed or deficient backflow preventers are required to be replaced for proper function of backflow protection.

Failed Vacuum Breaker



Plumbing Assessment

Plumbing Overview

Cost Estimates

The cost estimate tables below for recommended replacements encompass any associated mechanical, electrical, plumbing, controls, equipment, contracting, demolition, and installation costs. The anticipated start year for replacements is 2019. If equipment is recommended for replacement in the 6 to 10-year timeframe, then it has two listed costs: 2024 and 2028. These costs represent the inflated cost if the project were to be implemented that year. A 3% inflation amount was added for each year. Cost estimates were determined by referencing our experience with similar systems and the areas served by these systems. Cost estimates are as follows:

Recommended Replacement Timeframe	System Type	Location	Service	Recommended System Type	2019 Cost	2024 Cost
Health Life Safety (ASAP)	Thermostatic Mixing Valves (TMV)	WH Mech Room	H/E Master Mixer	New TMV	$ 6,000	
		At Fixtures	Fixtures	New TMV	$ 26,000	
	Failed Vacuum Breaker	At Fixture	At MB	New Vacuum Breaker	$ 500	
2019 - 2020	Domestic Cold/Hot Water Distribution and Circulation	Throughout	Tunnel	New Copper Pipe	$ 175,000	
			Basement	New Copper Pipe	$ 150,000	
			1st Floor	New Copper Pipe	$ 1,500,000	
			2nd Floor	New Copper Pipe	$ 300,000	
			3rd Floor	New Copper Pipe	$ 300,000	
2024 - 2028	Fire Protection	Throughout	Entire Building	Automated Sprinkler		$ 1,400,000
				TOTALS:	**$ 2,457,500**	**$ 1,400,000**

Total MEP Cost Estimates

The table below shows the total estimated replacement costs for each discipline as if they were implemented on the first recommended replacement timeframe year. For example, equipment that was recommended for replacement from 2019 to 2020 would have only the 2019 inflated cost shown.

Category	Recommended Replacement Timeframe	Equipment Type	2019 Cost	2020 Cost	2021 Cost	2024 Cost
Mechanical	2019 - 2020	Air Handlers	$ 8,515,000			
	2024 - 2028	Unit Vents				$ 2,200,000
	2024 - 2028	Exhaust Fans				$ 266,000
	2021 - 2023	Pumps			$ 66,000	
Electrical	2021 - 2023	Unit Substation Replacement			$ 874,182	
	2021 - 2023	Distribution Panelboard Replacement			$ 196,691	
	2019	Thermal Inspections	$ 25,000			
	2021 - 2023	Arc Flash Study			$ 26,523	
	2019	Switch Exercise & Other Preventative Maintenance	$ 10,000			
	2019 thru 2021	LED Lighting & Controls	$ 1,600,000	$ 1,648,000	$ 1,697,440	
Plumbing	Health Life Safety (ASAP)	Thermostatic Mixing Valves (TMV)	$ 32,000			
		Failed Vacuum Breaker	$ 500			
	2019 - 2020	Domestic Cold/Hot Water Distribution and Circulation	$ 175,000			
			$ 150,000			
			$ 1,500,000			
			$ 300,000			
			$ 300,000			
	2024 - 2028	Fire Protection				$ 1,400,000
		TOTALS:	**$ 12,607,500**	**$ 1,648,000**	**$ 2,860,836**	**$ 2,466,000**
		$ 19,582,336				

Equipment Type	Equipment Tag	Service	Approximate Unit Age as of 2018 (Years)	ASHRAE Median Service Life (Years)
Space Heating Hot Water Boilers	B-1 to B-4	Whole Building	1	15
Domestic Hot Water Boilers		Whole Building	1	10
Chillers	CH-1 "York"	Whole Building	3	20
	CH-2 "Carrier"	Whole Building	20	20
Pumps	YRK-CHWP-1	York Chllr. & Bldg. Loop	3	25
	YRK-CHWP-2	York Chllr. & Bldg. Loop	3	25
	YRK-CWP-1	Cooling Tower	3	25
	YRK-CWP-2	Cooling Tower	3	25
	CHP1	Carrier Chllr. & Bldg. Loop	20	25
	CHP2	Carrier Chllr. & Bldg. Loop	20	25
	CP-1	Cooling Tower	20	25
	CP-2	Cooling Tower	20	25
	BWP-S1	Primary Boiler Loop	1	25
	BWP-S2	Primary Boiler Loop	1	25
	BWP-S3	Primary Boiler Loop	1	25
	BWP-S4	Primary Boiler Loop	1	25
	HWP-S1	Secondary Heating Loop	1	25
	HWP-S2	Secondary Heating Loop	1	25
	HWP-S3	Secondary Heating Loop	1	25
Air Handling Units	AHU-A	C-South	54	37
	AHU-B	C-South	54	37
	AHU-C	C-North	54	37
	AHU-D	C-North	54	37
	AHU-E	Auditorium	54	30
	AHU-F	Auditorium Lobby and Stage	54	30
	AHU-G	Auditorium S. Classrooms and Backstage	54	30
	AHU-H	Auditorium N. Classrooms	54	30
	AHU-J	Pool	54	30
	AHU-K	Small Gym	54	30
	AHU-L	Dance Gym	54	30
	AHU-M	M-Wing	54	30
	AHU-N	Kitchen	54	30
	AHU-V	Spec Gym	54	25
	AHU-W	Spec Gym	54	25
	AHU-X	Spec Gym	54	25
	AHU-BB	Cafeteria	50	30
	A-Wing	Garage and Storage	50	25
Roof Top Units	RT-2	Staff Lounge & Dining Area	4	15
	RT-3	Food Lab V117 & V118	4	15
	RT-4	Offices V115, V116, & V119	4	15
	RT-5	V113, V114 & Office	4	15
	RT-6	V112	4	15
	RT-7	V111	4	15
	RT-8	V109 & V110	4	15
	RT-9	Rms. V106 to V108	4	15
	RT-10	Rms. V122 & V123	4	15
	RT-11	Rm. V130	4	15
	RT-12	Rm. V131 & Adjacent Offices	4	15
	RT-13	Fitness Center & Adjacent Offices	4	15
	RT-14	Girl's Locker Rm.	4	15
	RT-15	Girl's Locker Rm.	4	15
	RT-16	Team/Visitor Locker Rms.	4	15
	RT-1S	Classrooms V124 to V127	5	15
	RTU-S1	Fieldhouse	1	15
	RTU-S2	Fieldhouse	1	15
	RTU-S3	Fieldhouse	1	15
	RTU-S4	Fieldhouse	1	15
Unit Ventilators	A-Wing Uvs	A-Wing	21	20