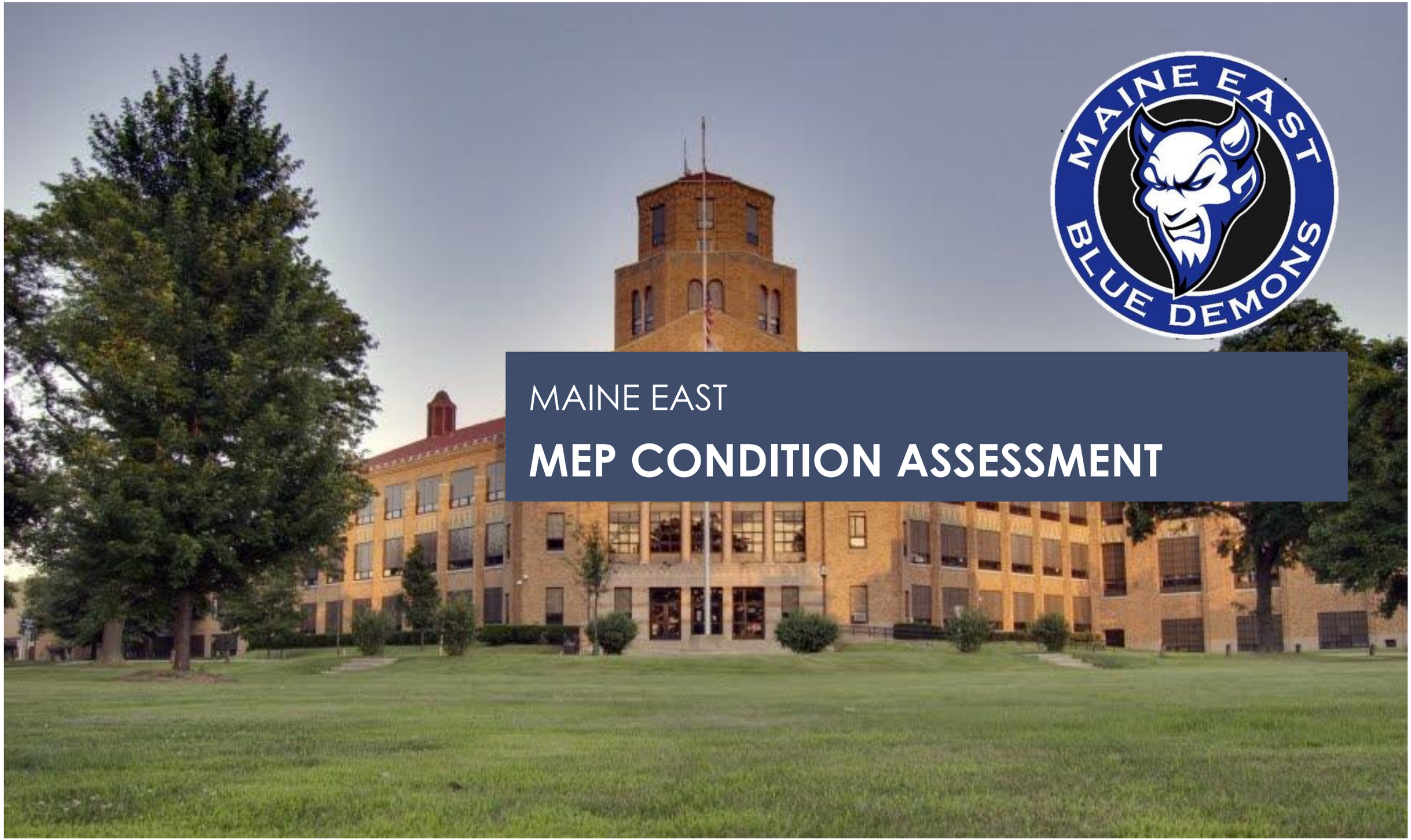


MAINE EAST

MEP CONDITION ASSESSMENT

MAINE EAST HIGH SCHOOL

This report section includes an overview of the existing mechanical cooling and heating systems serving Maine East High School. The sections will include: building cooling plant, building heating plant, mechanical ventilation systems, unit ventilators, roof top units and recommendations for replacement of these mechanical systems.

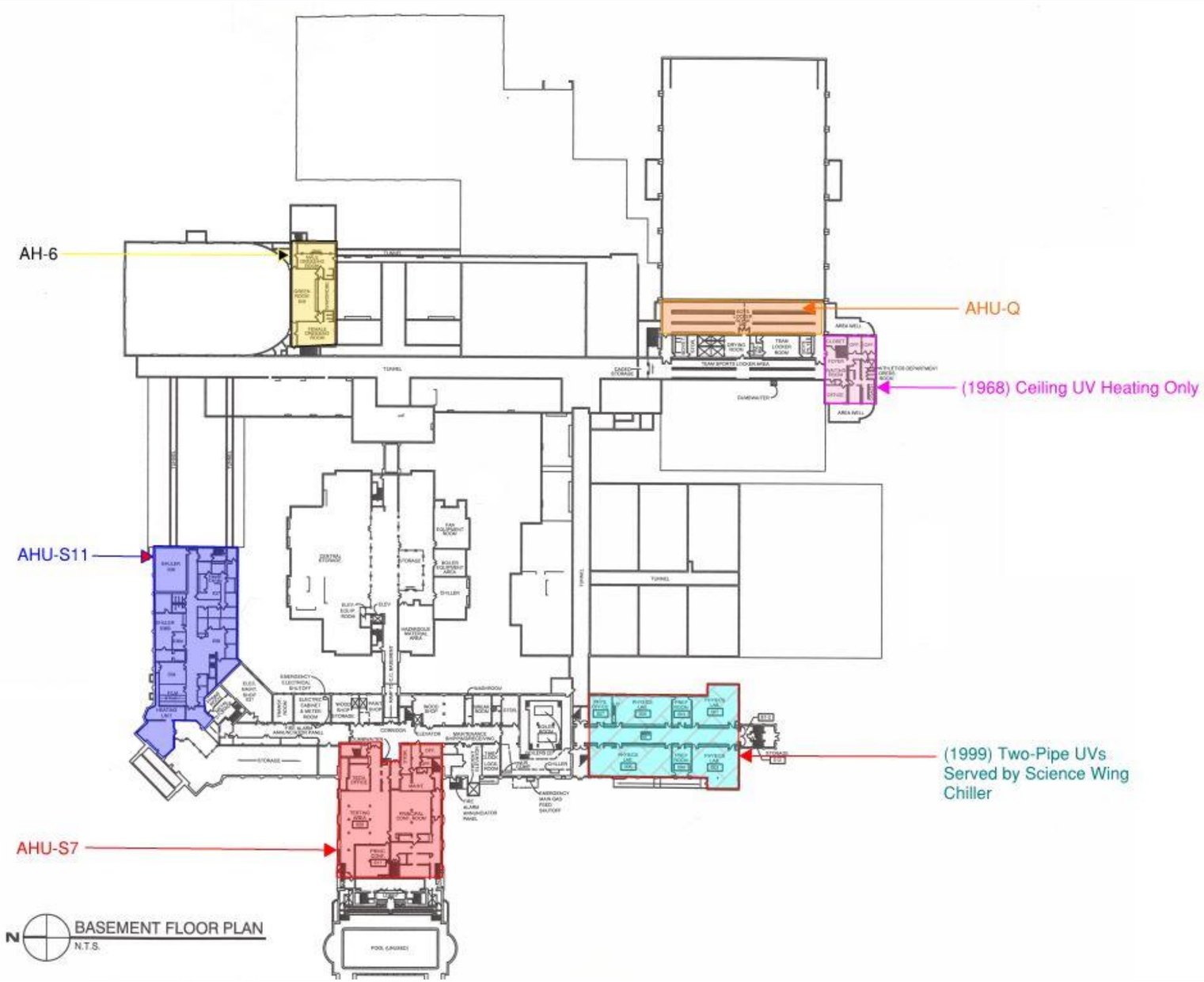
The system replacement recommendation(s) follow each equipment's existing conditions description. To determine the recommendations, our experience with similar systems and the ASHRAE median service life tables were utilized. Estimated equipment service life, according to the 2015 American Society of 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 four (4) maps. The maps display an overview of all the mechanical ventilation systems at Maine East. These systems will be discussed in further detail throughout the report.

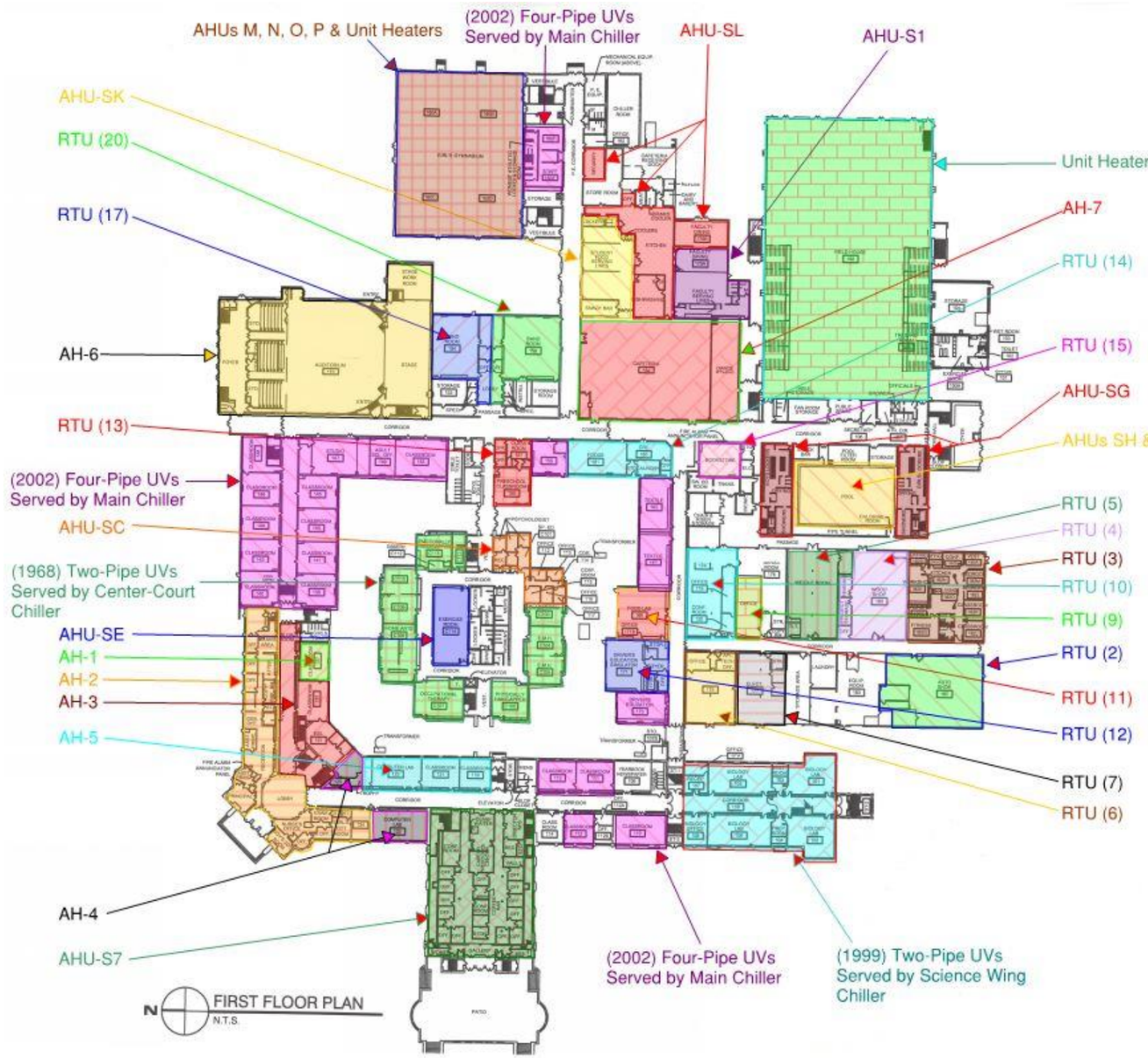
MAINE EAST – MECHANICAL VENTILATION OVERVIEW



Mechanical Assessment

HVAC Overview

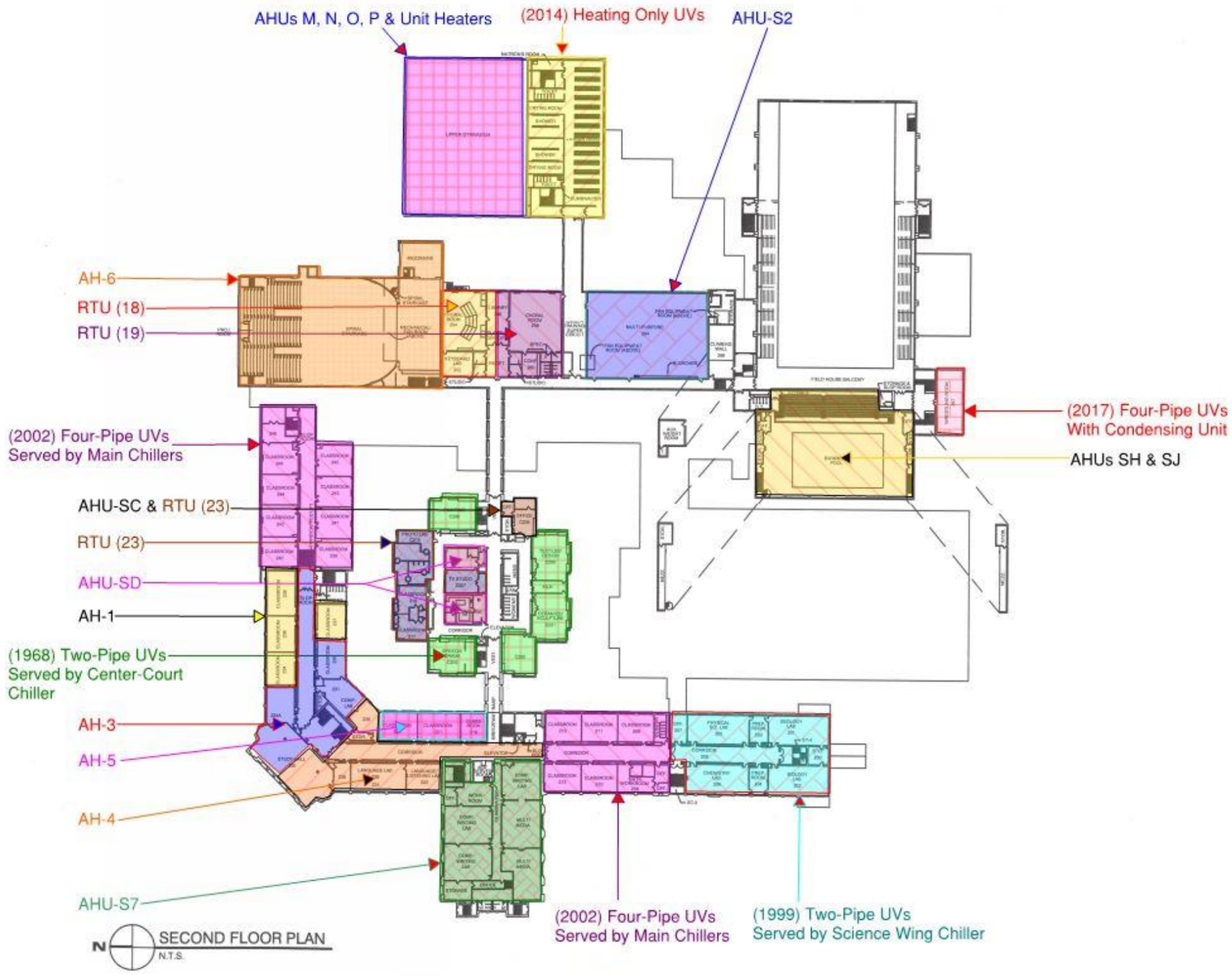
MAINE EAST – MECHANICAL VENTILATION OVERVIEW



Mechanical Assessment

HVAC Overview

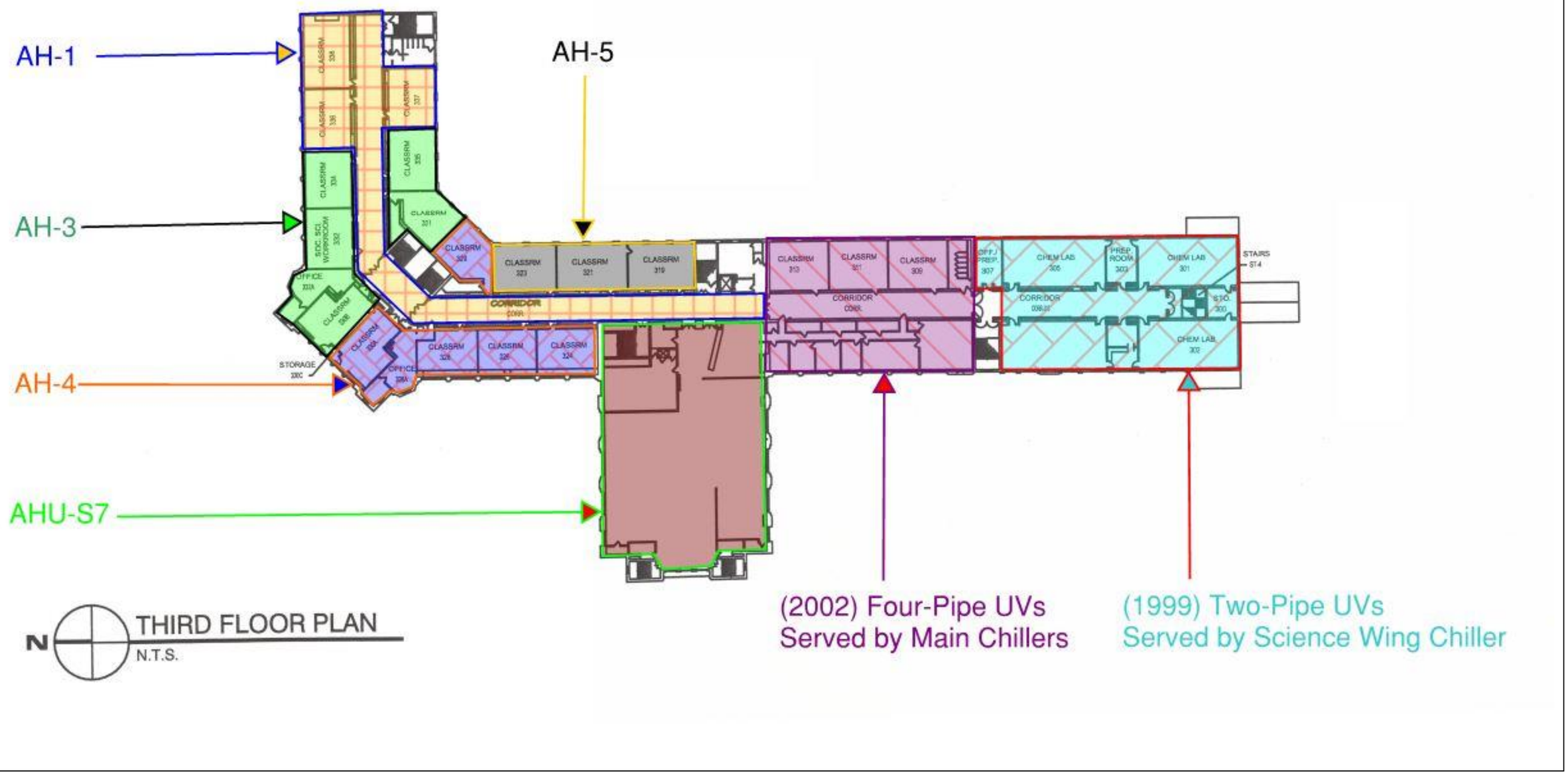
MAINE EAST – MECHANICAL VENTILATION OVERVIEW



Mechanical Assessment

HVAC Overview

MAINE EAST – MECHANICAL VENTILATION OVERVIEW



Mechanical Assessment

HVAC Overview

Building Cooling Plants

Space cooling for Maine East is provided by three (3) separate chilled water plants. The chillers are in three (3) separate mechanical rooms, and serve multiple two or four-pipe unit ventilators (UVs) as well as air handling units (AHUs) throughout the building.

SCIENCE WING CHILLED WATER PLANT

The first chilled water plant is equipped with one (1) 180-ton natural gas fired absorption chiller located in the basement boiler room and is commonly referred to as the "Science Wing Chiller." This plant serves the basement and all three floors of the Science Wing. The Science wing was renovated in 1999 and the associated pumps were also installed in 1999. The picture on the right shows the location of the chiller and the area it serves.

Water is circulated throughout the science wing by two (2) constant speed "Bell & Gossett" dual temperature pumps, also located in the boiler room. Each pump is rated for 15 HP, 75 ft. of head, and 438.5 GPM of flow. Hot water for the science wing dual temperature system is provided via one (1) "Bell & Gossett" steam-to-hot water shell and tube heat exchanger (HX located near the science wing chiller. Heat exchangers and the building heating plant will be discussed in further detail in the building heating section.

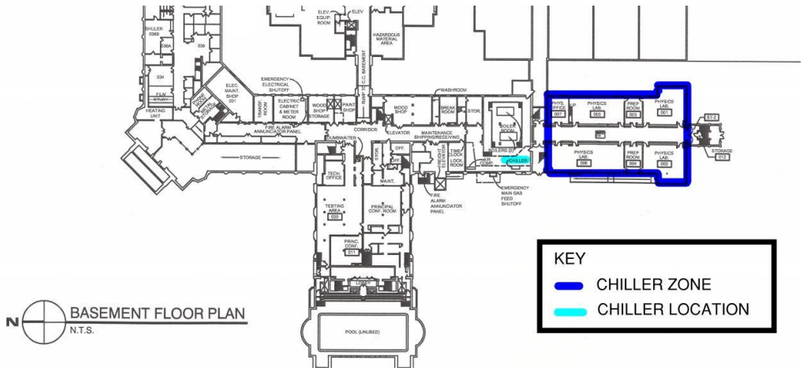
Heat rejection is provided by one (1) single cell "Marley" cooling tower, located on the industrial arts building roof. It is equipped with one (1) two-speed direct drive tower fan rated for 15 HP. Flow through the tower is provided by one (1) constant speed "Bell & Gossett" base-mounted condenser water pump rated for 25 HP, 80 ft. of head, and 762 GPM of flow.

Table 1: Science Wing Pumps

Tag	Service	Location	Pump Motor HP	Pump Feet of Head	Supply GPM	Fluid Medium
P-1	Science Wing	Science Chiller Rm.	15	75	438.5	Hot Water & Chilled Water
P-2	Science Wing	Science Chiller Rm.	15	75	438.5	Hot Water & Chilled Water
P-3	Science Wing Cooling Tower	Science Chiller Rm.	25	80	762	Condenser Water

It should be noted that a separate study evaluating the chilled water plants serving Maine East High School is currently underway. The study includes evaluation of the feasibility for interconnection of all (3) chilled water plants and the elimination of the center court chiller plant. For further details please reference this Maine East Chilled Water Study.

Science Wing Chiller Location & Zone



Science Wing Chiller

CENTER COURT CHILLED WATER PLANT

The second chilled water plant is equipped with one (1) “Trane” 250-ton steam driven absorption chiller, referred to as the “Center Court Chiller.” The center court building was constructed in 1969, and the chiller was later installed in 1995. Heat rejection for the center court chiller is provided by one (1) two-speed “Marley” single-cell cooling tower located on the center-court building roof. This plant serves the center court classroom two-pipe unit ventilators, finned tube radiators, two (2) AHUs located in the center court basement, and one (1) AHU located in the attic above the Learning Resource Center (LRC). The picture on the right provides the location of the steam boiler plant, the chiller, as well as the chillers’ zones of service.

There are six (6) total pumps located in the center court basement mechanical room and listed in the following table below. The first two (2) “Bell & Gossett” pumps were installed in approximately 1968 and serve hot water to the center court finned tube radiators. The next two (2) “Bell & Gossett” pumps were also installed in approximately 1968 and serve hot water and chilled water to the center court two-pipe unit ventilators. The fifth “Baldor” pump circulates chilled water throughout the chiller and the sixth is a 15 HP condenser water pump which serves the center court cooling tower. Both the chilled water and condenser water pumps were installed in 1995.

Table 2: Center Court Pumps

Tag*	Service	Location	Pump Motor HP	Pump Feet of Head	Supply GPM	Fluid Medium
P-FT1	Center Court FTRs	Center Court Mech. Rm.	3	57	62	Hot Water
P-FT2	Center Court FTRs	Center Court Mech. Rm.	3	57	62	Hot Water
P-UV1	Center Court UVs	Center Court Mech. Rm.	7.5	70	215	Hot Water & Chilled Water
P-UV2	Center Court UVs	Center Court Mech. Rm.	7.5	70	215	Hot Water & Chilled Water
P-CHW	Center Court Chiller	Center Court Mech. Rm.	15	-	-	Chilled Water
P-CW	Center Court Cooling Tower	Center Court Mech. Rm.	15	-	-	Condenser Water

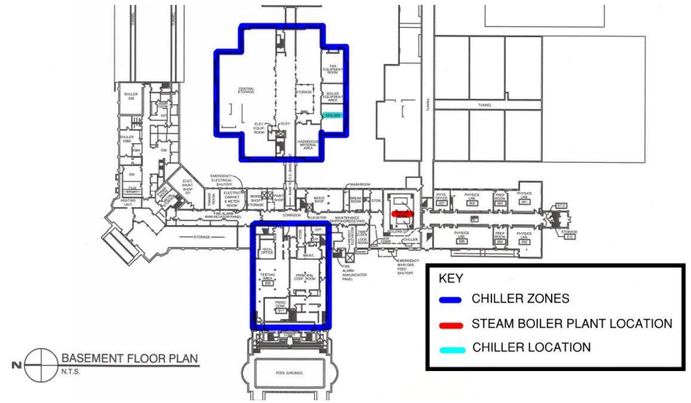
**Note no pump tag name was found, so tags were assigned to each pump.*

It should be noted that a separate study evaluating the chilled water plants serving Maine East High School is currently underway. The study includes evaluation of the feasibility for interconnection of all (3) chilled water plants and the elimination of the center court chiller plant. For further details please reference this Maine East Chilled Water Study.

1 TO 2 YEAR RECOMMENDATION

The four (4) “Bell & Gossett” pumps that serve the FTRs and UVs have been in operation since approximately 1968. They are in poor condition due to age and their reliability is diminishing. It is recommended to replace these pumps with a like for like replacement. Please reference the Pump Cost Estimates section for additional details.

Center Court Chiller Location and Zone



Center Court Chiller

Mechanical Assessment

HVAC Overview

MAIN CHILLED WATER PLANT

The third and final chilled water plant is equipped with two (2) 400-ton natural gas fired absorption chillers, known as "The Main Chillers." They are in the chiller room on the 1st floor and were installed in 2003. The associated pumping and cooling tower equipment was also installed in 2003. Equipment served includes six (6) AHUs and classroom four-pipe UVs located throughout the building. Note the highlighted picture to the right for the chillers location and areas served by these chillers.

This system utilizes a "primary-secondary" chilled water loop. The "primary" chilled water loop utilizes two (2) constant flow "Bell & Gossett" pumps, one (1) for each chiller. These pumps circulate water through their respective chiller and are each rated for 10 HP, 25 ft. of head and 922 GPM.

Chilled water is circulated throughout the "secondary" loop, by two (2) variable flow "Bell & Gossett" pumps that are each rated for 25 HP, 70 ft. of head, and 1060 GPM of flow. The secondary loop supplies chilled water to the areas highlighted in the photo on the right.

Heat rejection for the chillers is provided by two (2) "Evapco" cooling towers located on the roof. Flow through the towers is provided by two (2) constant flow "Bell & Gossett" condenser water pumps that are each rated for 40 HP, 60 ft. of head, and 950 GPM of flow.

Table 3: Main Chillers' Pumps

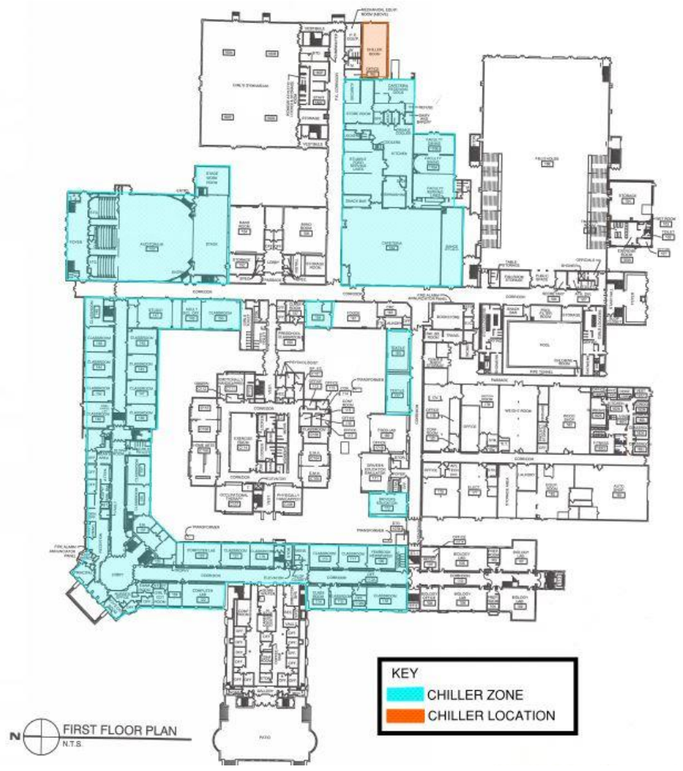
Tag	Service	Location	Pump Motor HP	Pump Feet of Head	Supply GPM	Fluid Medium
P-CH1	Primary CHW Loop	Chiller Rm.	10	25	922	Chilled Water
P-CH2	Primary CHW Loop	Chiller Rm.	10	25	922	Chilled Water
P-1	Secondary CHW Loop	Chiller Rm.	25	70	1060	Chilled Water
P-2	Secondary CHW Loop	Chiller Rm.	25	70	1060	Chilled Water
P-CT1	Cooling Tower	Chiller Rm.	40	60	950	Condenser Water
P-CT2	Cooling Tower	Chiller Rm.	40	60	950	Condenser Water

It should be noted that a separate study evaluating the chilled water plants serving Maine East High School is currently underway. The study includes evaluation of the feasibility for interconnection of all (3) chilled water plants and the elimination of the center court chiller plant. For further details please reference this Maine East Chilled Water Study.

1 TO 2 YEAR RECOMMENDATION

Based on conversations with maintenance staff the two (2) 3-way condenser water valves serving these chillers do not function properly. Please reference the Cost Estimates section for additional details.

Main Chilled Water Plant and Zones



Main Chillers

Mechanical Assessment

HVAC Overview

Building Heating Plant

Heating for the building is provided by one (1) steam boiler plant that consists of two (2) "Bryan" natural gas fired steam boilers located in the building's basement boiler room, note the picture on the right for location. Both boilers are equipped with "Gordon-Piatt Winfield" Burners that are each rated for a maximum firing rate of 21,000 MBH and a total minimum firing rate of 5,250 MBH. The boilers were installed in 2003 and serve the entire building's heating equipment, excluding areas served by gas-fired rooftop units (RTUs) which will be discussed in further detail within the mechanical ventilation section. The boilers provide steam to the center court steam absorption chiller, a domestic hot water heater, five (5) AHUs, unit heaters, and seven (7) steam-to-hot water heat exchangers. The heat exchangers provide heating hot water to the school's unit ventilators, air handling units, and unit heaters.

Steam is supplied to seven (7) heat exchangers that provide heating hot water to UVs, AHUs and cabinet heaters located throughout the building. The following table displays additional information regarding the heat exchangers.

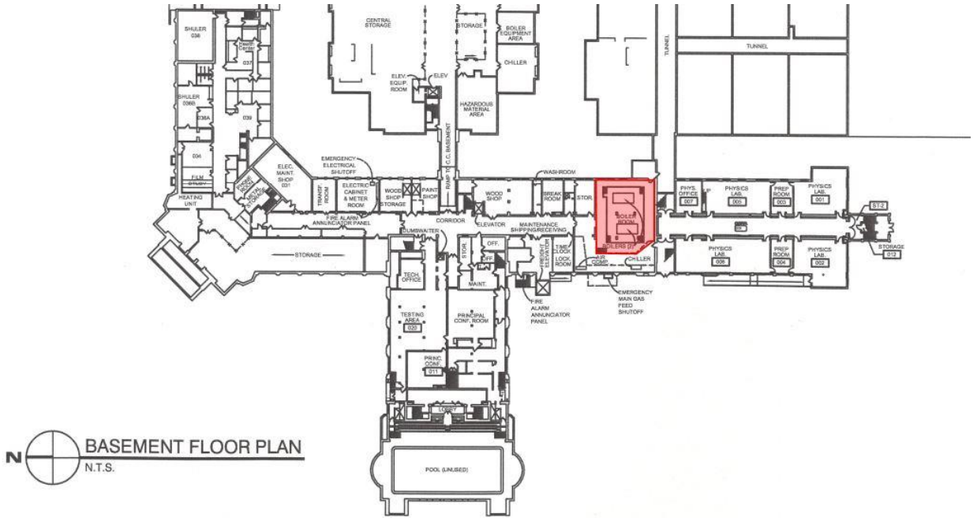
Table 4: Heat Exchanger Details

Tag	Area Served	Location	Age
*LRC-HX1	LRC AHU	LRC Attic	1968
*LRC-HX2	LRC Fin Tube Radiators	LRC Attic	1968
*CC-HX1	Center Court UVs	Center Court Mech Rm.	1968
*CC-HX2	Center Court Fin Tube Radiators	Center Court Mech Rm.	1968
*SW-HX	Science Wing UVs	Boiler Room	1999
HX-1	Remainder of UVs and AHUs	Attic	2002
HX-2	Remainder of UVs and AHUs	Attic	2002

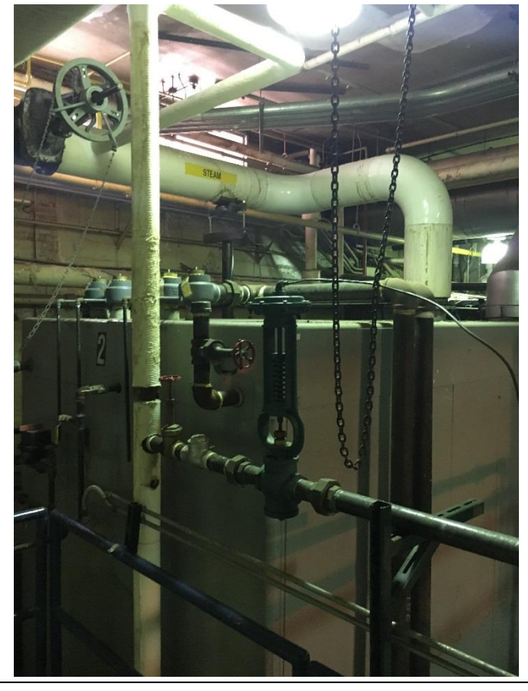
**Note no tag name was found, so tags were assigned to the associated HX.*

No alterations are recommended for the boiler equipment and heat exchangers within the scope of this report.

Boiler Plant Location



"Bryan" Steam Boiler



Mechanical Assessment

HVAC Overview

Mechanical Ventilation Systems

Ventilation for Maine East High School is provided by twenty-four (24) air handling units (AHUs), eighteen (18) roof top units (RTUs), and unit ventilators (UVs) located in most classrooms. Air is exhausted by exhaust fans located throughout the building.

AIR HANDLING UNITS

AHU-S11 is a variable volume air handling unit installed in 2014. The unit is equipped with a direct expansion (DX) cooling coil with an associated remote outdoor condensing unit for cooling and a steam coil for heating. This AHU serves the highlighted portion of the basement classrooms pictured right. AHU-S11 has a separate supply and return fan, and each are equipped with a variable frequency drive (VFD) for variable operation. Although, AHU-S11 was installed in 2014 the existing return fan was retrofitted for use with the new AHU. It was reported that this return fan has been in operation since approximately the 1950s. AHU-S11 operates utilizing demand controlled ventilation with CO2 sensors that respond based on the ventilation load needed in any given spaces. The following table provides a summary of AHU-S11.

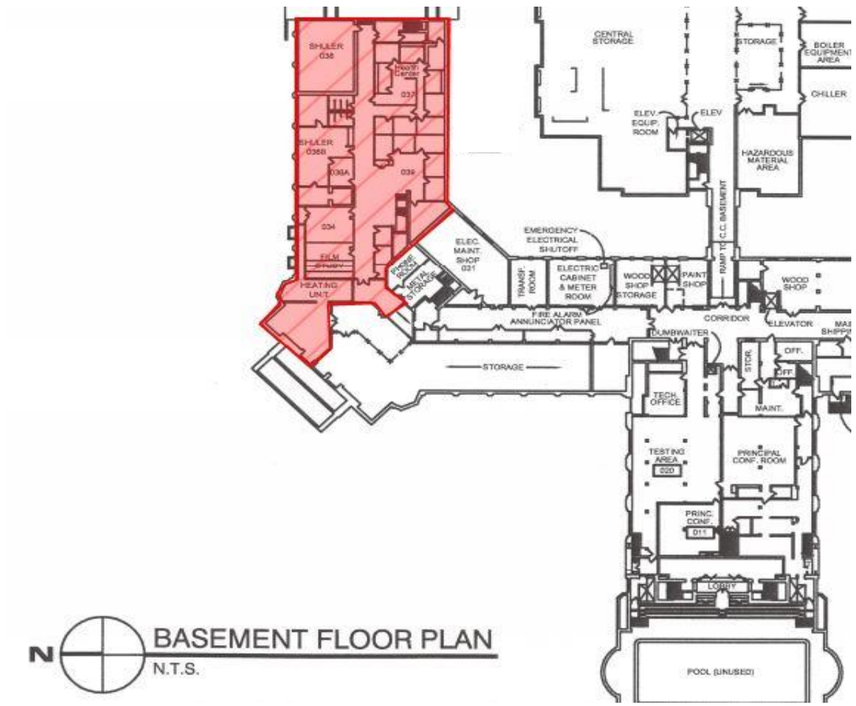
Table 5: AHU-S11

Tag	Area Served	Location	Supply CFM	Supply Fan HP	Cooling Medium	Heating Medium
AH-S11	North Basement Area	Basement	8,000	7.5	DX	Steam

1 TO 2 YEAR RECOMMENDATION

No alterations are recommended for AHU-S11; however, it is recommended to replace the associated return fan as it is significantly aged beyond its ASHRAE median service life of 25 years. Please reference the Exhaust/Return Fan Cost Estimates section for related pricing information.

AHU-S11 Zone



AH-1 to AH-5 serves the basement and floors one through three of the highlighted zone on the right, minus the zone of AHU-S11 discussed on the previous page. These units are all constant volume multi-zone units located in the fourth-floor attic and were installed in 2002. AH-2 utilizes a direct expansion (DX) cooling coil equipped with a remote outdoor condensing unit. The remaining (4) AHUs are equipped with chilled water coils and are supplied chilled water via the main chilled water plant. All (5) units have pre-heat and re-heat coils that are served hot water via the two (2) HXs located in the same attic space. In addition, each AHU is equipped with a supply and return fan. The table below provides a summary of the AHUs described above.

Table 6: AHUs 1-5

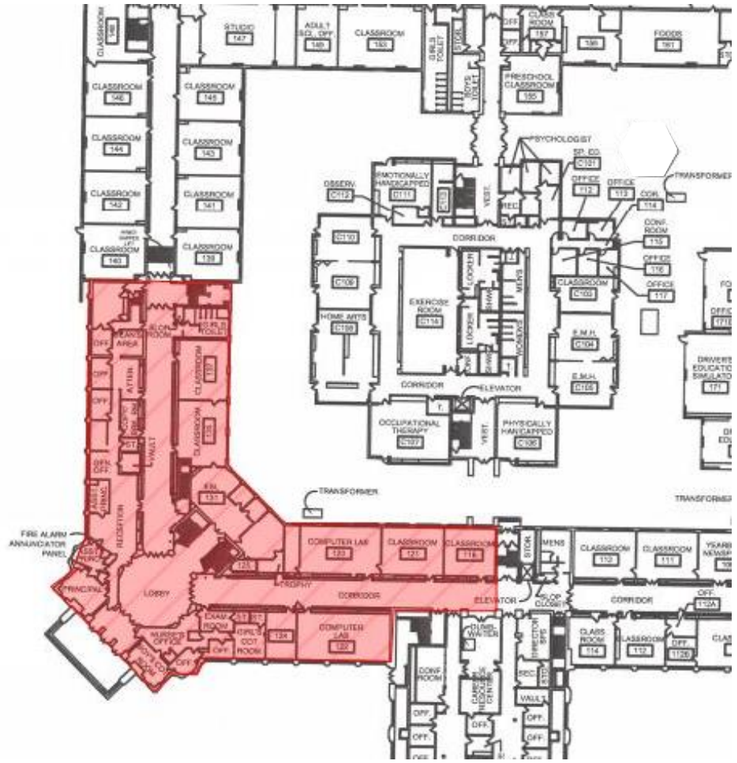
Tag	Area Served	Location	Supply CFM	Supply Fan HP	Cooling Medium	Heating Medium
AH-1	8 Zones: 238, 336/337, 338, Cor. 3, 137, 237, 234, 236	Attic	9,500	10	Chilled Water	Hot Water
AH-2	6 Zones: 124A, AD.W, AD.C, AD.NE, AD.SE, Store	Attic	6,000	7.5	DX	Hot Water
AH-3	12 Zones: 331, Cor. 2, 330A, 230, 231, 332, 135, 234A, 335, 235, 131, COR 1 & 334	Attic	12,400	20	Chilled Water	Hot Water
AH-4	11 Zones: 330B, 230A, 122, Cor. 2, 328, 222, 324, 326, 226, 129 & 229 & 329, 224	Attic	14,400	20	Chilled Water	Hot Water
AH-5	9 Zones: 119, 319, 219, 323, 123, 223, 321, 121, 221 & Cor. 3	Attic	12,400	20	Chilled Water	Hot Water

6 TO 10 YEAR RECOMMENDATION

Multi-zone 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. In addition, these units are constant flow which is significantly less efficient when compared to variable volume.

It is recommended to install variable frequency drives (VFDs) on the supply/return fans. The supply fans would serve new Terminal boxes equipped with hot water reheat coils. This recommendation is not pressing since these units were installed in 2002; however, it would result in long term energy savings. Additionally, fan motor life is extended because a fan motor with a 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 section for pricing details.

AH-1 to AH-5 Zone



Mechanical Assessment

HVAC Overview

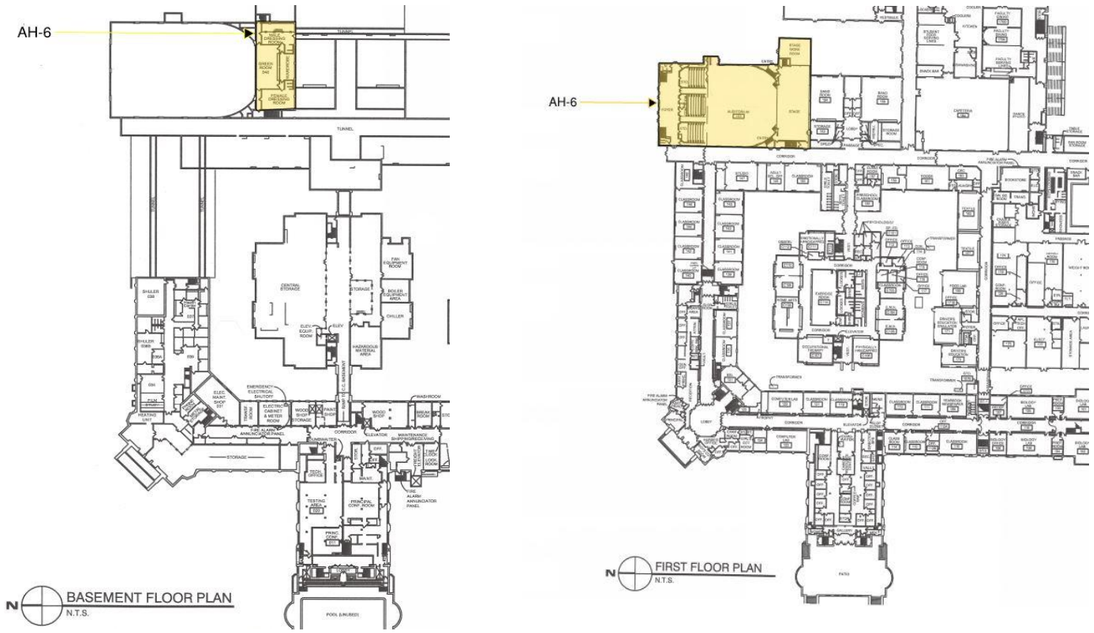
AH-6 serves the auditorium and basement dressing rooms with variable air volume supply and is equipped with a separately mounted variable volume return fan. This unit is equipped with a steam heating coil and chilled water cooling coil. It is located in the mechanical space above the auditorium. AH-7 is also a variable volume AHU that is equipped with a separately mounted variable volume return fan. AH-7 serves the cafeteria and dance studio and is equipped with a chilled water coil and steam heating coil. Both units are provided chilled water via the main chilled water plant and were installed in 2002.

Table 7: AH-6 & AH-7

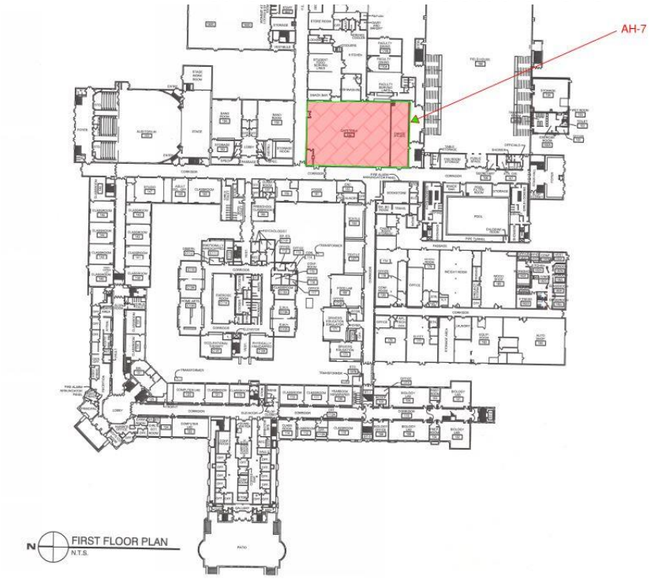
Tag	Area Served	Location	Supply CFM	Supply Fan HP	Cooling Medium	Heating Medium
AH-6	Auditorium and Dressing Rooms	2nd Floor Auditorium	54,000	60	Chilled Water	Steam
AH-7	Cafeteria and Dance Studio	2nd Floor Fan Room	29,000	30	Chilled Water	Steam

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

AH-6: Auditorium Zones



AH-7: Cafeteria and Dance Studio Zone



AHU-S1 is a constant volume AHU equipped with a DX cooling coil and an associated roof mounted condensing unit. Heating is provided by duct mounted steam coils. AHU-S1 delivers conditioned air to the faculty dining area; note the graphic on the right for AHU-S1's zone. AHU-S2 is a constant volume AHU that utilizes steam heating coils. AHU-S2 serves the multi-purpose room and is not equipped with any cooling equipment. AHU-S2 is equipped with a separate mounted return fan that recently had its motor replaced. Both units were installed in 1951 and are furnished with pneumatic controls. The following table below summarizes AHUs S1 and S2.

Table 8: AHU-S1 & AHU-S2

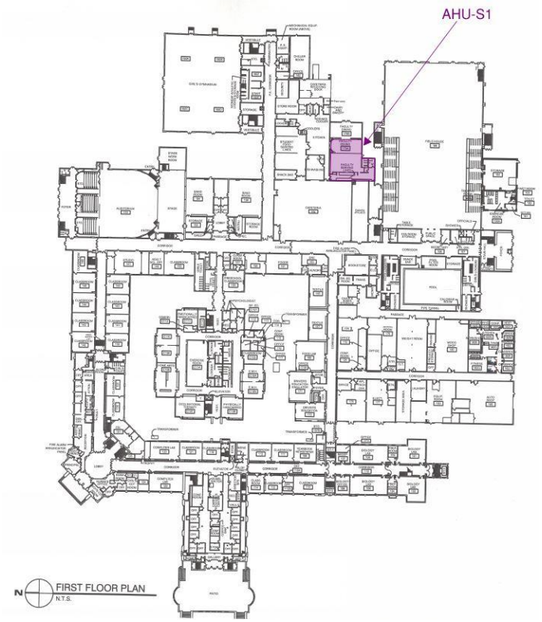
Tag	Area Served	Location	Supply CFM	Supply Fan HP	Cooling Medium	Heating Medium
AHU-S1	Faculty Dining	2nd Floor Fan Equipment Room	13,620	5	DX	Steam
AHU-S2	Multi-Purpose Room	2nd Floor Fan Equipment Room	19,700	5	None	Steam

1 TO 2 YEAR RECOMMENDATION

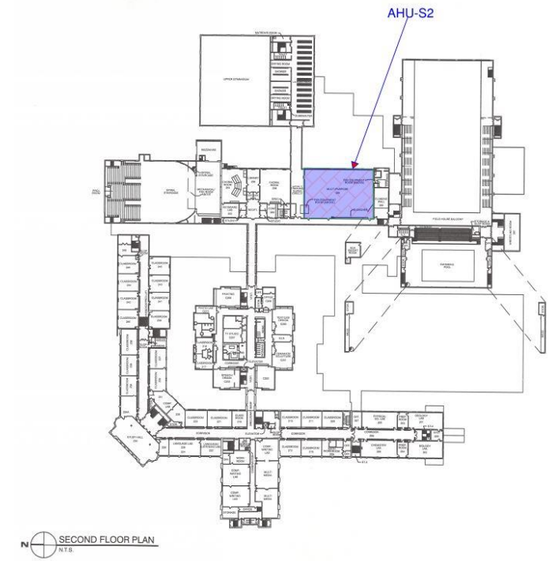
Faculty Dining AHU-S1 and Multi-Purpose AHU-S2 have been in operation since 1951. These AHUs are substantially aged, and have surpassed their ASHRAE median service life of thirty (30) years. Additionally, constant volume, systems are considerably less energy efficient than today's technology.

It is recommended to upgrade the AHUs referenced above with new AHUs that are variable volume supply/return and equipped with chilled water coils, either steam or hot water coils, and direct digital control (DDC) capabilities. Further investigation would be required to determine if steam or hot water coils are more cost effective. A variable volume system upgrade operates based on the demand of the spaces; when demand is low, the supply fan reduces its speed, which results in significant energy savings both from the perspective of fan energy as well as heating and cooling energy. DDC technologies offer precise unit control, and constant unit monitoring to notify of issues or recommended preventative maintenance procedures. Implementing DDC can provide increased system efficiencies and optimal comfort control. Additionally, fan motor life is extended when equipped with a VFD. Please reference the AHU Cost Estimates section for pricing details.

AHU-S1: Faculty Dining Zone



AHU-S2: Multi-Purpose Zone



AH-S7 is a constant volume multi-zone AHU that serves the entire Learning Resource Center (LRC) occupying the basement through third floor (pictured right). AHU-S7 is equipped with a chilled cooling coil and hot water heating coil. AH-S7 is located on the 4th floor attic. S7 was installed in 1968 and utilizes an "Andover" pneumatic control system which is in a limited operating state due to its age and condition. AHU-S7 is served chilled water from the center-court chiller. AHU S-38 also installed in 1968 once served the basement pool area, but is no longer in operation. The following table summarizes the AHUs described above:

Table 9: AHU S-7 & AHU S-38

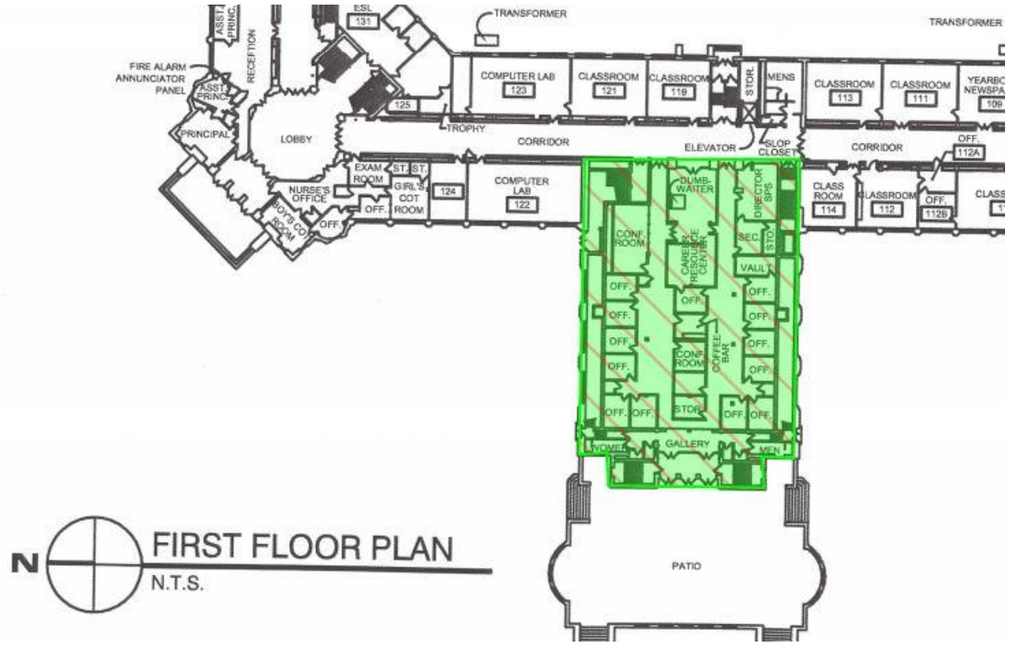
Tag	Area Served	Location	Supply CFM	Supply Fan HP	Cooling Medium	Heating Medium
AH-S7	Basement to 3rd Floor of LRC	Upper Attic	40,370	25	Chilled Water	Hot Water
AH-S38	Basement Pool Area (No Longer Operating)	Upper Attic	9,400	5	None	Hot Water

1 TO 2 YEAR RECOMMENDATION

AHU-S7 has been in operation since 1968. This AHU is reportedly limited in use due to its aged pneumatic control system and has condensation leaking issues. According to ASHRAE, the median service life of an AHU of this type is thirty (30) years. This unit is well past its useful life and because of its aged characteristics, and poor controllability, this unit falls in the 1 to 2-year recommendation for replacement category.

It is recommended to upgrade this AHU with a new variable volume AHU that is equipped with chilled water coils, hot water coils and DDC. With the transition to variable flow, and new unit technologies of DDC capabilities, considerable energy savings, reliability and comfort improvements would be achieved. Please reference the AHU Cost Estimates section for pricing details.

AH-S7: Learning Resource Center Zone



There are three (3) constant volume AHUs located in the basement fan room of the center court building. All units were installed in 1968. AHU-SC and AHU-SE are equipped with chilled water coils and AHU-SD is equipped with an associated remote condensing unit located on the center court roof. All three (3) units are equipped with heating hot water coils. The center court chilled water plant provides chilled water to these units and the two (2) center court heat exchangers provide hot water to their coils. All three (3) AHUs are equipped with pneumatic controls and each have separate return fans. AHU-SE serves only the exercise room, while multi-zone unit AHU-SC serves various office spaces. Multi-zone unit AHU-SD serves the TV studio, and computer labs located on the first and second floors of the center court building. Further details on the center-court AHUs are provided in the table below and graphics on the right.

Table 10: AHU-SC, AHU-SD, AHU-SE

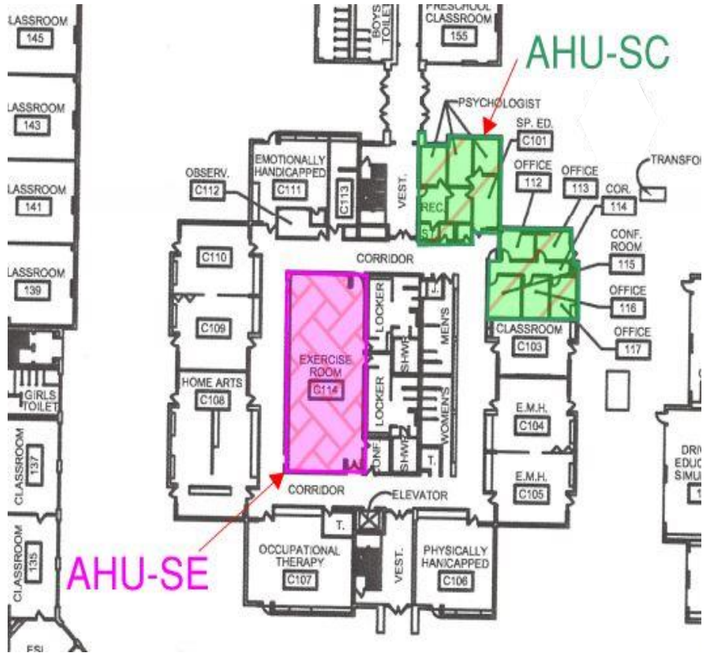
Tag	Area Served	Location	Supply CFM	Supply Fan HP	Cooling Medium	Heating Medium
AHU-SC	Psychologist and Rms. C112 to C117	Basement Fan Equipment Rm.	2,480	2	Chilled Water	Hot Water
AHU-SD	TV Studio & Computer Lab	Basement Fan Equipment Rm.	6,635	5	DX	Hot Water
AHU-SE	Exercise Room	Basement Fan Equipment Rm.	1,650	1	Chilled Water	Hot Water

1 TO 2 YEAR RECOMMENDATION

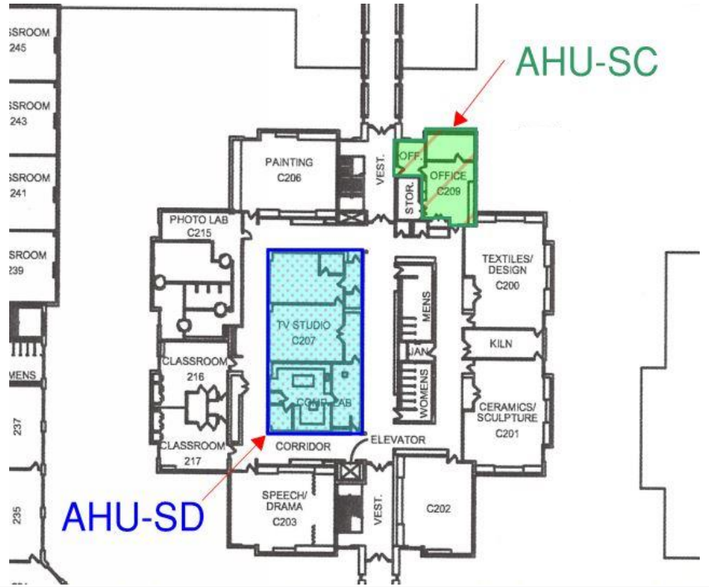
The three (3) center court AHUs have been in operation since 1968. The ASHRAE tables display a median service life for AHUs of this type to be thirty (30) years. Due to their diminishing reliability due to age, these units are recommended for replacement within the next 1 to 2 years.

It is recommended to upgrade each of these AHUs with new variable volume AHUs that are equipped with chilled water coils, hot water coils and DDC interconnectivity. With the transition to variable flow, and DDC capabilities, considerable energy savings, reliability and comfort improvements would be achieved. Please reference the AHU Cost Estimates section for pricing details.

AHUs SC & SE: Center Court AHUs - 1st Floor Zone



AHUs SC & SD: Center-Court AHUs - 2nd Floor



AHU-SG is a constant volume heating only AHU that resides below the pool. This unit is equipped with a hot water heating coil, and provides 4,765 CFM of 100% outdoor air to the pool locker rooms. The pool area is served by two (2) constant volume AHUs (AHU-SH and AHU-SJ) that are each equipped with hot water coils. These AHUs provide 17,090 CFM of ventilated air to the pool area and utilize face and bypass dampers. All three (3) of these units utilize pneumatic controls and were installed in 1968. The following table below provides a summary of the pool equipment.

Table 11: AHU-SG, AHU-SH, AHU-SJ

Tag	Area Served	Location	SUPPLY CFM	Supply Fan HP	Cooling Medium	Heating Medium
AHU-SG	Pool Locker Rooms	Under Pool Bleachers	4,765	3	None	HW
AHU-SH	Pool	Pool Equipment Room	9,550	5	None	HW
AHU-SJ	Pool	Pool Equipment Room	7,540	3	None	HW

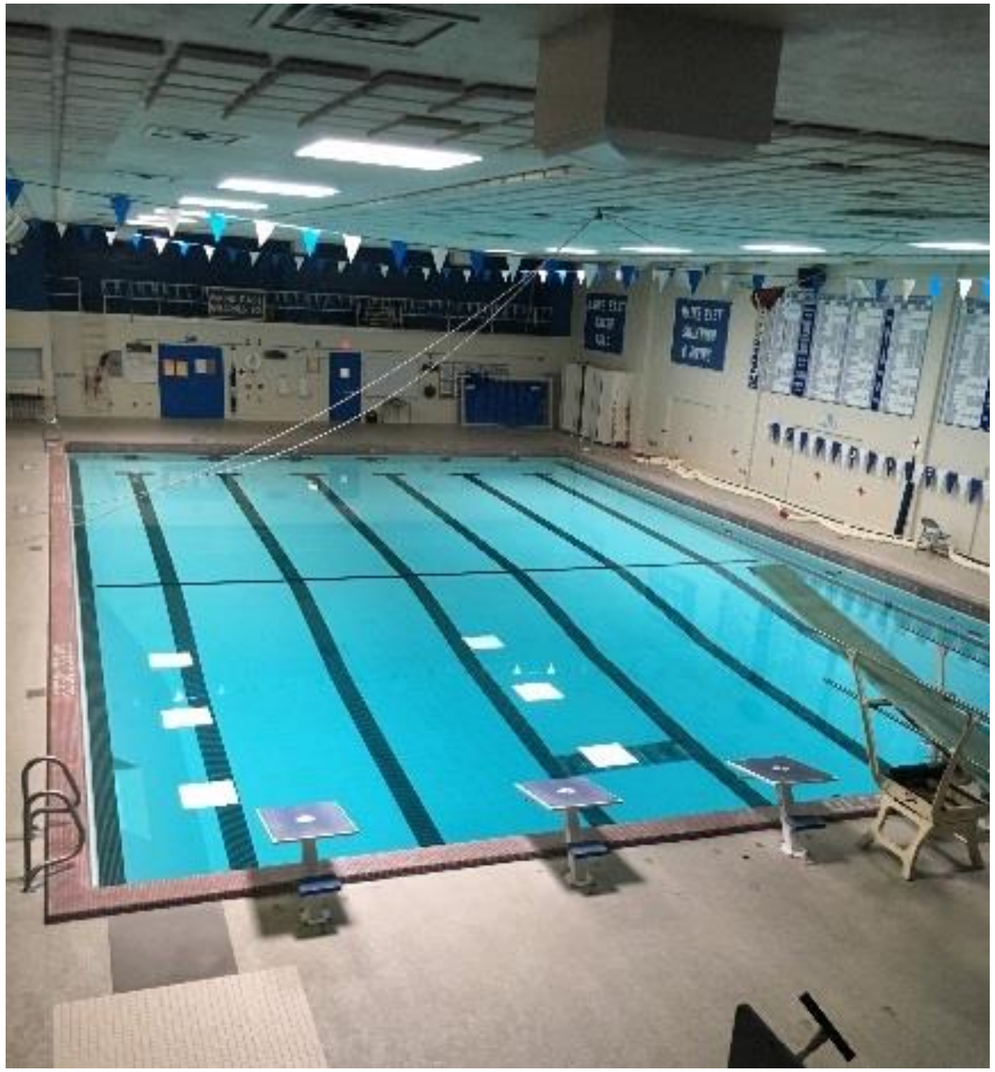
1 TO 2 YEAR RECOMMENDATION

The pool units, AHU SH and SJ, are incapable of providing any dehumidification to the pool area since they do not have any means of cooling. These AHUs are also significantly aged and have far exceeded the ASHRAE median equipment service life of thirty (30) years.

It is recommended to replace units AHU-SH and AHU-SJ with new pool dehumidification units capable of variable flow operation, and equipped with DDC controls. The advantages of a new pool dehumidification unit include providing cool dry air during the summer and warm dry air during the winter. These new pool units would eliminate excess humidity in the pool air and improve occupant comfort.

For pool locker room AHU-SG, it is recommended to upgrade this unit to a variable volume AHU equipped with a hot water coil, cooling capabilities, and DDC controls. This new unit would provide ample comfort improvements and long-term energy efficiency benefits. Please reference the AHU Cost Estimates section for pricing details.

AHUs SH & SJ: Pool Units



The back of house kitchen areas are served by two (2) constant volume AHUs that were installed in 1968. The picture on the right displays the spaces served by each AHU. AHU-SK is equipped with a direct expansion (DX) cooling coil with an associated remote outdoor condensing unit. AHU-SL is heating only. Both units have hot water heating coils, pneumatic controls and are located in the mechanical room adjacent to the chiller room. The following table below summarizes AHUs SK and SL.

Table 12: AHU-SK & AHU-SL

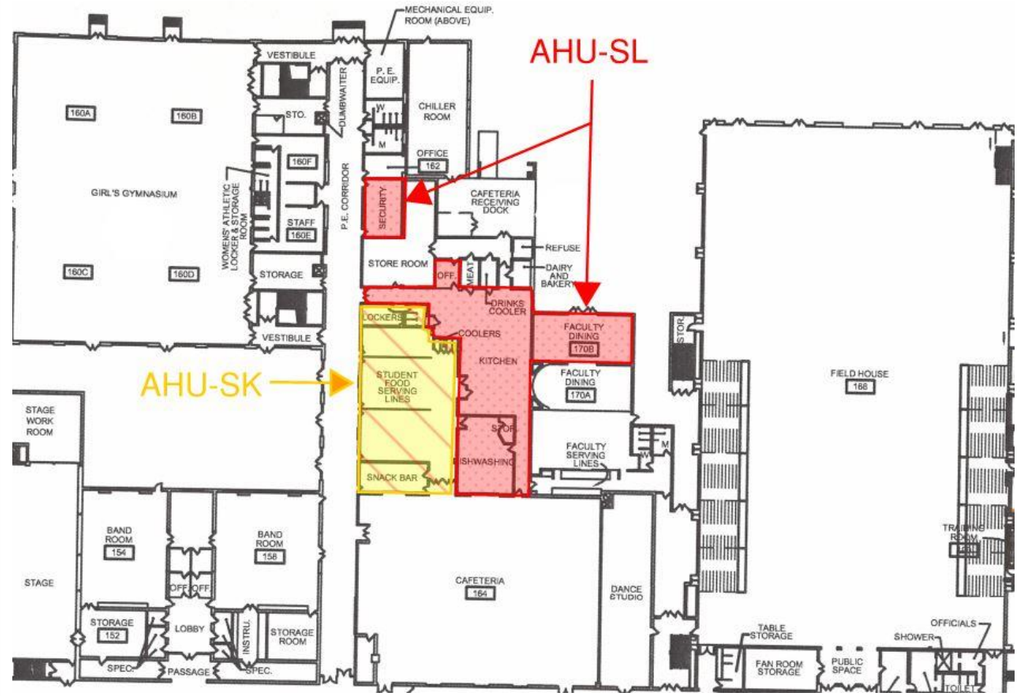
Tag	Area Served	Location	SUPPLY CFM	Supply Fan HP	Cooling Medium	Heating Medium
AHU-SK	Kitchen/Serving Lines	P.E. Equipment Room	3,850	3	DX	HW
AHU-SL	Security/Back of Lounge	P.E. Equipment Room	10,000	5	None	HW

1 TO 2 YEAR RECOMMENDATION

AHU-SK and AHU-SL have been operating since 1968. The ASHRAE tables display a median service life for AHUs of these types to be thirty (30) years. These units have exceeded their ASHRAE defined median equipment service life and are recommended for replacement due to their age and their diminishing reliability.

It is recommended to upgrade each of these AHUs with new variable volume AHUs equipped with chilled water coils, hot water coils and DDC capabilities. The benefits of variable flow, and modern unit technologies would provide considerable energy savings, equipment reliability and comfort improvements. Please reference the AHU Cost Estimates section for pricing details.

AHU-SK & SL: Kitchen Area and Back of Lounge Zones



The girl's gymnasium is provided ventilation via four (4) constant volume AHUs (AHU-SM, AHU-SN, AHU-SO, and AHU-SP) installed in 1968. These AHUs supply 100% outdoor air to the girl's gymnasium and are equipped with hot water heating only. Note the two (2) gymnasium AHUs pictured right. Examine the table below for a summary of the girl's gymnasium units.

Table 13: AHU-SM, AHU-SN, AHU-SO & AHU-SP

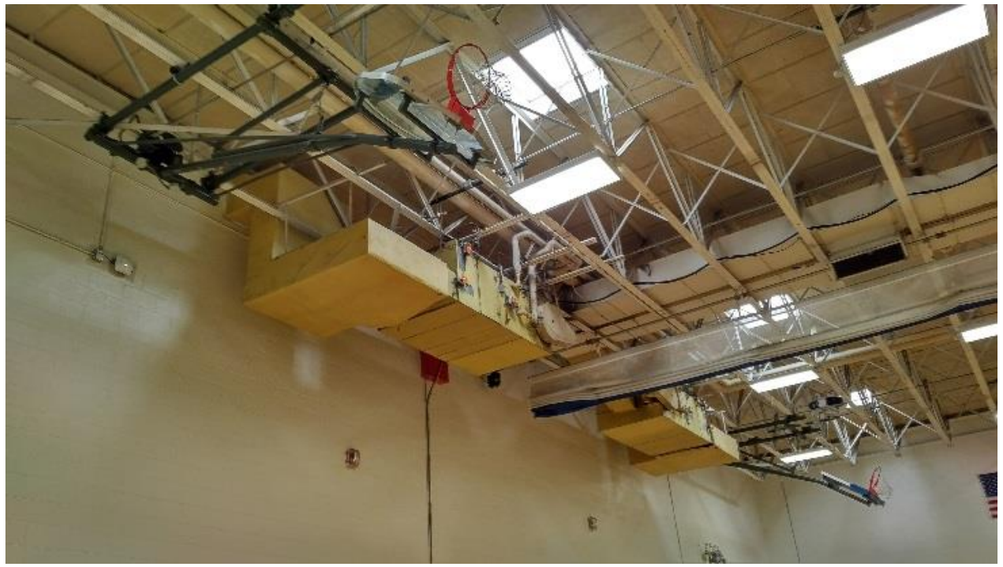
Tag	Area Served	Location	SUPPLY CFM	Supply Fan HP	Cooling Medium	Heating Medium
AHU-SM	Girl's Gymnasium	Girl's Gymnasium	4,000	1.5	None	HW
AHU-SN	Girl's Gymnasium	Girl's Gymnasium	4,000	1.5	None	HW
AHU-SO	Girl's Gymnasium	Girl's Gymnasium	4,000	1.5	None	HW
AHU-SP	Girl's Gymnasium	Girl's Gymnasium	4,000	1.5	None	HW

1 TO 2 YEAR RECOMMENDATION

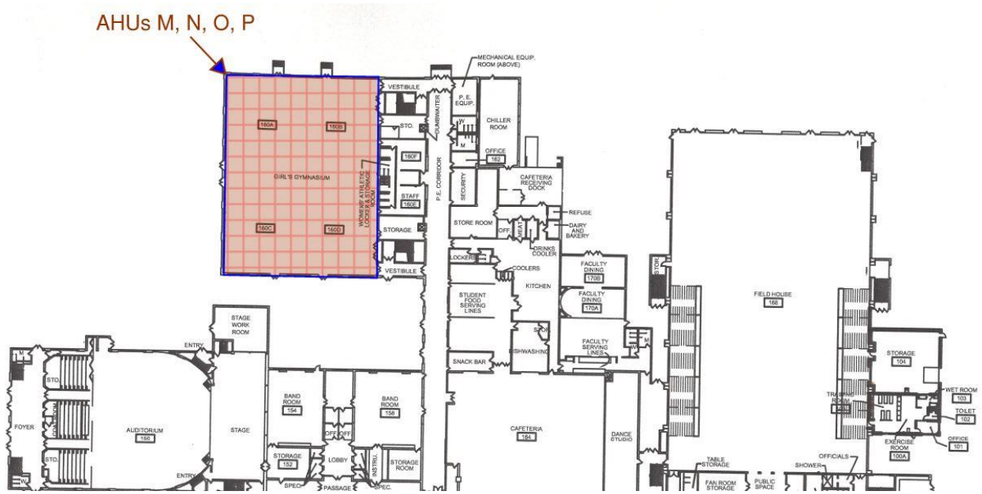
The girl's gymnasium AHUs have been in operation since 1968, and supply constant volume air with heating only. According to ASHRAE, the median service life of a packaged medium-duty air handling unit is 25 years. These units have exceeded their ASHRAE median equipment service life and are ceiling hung making them difficult to service.

It is recommended to update these units with more accessible, variable speed, packaged roof top units equipped with hot water or gas heating and cooling capabilities. Further investigation would be required to determine if steam or hot water coils are more cost effective. With the conversion to variable flow, roof-mounted, and cooling capable packaged RTUs, long-term savings and immediate comfort improvements would be achieved. Please reference the AHU Cost Estimates section for pricing details.

AHUs SM, SN, SO, & SP: Girl's Gymnasium Units



AHUs SM, SN, SO, & SP Zone



The basement boy's locker room is served by one (1) constant volume mixed air AHU that utilizes a steam heating coil. The unit has been in operation since 1968 and utilizes face and bypass dampers and provides heating only.

Table 14: Boy's Locker Room: AHU-S4

Tag	Area Served	Location	SUPPLY CFM	Supply Fan HP	Cooling Medium	Heating Medium
AHU-S4	Boy's Locker Room	Boy's Locker Room	3,000	1	None	Steam

1 TO 2 YEAR RECOMMENDATION

AHU-S4 was installed in 1968 and is in poor condition. The ASHRAE median service-life for a medium sized indoor AHU of this type is twenty-five (25) years.

It should be noted that a separate project to replace this AHU is scheduled to take place in summer of 2018. For further details please reference this project.

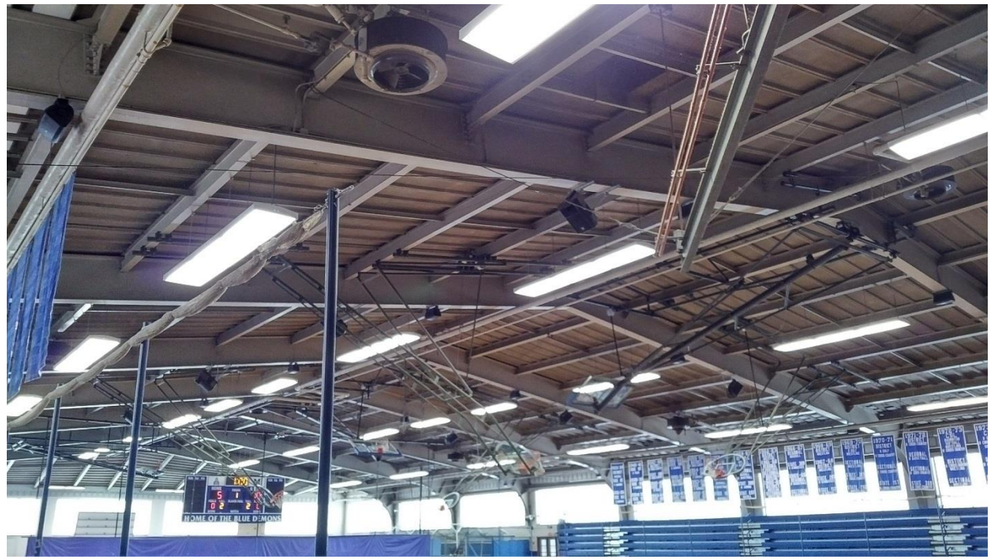
AHU-S4: Boy's Locker Room

The fieldhouse is heated by eleven (11) ceiling suspended steam unit heaters and there are six (6) ceiling mounted louvers that allow for fresh air infiltration. There is no means of cooling for the fieldhouse. Based on our observations, there appears to be a lack of adequate ventilation for this space given how many people may occupy it.

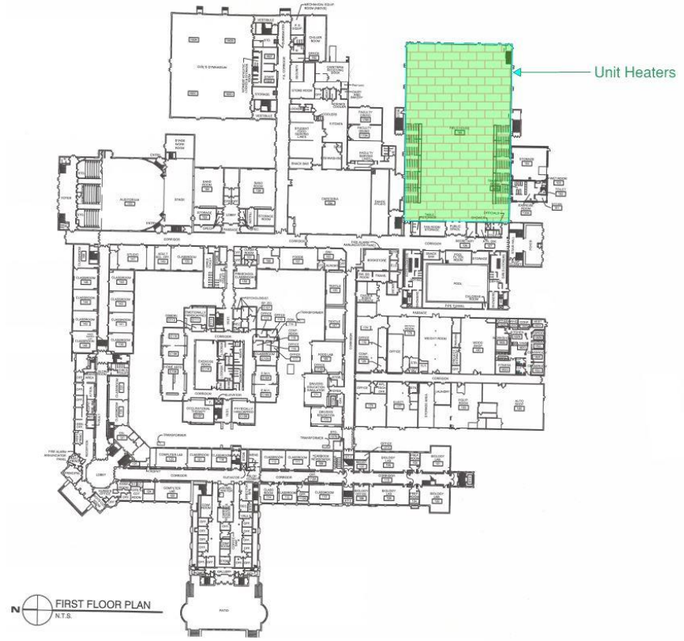
1 TO 2 YEAR RECOMMENDATION

It is recommended to equip the fieldhouse with either two (2) or four (4) variable volume packaged rooftop units that utilize DX cooling and gas heating. Immense comfort and ventilation improvements would be satisfied with this upgrade. Please reference the Roof Top Unit Cost Estimates section for pricing details.

Fieldhouse Unit Heaters



Fieldhouse Zone



Mechanical Assessment

HVAC Overview

Miscellaneous AHUs:

1. Copy Room AHU – This AHU is hung from the copy room ceiling and is thought to be from the 60s. It utilizes a DX cooling coil with an associated condensing unit on the roof to provide cooling only to this space. This AHU is aged beyond it's expected service life.
2. Boys' Team Sports Lower Level Locker Room AHU – This AHU is in the first-floor fan storage room adjacent to the fieldhouse and is believed to be from 1960s. It is equipped with a steam heating coil and serves the basement level boy's locker room. Elara is currently in the process of designing a replacement for this unit. Please refer to this project for further information.
3. Foyer AHU – This AHU is located in a closet adjacent to the foyer room on the south side of the building. This unit is equipped with a steam heating coil and a return fan. It is believed that this unit is from the 1960s.

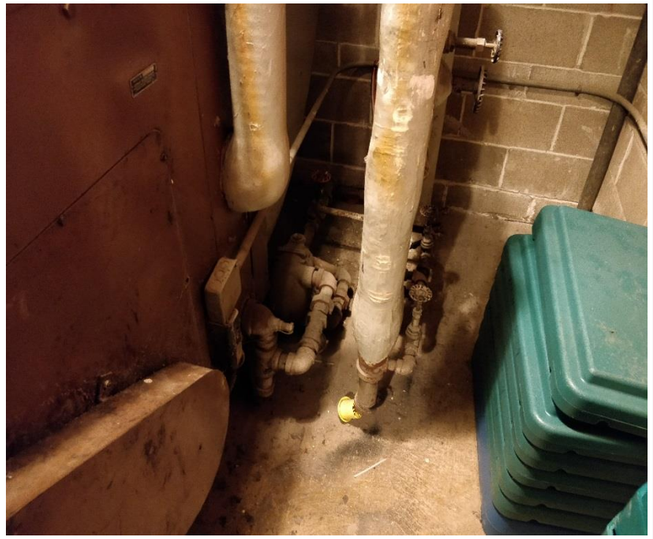
1 TO 2 YEAR RECOMMENDATIONS

Due to the aged condition of the Xerox Room AHU, it is recommended to replace it with a unit equipped with a DX cooling coil with an associated condensing unit and either steam, electric or hot water heating coil. Further evaluation would be required to determine which type of heating is most cost effective.

Due to the aged condition of the Foyer AHU, it is recommended to replace it with a unit equipped with chilled water coils or DX cooling and steam heating coils; further evaluation would be required to determine which type of cooling is most cost effective. This upgrade would provide an increase in reliability and occupant comfort as this unit currently does not provide cooling. Please refer to the AHU Cost Estimates section for pricing details.

1. Copy Room AHU

2. Boys' Team Sports Lower Level Locker Room



3. Foyer AHU

UNIT VENTILATORS

Many of the classrooms are served by two-pipe or four-pipe unit ventilator (UV) systems. The capacity of the UV varies depending on the size of the space served. The two-pipe UVs have one (1) supply pipe and one (1) return pipe and can only provide heating or cooling depending on the season. This type of two-pipe system is also referred to as a dual temperature system.

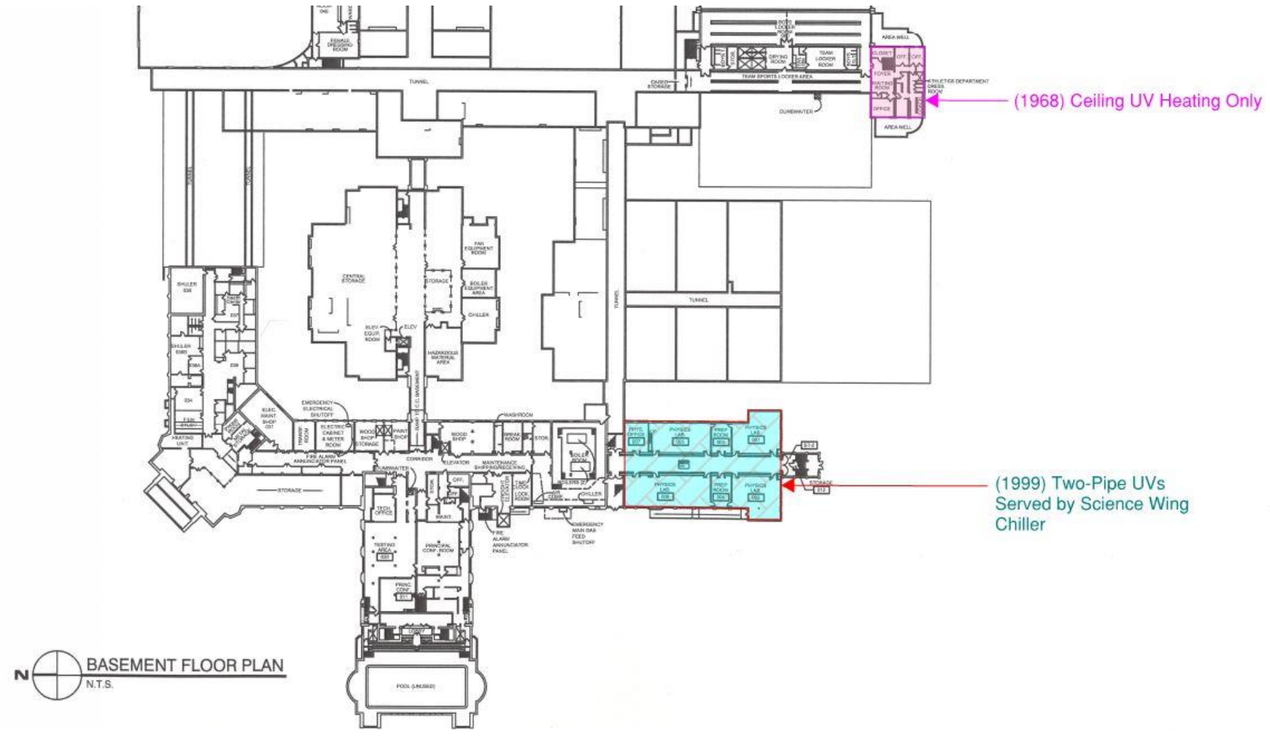
A four-pipe UV system has two (2) sets of supply and return pipes, two (2) supply/return pipes for heating, and two (2) supply/return pipes for cooling, for a total of four (4) pipes. This type of system is more flexible than the two-pipe system because it can provide heating or cooling regardless of season so long as the heating and cooling plants are running to provide hot and chilled water to their respective pipes. All UVs are served hot water via steam-to-hot water heat exchangers. The maps provided on the right and below indicate the locations where unit ventilators are utilized as well as the system type, and year of installation.

There are three (3) main varieties of UVs at Maine East. The first, and the oldest, are the Center Court UVs. These UVs are original to the Center Court addition from 1968 and are served chilled water from the Center Court chiller and steam from the main boiler plant that is converted to hot water via a HX located in the basement chiller room of the Center Court. These UVs utilize a two-pipe delivery system; therefore, this system lacks flexibility due to its ability to only provide either heating or cooling depending on the season. Examine the green highlighted zones in the following pictures for a view of the Center-Court UV zones.

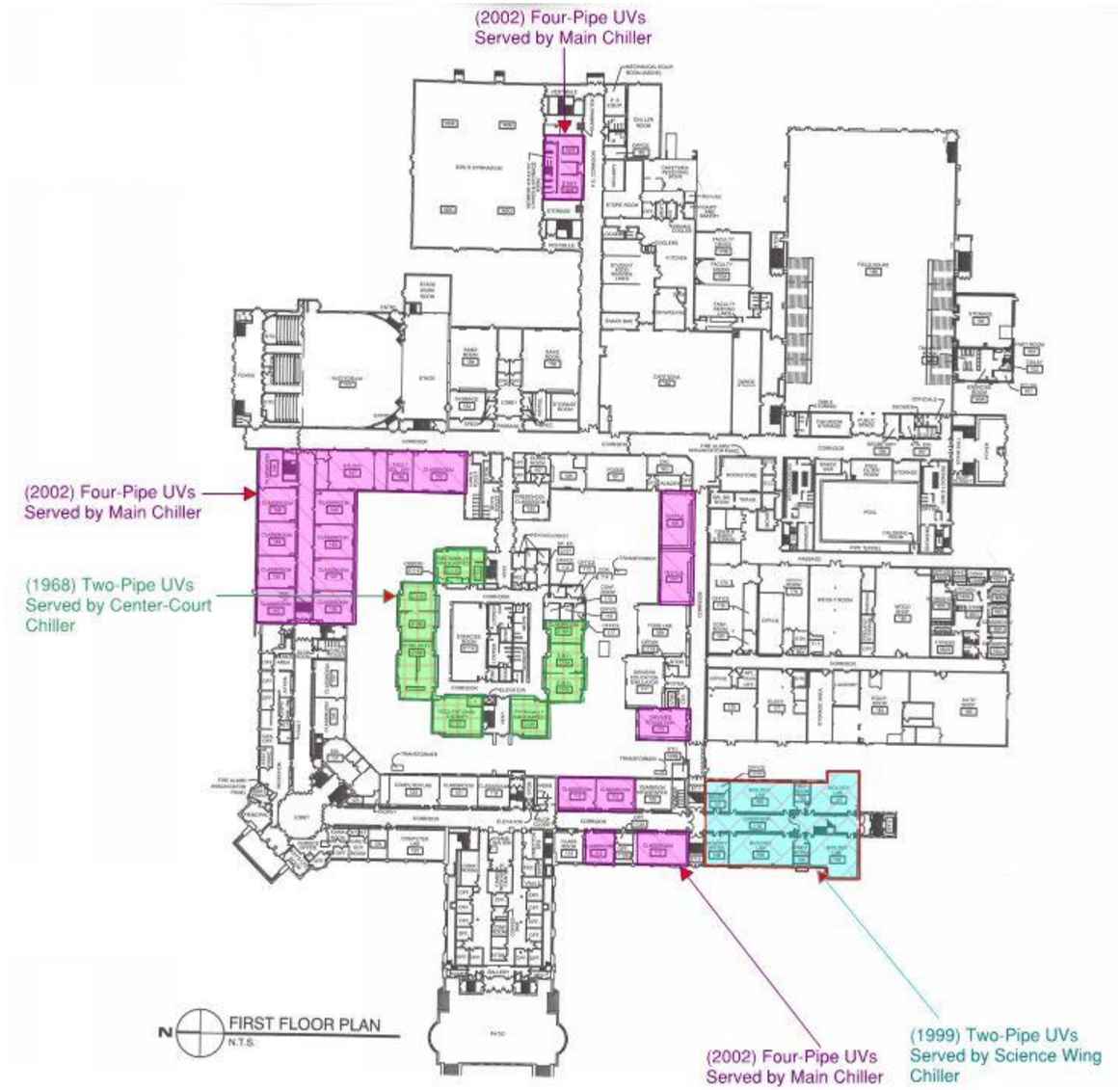
The second variety of UVs are in the basement through third floors of the Science Wing. These are two-pipe UVs that were installed in 1999 and are served chilled water via the Science Wing chilled water plant and hot water via a steam-to-hot water HX. The Science Wing UV zones can be viewed in the following pictures in the blue highlighted areas.

The final variety, and newest UVs, are four-pipe UVs installed in 2002. These UVs are served chilled water from the Main Chiller Plant and hot water via steam-to-hot water heat exchangers. The service zone for these UVs is indicated in purple and can be viewed on the following pages.

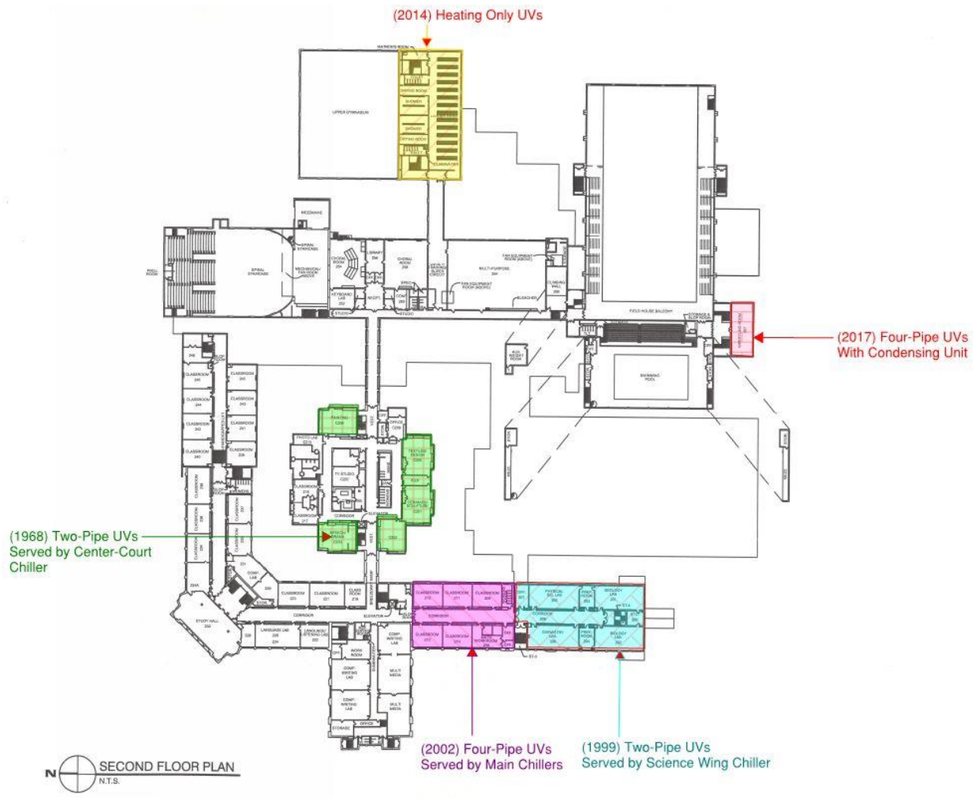
Basement Floor Unit Ventilators



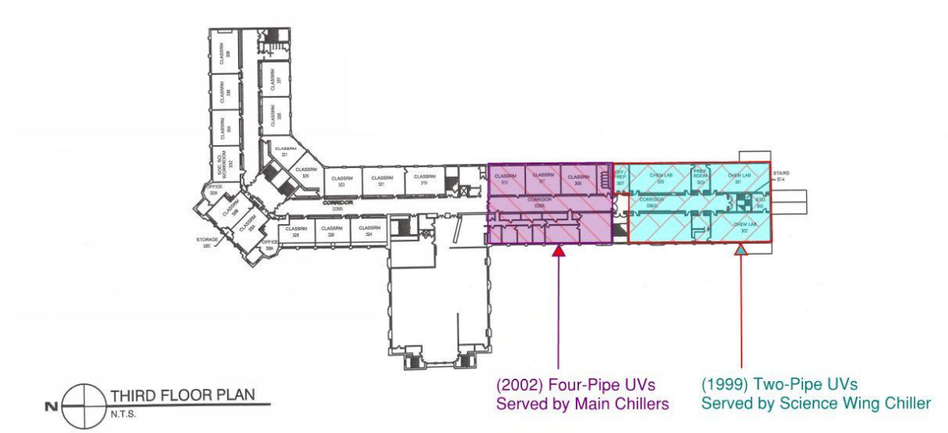
First Floor Unit Ventilators



Second Floor Unit Ventilators



Third Floor Unit Ventilators



Mechanical Assessment

HVAC Overview

1 TO 2 YEAR RECOMMENDATION

The Two-Pipe Center Court UVs were installed in 1968 and are original to the center court building. The ASHRAE median service life for a unit ventilator is thirty (30) years. The UVs have exceeded the median service life by twenty (20) years. It is recommended to replace them due to their aged condition.

There are two options 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 supply (DOAS) unit on the roof that serves local fan coil units equipped 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 for pricing details.

6 TO 10 YEAR RECOMMENDATIONS

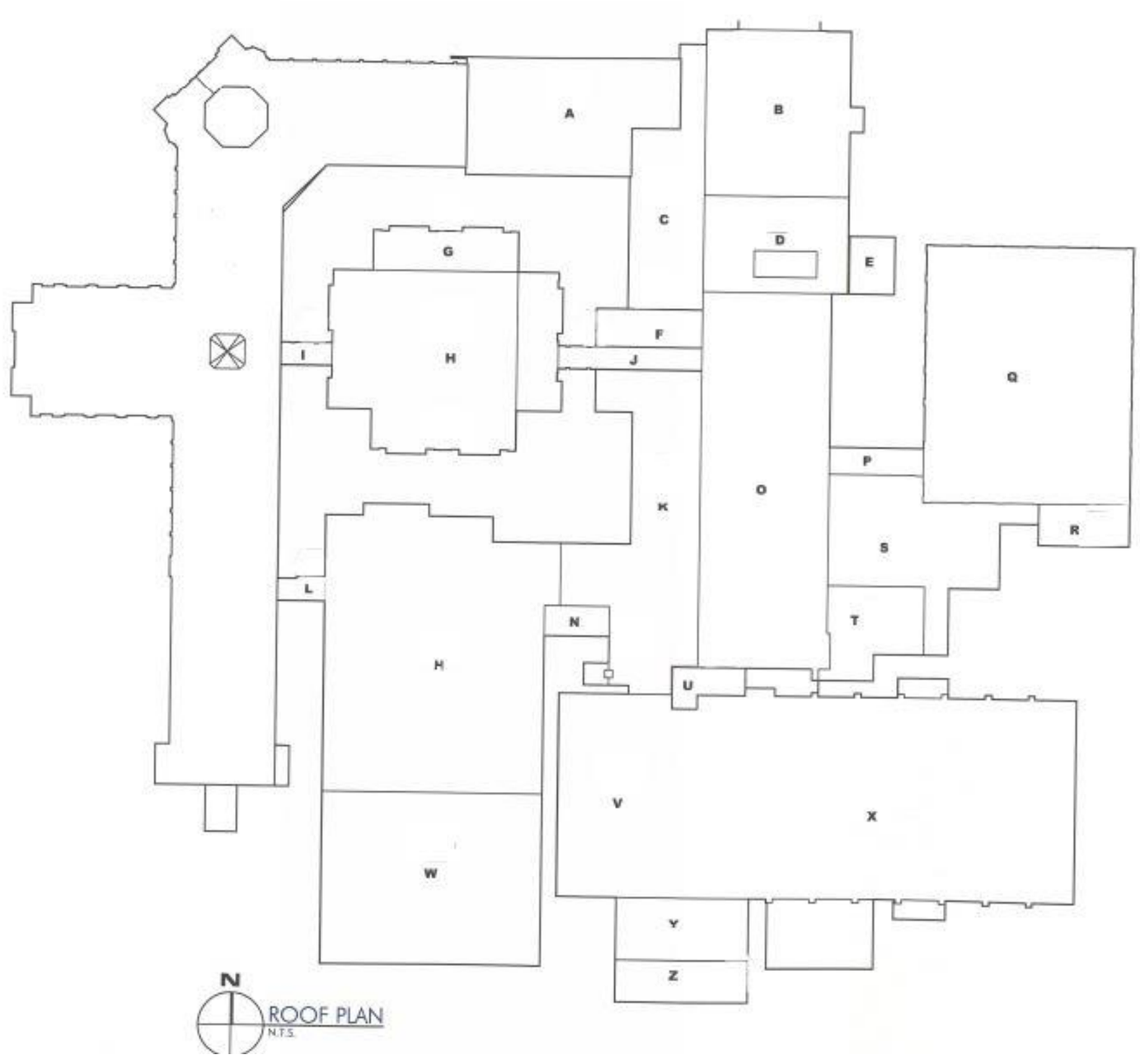
The Two-Pipe Science Wing UVs are from 1997 and the Four-Pipe UVs served by the Main Chillers were installed in 2002. Both UV systems still have approximately (10) years of remaining service life, however they are recommended for replacement within 6 to 10 years.

There are two options 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 supply (DOAS) unit 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 considerable energy savings due to its variable volume supply. Please reference the UV Cost Estimates for pricing details.

ROOF TOP UNITS (RTUs)

The figure to the right provides roof locations of the RTUs that serve Maine East High School. The table on the following page summarizes information for the RTUs including: year installed, reference tag, make, roof location, areas served, heating and cooling type, and tonnage. The graphics following the aforementioned tables highlight the areas served by each RTU.

Roof Top Unit Location Key



Mechanical Assessment

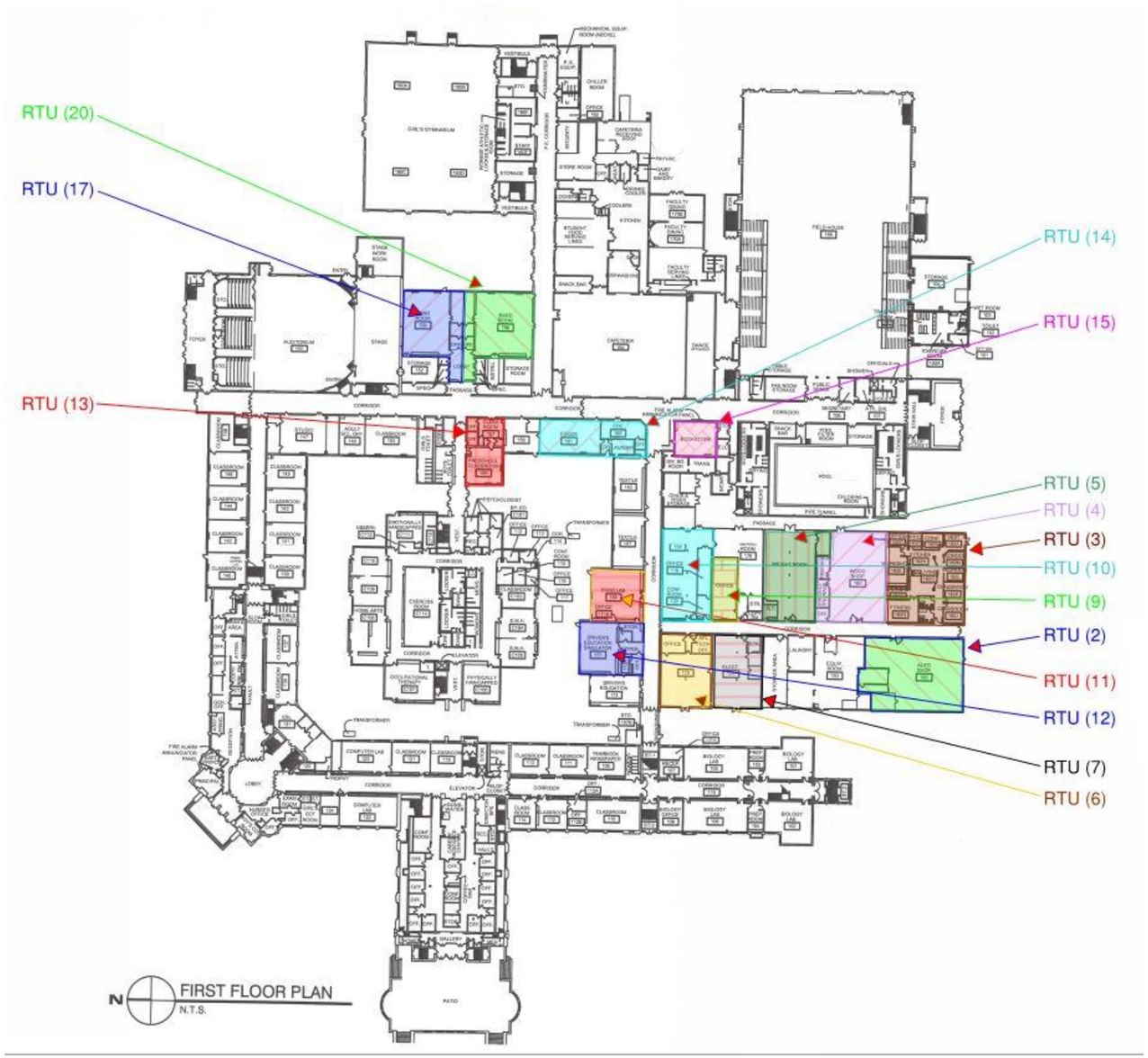
HVAC Overview

Roof Top Unit Details

Year Installed	Reference Tag	Make	Roof Location	Areas Served	Heating	Cooling	Tonnage
2002	2	Trane	W	Rm. 185 - Auto Shop	Duct Mounted HW Reheat	DX	13
2009	3	Carrier	W	Offices, Kitchen/Living	Natural Gas	DX	20
2002	4	Trane	W	Rm. 180 - Wood Shop	Duct Mounted HW Reheat	DX	13
2002	5	Trane	W	Weight Room	Duct Mounted HW Reheat	DX	10
2002	6	Trane	H	Rm 175 & Nearby Offices	Duct Mounted HW Reheat	DX	8
2002	7	Trane	H	Rm. 177	Duct Mounted HW Reheat	DX	9
1995	9	Trane	H	Office Near Xerox Rm.	Natural Gas	DX	3
1984	10	Carrier	H	Rm. 174 & Offices	None	DX	10
2002	11	Trane	H	Rm. 169 - Food Lab	Natural Gas	DX	8
2002	12	Trane	H	Rm. 171	Natural Gas	DX	8
2002	13	Trane	K	Rm. 155, 157	Natural Gas	DX	5
2002	14	Trane	K	Rm. 161	Natural Gas	DX	8
2002	15	Trane	K	Bookstore	Natural Gas	DX	5
1994	17	York	O	Band Room 154	Natural Gas	DX	8
1995	18	Carrier	O	Choral Rm. 254	Natural Gas	DX	9
2005	19	Lennox	O	Choral Rm. 258	Natural Gas	DX	21
2008	23	Carrier	H	Rm's. C208, C215, C216, C217	Natural Gas	DX	6
1994	20	York	O	Band Rm. 158	Natural Gas	DX	9

First Floor

MAINE EAST ROOF TOP UNIT ZONES

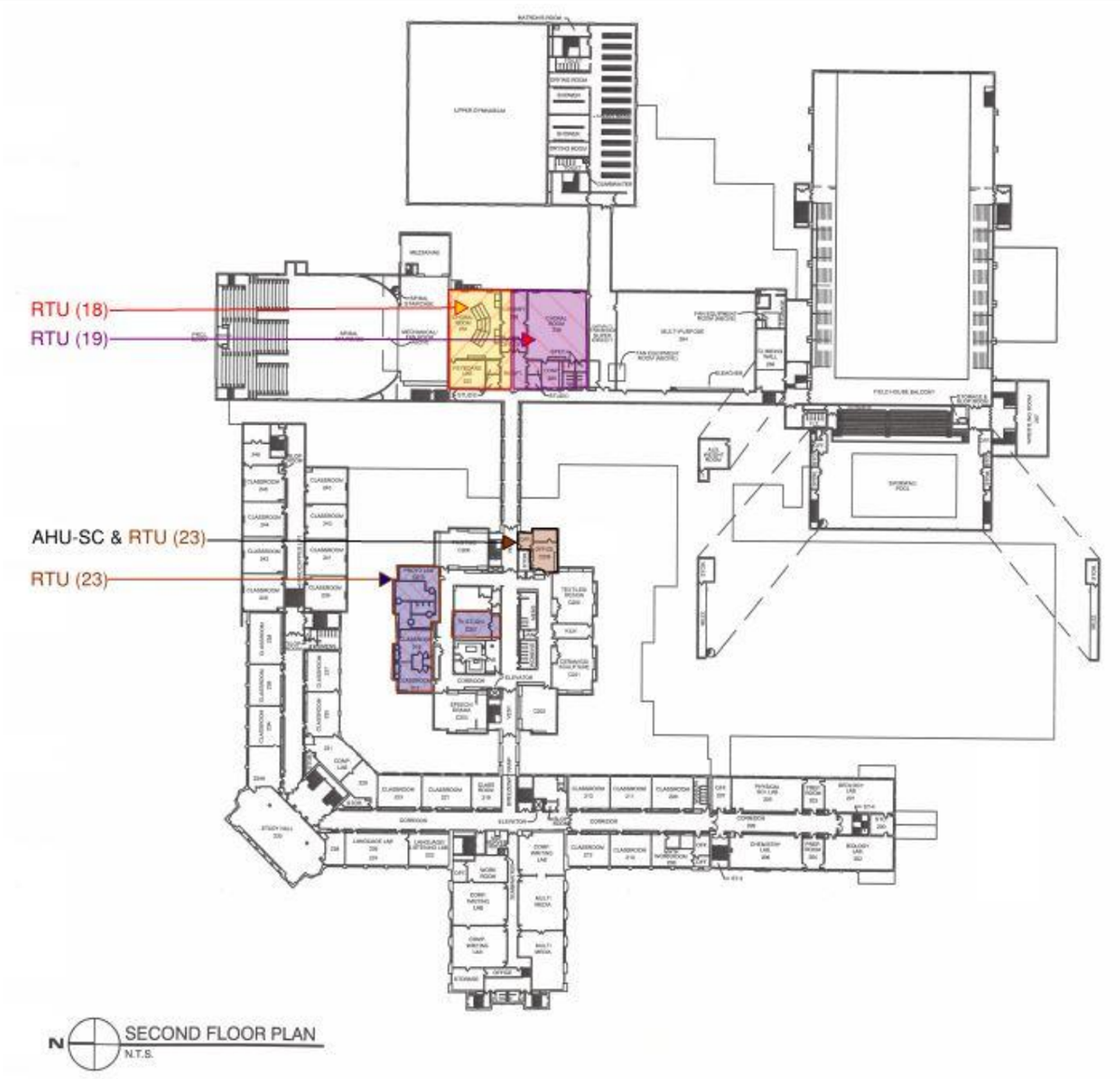


Mechanical Assessment

HVAC Overview

Second Floor

MAINE EAST ROOF TOP UNIT ZONES



Mechanical Assessment

HVAC Overview

ROOF TOP UNIT RECOMMENDATIONS

The ASHRAE median service life for packaged roof top units is 15 years. Roof top units are exposed to the elements which accelerates corrosion and reduces their useful service life. Therefore, the units recommended for replacement are for RTUs greater than 15 years in age. Please reference the RTU Cost Estimates section for pricing details.

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 was utilized. Cost estimates were determined by referencing our experience with similar systems and the areas served by these systems. Cost estimates are as follows:

ROOF TOP UNIT COST ESTIMATES (1 TO 2 YEARS) & (6 TO 10 YEARS)

Recommended Replacement Timeframe	Year Installed	Reference Tag	Make	Roof Location	Areas Served	Heating	Cooling	Tonnage	Year 2019 Cost	Year 2020 Cost	Year 2024 Cost	Year 2028 Cost
2019 - 2020	1984	10	Carrier	H	Rm. 174 & Offices	None	DX	10	$ 35,000	$ 36,050		
	1994	17	York	O	Band Room 154	Natural Gas	DX	8	$ 35,000	$ 36,050		
	1994	20	York	O	Band Rm. 158	Natural Gas	DX	9	$ 35,000	$ 36,050		
	1995	9	Trane	H	Office Near Xerox Rm.	Natural Gas	DX	3	$ 10,000	$ 10,300		
	1995	18	Carrier	O	Choral Rm. 254	Natural Gas	DX	9	$ 35,000	$ 36,050		
	2002	2	Trane	W	Rm. 185 - Auto Shop	Duct Mtd. HW Reheat	DX	13	$ 45,000	$ 46,350		
	2002	4	Trane	W	Rm. 180 - Wood Shop	Duct Mtd. HW Reheat	DX	13	$ 45,000	$ 46,350		
	2002	5	Trane	W	Weight Room	Duct Mtd. HW Reheat	DX	10	$ 35,000	$ 36,050		
	2002	6	Trane	H	Rm 175 & Nearby Offices	Duct Mtd. HW Reheat	DX	8	$ 35,000	$ 36,050		
	2002	7	Trane	H	Rm. 177	Duct Mtd. HW Reheat	DX	9	$ 35,000	$ 36,050		
	2002	11	Trane	H	Rm. 169 - Food Lab	Natural Gas	DX	8	$ 35,000	$ 36,050		
	2002	12	Trane	H	Rm. 171	Natural Gas	DX	8	$ 35,000	$ 36,050		
	2002	13	Trane	K	Rm. 155, 157	Natural Gas	DX	5	$ 20,000	$ 20,600		
	2002	14	Trane	K	Rm. 161	Natural Gas	DX	8	$ 35,000	$ 36,050		
	2002	15	Trane	K	Bookstore	Natural Gas	DX	5	$ 20,000	$ 20,600		
	TBD	TBD	TBD	TBD	Fieldhouse	Natural Gas	DX	TBD	$750,000	$772,500		
2024 - 2028	2005	19	Lennox	O	Choral Rm. 258	Natural Gas	DX	21			$ 75,000	$ 84,413
	2008	23	Carrier	H	Rm's. C208, C215, C216, C217	Natural Gas	DX	6			$ 25,000	$ 28,137
	2009	3	Carrier	W	Offices, Kitchen/Living	Natural Gas	DX	20			$ 75,000	$ 84,413
								TOTALS:	**$1,240,000**	**$1,277,200**	**$175,000**	**$ 196,964**

AIR HANDLING UNIT COST ESTIMATES (1 TO 2 YEARS) & (6 TO 10 YEARS)

Recommended Replacement Timeframe	AHU	Location	Service	Existing System Type	Recommended System Type	2019 Cost	2020 Cost	2024 Cost	2028 Cost
2019 - 2020	AHU-S7	LRC Attic	LRC - All Floors	Multizone	VAV AHU	$900,000	$927,000		
	AHU-SC	Center Court Mech.	Psych, C112, C117	Three Zone	VAV AHU	$90,000	$92,700		
	AHU-SD	Center Court Mech.	TV Studio & Comp. Lab	Two-Zone	Two Zone VAV	$70,000	$72,100		
	AHU-SE	Center Court Mech.	Exercise Rm.	Single Zone	VAV AHU	$60,000	$61,800		
	AHU-SG	Sub Pool Mech.	Pool Locker Rms.	Single Zone	VAV AHU	$90,000	$92,700		
	AHU-SH	Pool Mech.	Pool	Single Zone	Pool Dehumidification Unit	$80,000	$82,400		
	AHU-SJ	Pool Mech.	Pool	Single Zone	Pool Dehumidification Unit	$80,000	$82,400		
	AH-SK	P.E. Equip. Rm.	Kitchen	Four Zone	VAV AHU	$100,000	$103,000		
	AH-SL	P.E. Equip. Rm.	Faculty Dining	Three Zone	VAV AHU	$160,000	$164,800		
	AHU-SM	Girl's Gym	Girl's Gym	Single Zone	VAV RTU	$115,000	$118,450		
	AHU-SN	Girl's Gym	Girl's Gym	Single Zone	VAV RTU	$115,000	$118,450		
	AHU-SO	Girl's Gym	Girl's Gym	Single Zone	VAV RTU	$115,000	$118,450		
	AHU-SP	Girl's Gym	Girl's Gym	Single Zone	VAV RTU	$115,000	$118,450		
	AHU-S2	2nd Fl. Fan Equip. Rm.	Multi-Purpose	Single Zone	VAV AHU	$250,000	$257,500		
	AHU-S1	2nd Fl. Fan Equip. Rm.	Faculty Dining	Single Zone	VAV AHU	$85,000	$87,550		
	Copy Room	Copy Room	Copy Room	Single Zone With Cond. Unit	CV AHU	$60,000	$61,800		
	Foyer	Foyer	Foyer	Single Zone	CV AHU	$60,000	$61,800		
2024 - 2028	AH-1	Attic	8 Zones	Multizone	Convert to VAV AHU			$110,000	$123,806
	AH-2	Attic	6 Zones	Multizone	Convert to VAV AHU			$85,000	$95,668
	AH-3	Attic	12 Zones	Multizone	Convert to VAV AHU			$160,000	$180,081
	AH-4	Attic	11 Zones	Multizone	Convert to VAV AHU			$150,000	$168,826
	AH-5	Attic	9 Zones	Multizone	Convert to VAV AHU			$125,000	$140,689
					TOTALS:	**$ 2,545,000**	**$ 2,621,350**	**$ 630,000**	**$ 709,071**

CENTER COURT UNIT VENTILATOR COST ESTIMATES - 2 RECOMMENDATIONS (1 TO 2 YEARS)

UV	Location	Service	Area Served (ft2) or Quantity	Existing System Type	Recommended System Type	2019 Cost	2020 Cost
UV	Center Court	Center Court	12,798	Two-Pipe UV	FCU-DOAS	$ 600,000	$ 618,000
OR							
UV	Center Court	Center Court	20	Two-Pipe UV	Vertical Change Air UVs	$ 500,000	$ 515,000

MAIN CHILLER UNIT VENTILATOR COST ESTIMATES - 2 RECOMMENDATIONS (6 TO 10 YEARS)

UV	Location	Service	Area Served (ft2) or Quantity	Existing System Type	Recommended System Type	2024 Cost	2028 Cost
UV	Main Chiller UV Zones	Main Chiller UV Zones	38,574	Four-Pipe UV	FCU-DOAS	$ 1,500,000	$ 1,688,263
OR							
UV	Main Chiller UV Zones	Main Chiller UV Zones	42	Four-Pipe UV	Vertical Change Air UVs	$ 1,000,000	$ 1,125,509

SCIENCE WING UNIT VENTILATOR COST ESTIMATES - 2 RECOMMENDATIONS (6 TO 10 YEARS)

UV	Location	Service	Area Served (ft2) or Quantity	Existing System Type	Recommended System Type	2024 Cost	2028 Cost
UV	Science Wing	Science Wing	21,400	Two-Pipe UV	FCU-DOAS	**$ 900,000**	**$ 1,012,958**
OR							
UV	Science Wing	Science Wing	17	Two-Pipe UV	Vertical Change Air UVs	**$ 425,000**	**$ 478,341**

EXHAUST FANS: (5 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 available existing engineering drawings on file, there are approximately (52) 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 5 to 10-year timeframe. This estimate also includes the cost to replace AHU-S11's separate exhaust fan. The costs estimates are as follows:

- **2024 Cost: $ 250,000**
- **2028 Cost: $ 287,000**

CENTER COURT PUMPS: (1 TO 2 YEARS)

Tag	Service	Recommended Replacement Type	2019 Cost	2020 Cost
P-FT1	Center Court FTRs	Like For Like	$ 5,000	$ 5,150
P-FT2	Center Court FTRs	Like For Like	$ 5,000	$ 5,150
P-UV1	Center Court UVs	Like For Like	$ 8,000	$ 8,240
P-UV2	Center Court UVs	Like For Like	$ 8,000	$ 8,240
		Totals:	**$ 26,000**	**$ 26,780**

MAIN CHILLER VALVES: (1 TO 2 YEARS)

- **2019 Cost: $50,000**
- **2020 Cost: $51,500**

TOTAL MECHANICAL COST ESTIMATES

Category	Recommended Replacement Timeframe	Equipment Type	2019 Cost	2024 Cost
Mechanical	2019	Main Chiller Valves	$ 50,000	
	2019 - 2020	AHUs	$ 2,545,000	
	2024 - 2028	AHUs		$ 630,000
	2019 - 2020	Center Court UVs	$ 500,000	
	2024 - 2028	Main Chiller UVs		$ 1,000,000
	2024 - 2028	Science Wing UVs		$ 425,000
	2024 - 2028	Exhaust Fans		$ 250,000
	2019 - 2020	Center Court Chiller Pumps	$ 26,000	
	2019 - 2020	RTUs	$ 1,240,000	
	2024 - 2028	RTUs		$ 175,000
		TOTALS:	**$ 4,361,000**	**$ 2,480,000**

Note: The Unit Ventilator costs above are for the direct replacement option of unit ventilators. The alternate Unit Ventilator replacement costs are shown on pages 27 and 28.

MAINE EAST HIGH SCHOOL

This report section will review the existing electrical systems at Maine East 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.

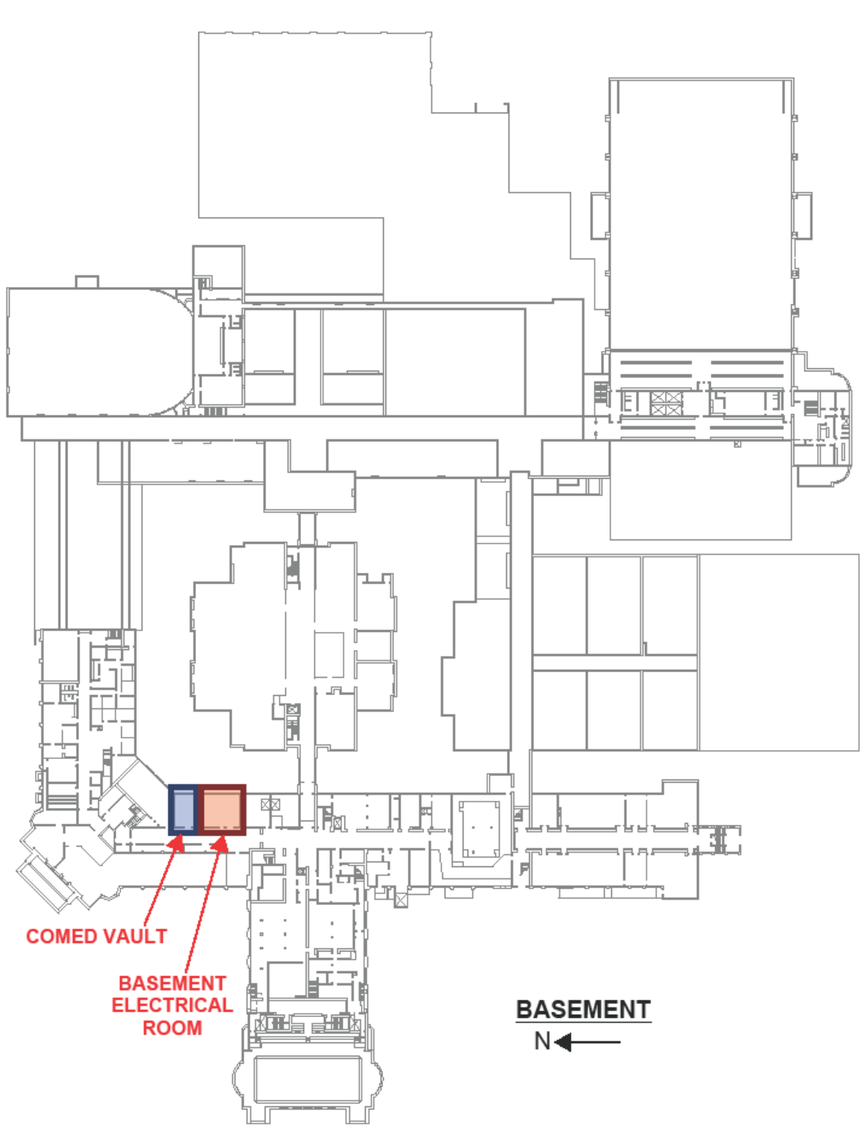
Determinations are made regarding service life by visually evaluating the equipment, determining the availability of replacement parts, and comparing the known age of the equipment to what the average service life may be for a similar unit. There is no exact standard for what the service life is of a 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.

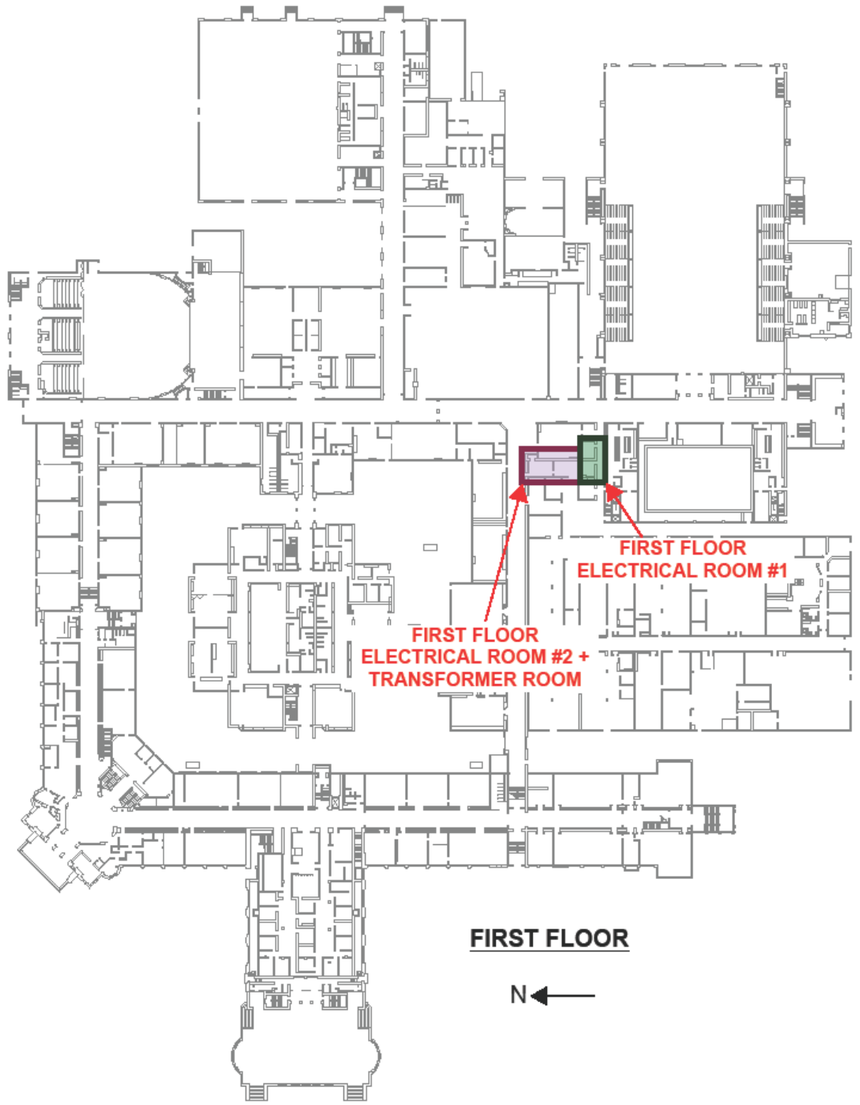
Recommendations will be presented in two groups:

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 sections of the school. These names will be referenced throughout this report.

Location Key





Electrical Assessment

Systems Overview

Building Primary Electrical Distribution

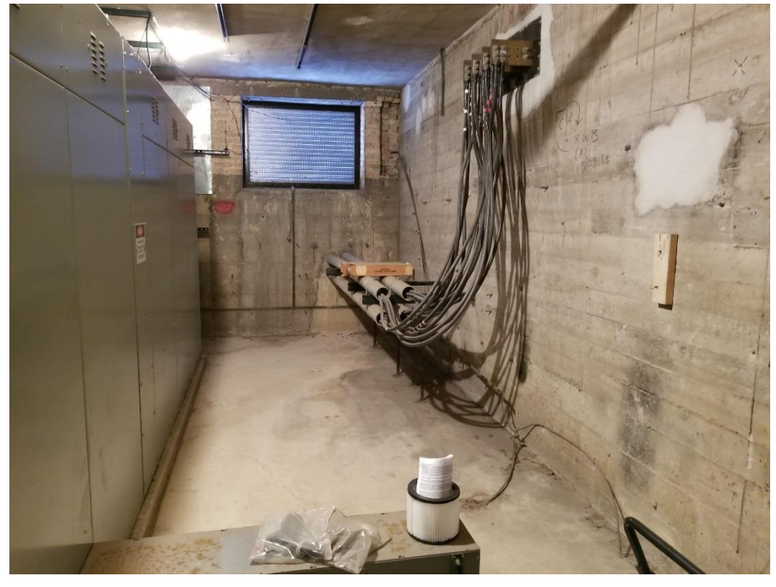
The primary electrical distribution system for Maine East is provided by two pole-mounted medium-voltage switches from ComEd, one originating from Dempster Street, one from Potter Street. These two feeders are connected to a ComEd-owned automatic-throwover (ATO) switch. A feeder from load side of the ATO then connects to the main switchgear, located in the school's basement. The main switchgear consists of primary metering and distribution hardware to split the service out to six transformers, which step down the voltage to either 120/208V, 3-phase, or 277/480V, 3-phase.

The vault switchgear is in good condition, and has been relatively recently installed. Therefore, no adjustments are required for this portion of the distribution system.

The building's electrical distribution areas are described in detail in the following sections.

ComEd Vault Switchgear

Secondary Cables to Basement Electrical Room



Electrical Assessment

Electrical Systems Overview

BASEMENT ELECTRICAL ROOM

The distribution switchboard in the basement electrical room is fed from a step-down transformer outside the building. The switchboard is rated for 1200A at 120/208V, 3-phase.

The first section of this switchboard contains two 'main' circuit breakers, one of which serves as the main disconnecting means for the normal power distribution sections, while the other provides a 300A disconnecting means for an 'emergency' panelboard that feeds emergency and exit lighting. The second and third sections each have a board containing normal power distribution breakers for smaller panels and equipment. The switchboard was manufactured by Erickson Electrical Equipment Co, with breakers from Westinghouse (now owned by Eaton). The switchboard is fairly old, however it still appears to be in acceptable condition.

Some distribution equipment can be found in this room outside of the switchboard, mounted along the walls. While some of the oldest pieces of equipment are no longer functional, there are a few live-front enclosures that still see active use, such as fuse panels for lighting.

HEALTH LIFE SAFETY (0 TO 1 YEAR) RECOMMENDATION FOR BASEMENT ELECTRICAL ROOM

We strongly recommend the replacement of all existing live-front equipment as soon as possible. Virtually all such equipment can be replaced by a dead-front equivalent, providing much greater safety to maintenance personnel and anyone else who may need to access the equipment.

We recommend to exercise the existing switchboard breakers 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 switchboard, distribution panels, and other equipment in order to more easily identify problematic areas of unwanted heat buildup in the system.

The switchboard room currently has several items scattered about the floor, obstructing access to most of the room's electrical equipment. It is recommended to find suitable storage for these items and maintain a minimum 36 inch front clearance for all electrical equipment.

3 TO 5 YEAR RECOMMENDATION FOR BASEMENT ELECTRICAL ROOM

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 for all electrical equipment. It is recommended to perform an arc flash study and apply the labels in a timely manner to comply.

It is recommended to inspect the switchboard and all outgoing feeder cables for cloth-insulated wire. Should cloth wire be encountered, it is best to replace it quickly with a thermoplastic equivalent. Doing so reduces risks associated with older insulation such as excessive heat, brittleness, and potential exposure to asbestos.

Basement Electrical Room Switchboard

Live-front Distribution Equipment – Basement Electrical Room

FIRST FLOOR ELECTRICAL ROOM #1

The distribution switchboard in the first floor electrical room south of the bookstore is fed from three single-phase transformers in the room directly north, accessible from First Floor Electrical Room #2. The switchboard is rated for 2000A at 120/208V, 3-phase.

The first section of this switchboard contains the 'main' circuit breaker for all the distribution breakers in the next two board sections. Most of the circuit breakers in the switchboard appear to feed a lighting panel, based on the labeling. The entire switchboard was manufactured by I-T-E circuit breaker company. The switchboard is fairly old, however it still appears to be in acceptable condition for use.

Some branch circuit panels can be found in this room outside of the switchboard, mounted along the walls. The majority of the outgoing feeders are routed outside of this room.

1 TO 2 YEAR RECOMMENDATION FOR FIRST FLOOR ELECTRICAL ROOM #1

We recommend to exercise the existing switchboard breakers 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 switchboard, distribution panels, and other equipment in order to more easily identify problematic areas of unwanted heat buildup in the system.

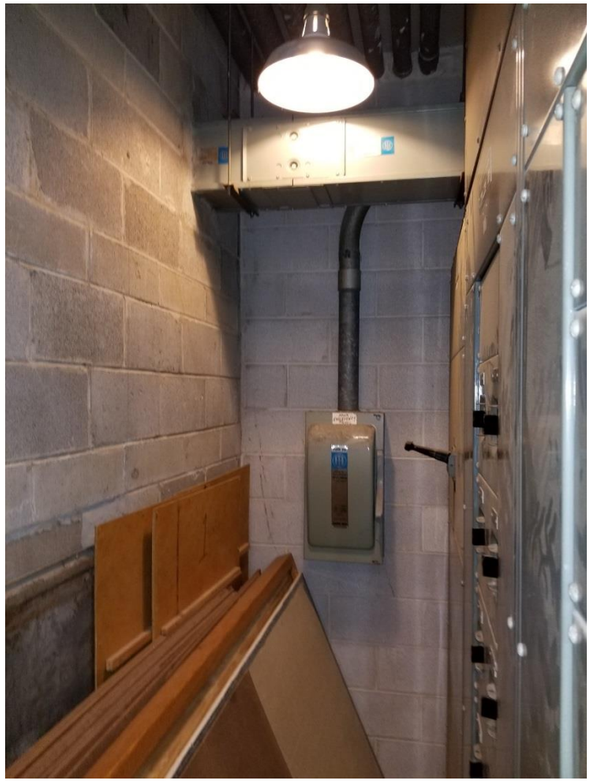
The switchboard room currently has several items obstructing access to most of the room's electrical equipment. It is recommended to find suitable storage for these items and maintain a minimum 36 inch front clearance for all electrical equipment.

3 TO 5 YEAR RECOMMENDATION FOR FIRST FLOOR ELECTRICAL ROOM #1

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 in a timely manner to comply.

It is recommended to inspect the switchboard and all outgoing feeder cables for cloth-insulated wire. Should cloth wire be encountered, it is best to replace it quickly with a thermoplastic equivalent. Doing so reduces risks associated with older insulation such as excessive heat, brittleness, and potential exposure to asbestos.

Switchboard and Disconnect Switch



Electrical Assessment

Electrical Systems Overview

FIRST FLOOR ELECTRICAL ROOM #2

The distribution switchboard in the first floor electrical room west of the bookstore is fed from three single-phase step-down transformers in a room immediately east. The switchboard is rated for 120/208V, 3-phase. At the time of survey, we were unable to verify the current rating of the main breaker or switchboard bus.

The first four sections of this switchboard contain (23) power distribution breakers, which generally feed smaller power distribution boards or branch circuit panels. The fifth section contains the main circuit breaker for the board and the incoming feeder wires from the transformers. The switchboard was manufactured by I-T-E circuit breaker company. The switchboard appears to be in less satisfactory condition than other such units in the school.

The transformers that feed this room and First Floor Electrical Room #1 are accessible through this room. Since there is 12.47kV live wire run in this room without conduit, it is important to keep the area off-limits to non-qualified personnel.

1 TO 2 YEAR RECOMMENDATION FOR FIRST FLOOR ELECTRICAL ROOM #2

We recommend to exercise the existing switchboard breakers 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 switchboard, distribution panels, and other equipment in order to more easily identify problematic areas of unwanted heat buildup in the system.

The switchboard room currently has several items obstructing access to most of the room's electrical equipment. It is recommended to find suitable storage for these items and maintain a 36 inch minimum front clearance for all electrical equipment.

3 TO 5 YEAR RECOMMENDATION FOR FIRST FLOOR ELECTRICAL ROOM #2

This switchboard is at or past its expected lifespan and does not appear to be in as good a condition as the other switchboards encountered in the facility. 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.

During the replacement process, it is recommended to inspect the switchboard and all outgoing feeder cables for cloth-insulated wire. Should cloth wire be encountered, it is best to replace it quickly with a thermoplastic equivalent. Doing so reduces risks associated with older insulation such as excessive heat, brittleness, and potential exposure to asbestos.

When the new switchboard is in place, 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 in a timely manner to comply.

Switchboard – First Floor Electrical Room #2

Indoor Transformers Feeding First Floor Electrical Rooms

BUILDING PANELBOARDS

The school's load centers are distributed throughout the school, only a few are located in the switchboard rooms where the main power distribution resides. The condition of the panels are varied, many having been replaced over the course of the facility's history from live-front fuse panels to newer units from Square-D, I-T-E, and Erickson, though a few live-front units still remain. Almost all panelboards are three-phase units, with supply voltages that are either 120/208V or 277/480V throughout the school. Many panelboards are recessed-type, found in the facility corridors

HEALTH LIFE SAFETY (0 TO 1 YEAR) RECOMMENDATION FOR BUILDING PANELBOARDS

We recommend annual thermal inspections of the distribution panels in order to more easily identify problematic areas of unwanted heat buildup in the system.

As mentioned, live-front equipment is inherently dangerous and is not code-compliant. It is highly recommended to replace all such equipment with a dead-front equivalent as soon as possible.

3 TO 5 YEAR RECOMMENDATION FOR BUILDING PANELBOARDS

Other panelboard candidates for replacement may be determined based on thermal scans or maintenance requirements over time. Building staff may have knowledge of specific problematic panelboards that can be replaced to create a more reliable distribution system, and panels that have high thermal readings may be experiencing material deterioration that is most easily alleviated through replacement.

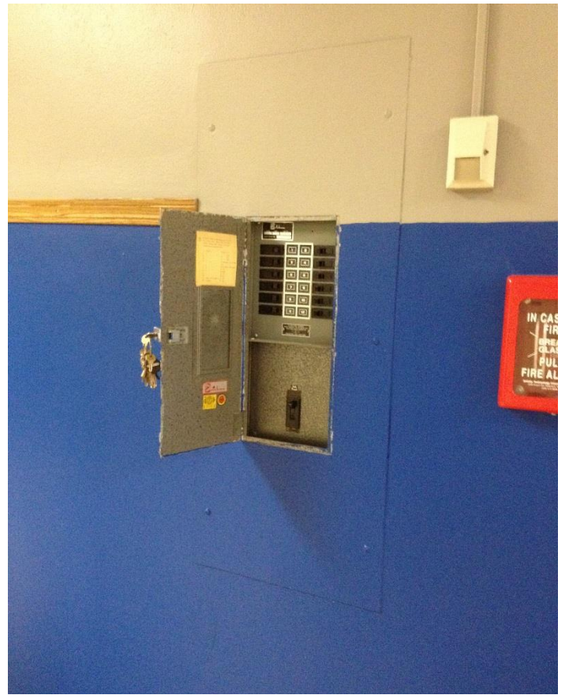
It is recommended to replace all older panelboards in a given area as the spaces are renovated in the future with new units. If possible, it would be beneficial to install the new panelboards with additional spare circuit capacity for future use.

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

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.

Lighting Panelboards - Auditorium

Panel Recessed in Corridor



FIRE ALARM

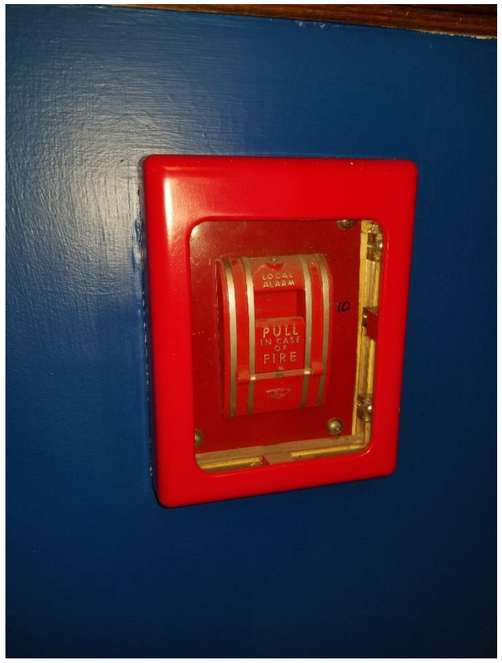
The building contains a Siemens fire alarm system with a Cerberus Pyrotronics ‘MXL’ main fire alarm control panel, consisting of audio, visual, heat detector, smoke detector, duct smoke detectors, and pull station devices. The system is outdated and does not meet present code in certain areas.

1 TO 2 YEAR RECOMMENDATIONS FOR FIRE ALARM SYSTEM

The requirement of addressable devices requires the installation of new expansion cards in the existing fire alarm panel. There is not enough space in the existing fire alarm panel to install new cards, and due to the magnitude of new code requirements, it is recommended to install a completely new system that meets all requirements.

Fire Alarm Control Panel

Fire Alarm Pull Station



Electrical Assessment

Electrical Systems Overview

LIGHTING

The lighting system within the building consists primarily of T8 and T12 fluorescent fixtures within the corridors, classrooms, common spaces, and offices, using troffer, surface-mount, and pendant fixtures. Some corridors in the basement have retrofitted LED lamps in the T8 sockets. Control is performed mostly through toggle switches and contactors, with a dimming system used in the auditorium area. Lighting throughout most of the facility is 277V, with the exception of the center core area and emergency lighting, which uses 120V.

Many mechanical spaces within the building, including all substation rooms, use screw-in lamp types which house either CFL lamps, incandescent lamps, or LED retrofit lamps. Each electrical room that was surveyed had poor light levels, aside from the ComEd vault room in the basement.

EMERGENCY AND EXIT LIGHTING

The building uses individual battery back-up for most emergency and exit lighting, and does not have a backup generator. Emergency fixtures are powered from “emergency” panels, fed from a separate breaker in the basement electrical room switchboard. The existing exit signs house mostly fluorescent and LED retrofit 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, along with some remote heads mounted on walls.

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. Fixtures that have been retrofitted with LED T8 tube replacements should eventually be removed and replaced with fixtures that contain integrated LEDs and drivers, due to the higher quality and longer life of a dedicated fixture.

Another lighting recommendation is to expand the capabilities of the lighting 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.

Exit Sign

Emergency Lighting – Ceiling Mounted

Electrical Assessment

Electrical Systems Overview

Cost Estimates

Cost estimates for recommended replacements encompass any associated demolition, general contracting, installation, and equipment costs. 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:

MAIN SWITCHBOARD REPLACEMENT COSTS

Per the existing system description, only the F1-2 switchboard is recommended to be replaced in the next five years. The costs are given for the basement and F1-1 switchboard for informative purpose.

Recommended Replacement Timeframe	Switchboard	Location	2022 Cost	2024 Cost
2022 - 2024	F1-2	West of Bookstore	**$ 168,826**	**$ 179,108**

DISTRIBUTION PANEL REPLACEMENT

The variety of panel conditions makes a sweeping cost to replace all existing units inadvisable and not particularly applicable for this facility. Costs for individual panel replacement when a given space is renovated can be estimated at **$2,000** for a 100A panel, **$3,000** for a 200A panel, and **$5,000** for a 400A panel, including labor and material. The number of panels on each floor is as follows:

Floor	Panels
Basement	34
1F	99
2F	30
3F	18
Attic	1

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	$19.5
100	$30
150	$50
200	$67
400	$134
600	$200
800	$267
1000	$334
1200	$400

THERMAL INSPECTIONS

The estimated cost for complete thermal inspections in the facility is **$35,000** in 2019 dollars.

ARC FLASH STUDY

The cumulative approximate cost for the arc fault and coordination study for the school's switchboards and distribution panels is **$20,000** in 2019 dollars. This is assuming that the study is done concurrent with a switchboard replacement.

EXERCISING OF SWITCHES AND OTHER PREVENTATIVE MAINTENANCE

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

LIGHTING

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 **670,000** ft^2, the total cost of the retrofit is estimated to be **$6,700,000** in 2019 dollars.

FIRE ALARM

The estimated cost of completing a replacement of the fire alarm system sufficient to bring the facility up to code is approximately **$1,500,000**. This new system includes a complete one-way speaker system installed throughout the school.

TOTAL ELECTRICAL COST ESTIMATES

Category	Recommended Implementation Timeframe	Equipment Type	2019 Cost	2021 Cost	2024 Cost
Electrical	2021 - 2023	Main Switchboard Replacement		$ 168,826	
	2019	Thermal Inspections	$ 35,000		
	2021 - 2023	Arc Flash Study		$ 22,510	
	2019	Switch Exercise & Preventative Maintenance	$ 10,000		
	2019 thru 2024	LED Lighting & Controls	$ 2,233,333	$ 2,369,343	$ 2,589,045
	2019 - 2020	Fire Alarm	$ 900,000		
		TOTALS:	**$ 3,178,333**	**$ 2,560,680**	**$ 2,589,045**

Note: The distribution panel replacement and the cloth wiring replacement costs were excluded from the table above. Their cost estimates are shown on pages 37 and 38.

MAINE EAST HIGH SCHOOL

This report section will overview the existing plumbing systems at Maine East 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 – 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.
3. 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.
4. 5 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.

Domestic Hot Water Plants

Domestic hot water for Maine East is provided by two (2) domestic hot water plants. One plant is located in the main building basement mechanical area (replaced in 2002) and the other plant is located in the pool equipment mechanical room (replaced in 2016).

DOMESTIC HOT WATER PLANTS

The domestic hot water plant in the main building basement mechanical room is comprised of one (1) 500-gallon water heater with steam driven heat exchanger. The water heater and localized piping were replaced in 2002. This plant serves approximately half of the building's domestic hot water load. The pictures on the right show the equipment and location of the domestic hot water plant.

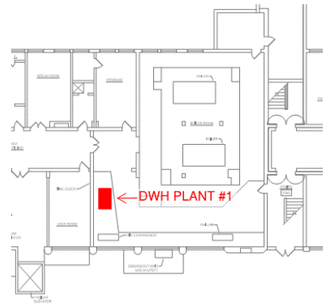
The domestic hot water plant in the pool equipment room is comprised of two (2) 800-MBH high-efficiency gas-fired domestic water heaters and one (1) 500-gallon hot water storage tank. The water heaters and storage tank and localized piping were replaced in 2016. This plant serves approximately half of the 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.

6 TO 10 YEAR RECOMMENDATION

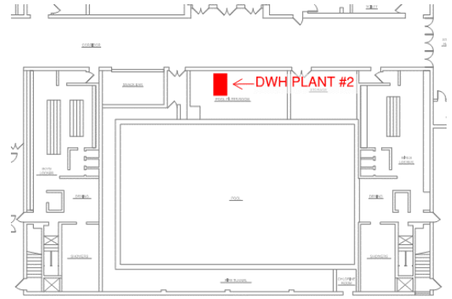
Due to average life expectancy, the water heater system should be planned to be replaced in six (6) to ten (10) year range.

However, note that if mechanical absorption chillers are replaced, then the steam-driven water heater plant would be impacted and recommended to be replaced with that mechanical scope. Separate chiller report study is being prepared.

Domestic Hot Water Plant Locations



Basement



First Floor

Domestic Hot Water Plants

Plant #1

Plant #2

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 East 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 balance 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 Failed Existing Galvanized Piping

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.

The master thermostatic mixing at the main building basement mechanical room requiring repair or replacement.

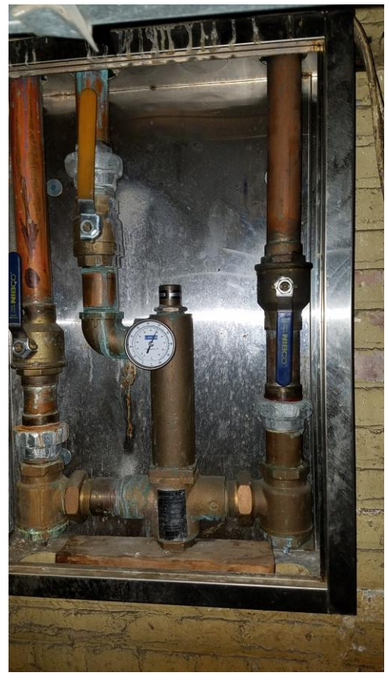
HEALTH LIFE SAFETY RECOMMENDATION

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

Master Mixing Valve to be Replaced



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, but if necessary can be sooner. 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:

PLUMBING COST ESTIMATES

Category	Recommended Replacement Timeframe	Existing System Type	Location	Service	Recommended System Type	2019 Cost	2024 Cost
Plumbing	Health Life Safety (ASAP)	Thermostatic Mixing Valves (TMV)	WH Mech Room	WH Master Mixer	New TMV	$ 8,000	
			At Fixtures	Fixtures	New TMV	$ 40,000	
	2019 - 2020	Domestic Cold/Hot Water Distribution and Circulation	Throughout	Tunnel	New Copper Pipe	$ 60,000	
				Basement	New Copper Pipe	$ 600,000	
				1st Floor	New Copper Pipe	$ 1,200,000	
				2nd Floor	New Copper Pipe	$ 470,000	
				3rd Floor	New Copper Pipe	$ 225,000	
	2024 - 2028	Domestic Hot Water Plants	Boiler Room	West Side	Hi-Efficiency WH Type		$ 200,000
	2024 - 2028	Fire Protection	Throughout	Entire Building	Automatic Sprinklers		$ 1,550,000
					TOTALS:	**$ 2,603,000**	**$ 1,750,000**

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 2021 would have the 2019 inflated cost shown.

Category	Recommended Replacement Timeframe	Equipment Type	2019 Cost	2021 Cost	2024 Cost
Mechanical	2019	Main Chiller Valves	$ 50,000		
	2019 - 2020	AHUs	$ 2,545,000		
	2024 - 2028	AHUs			$ 630,000
	2019 - 2020	Center Court UVs	$ 500,000		
	2024 - 2028	Main Chiller UVs			$ 1,000,000
	2024 - 2028	Science Wing UVs			$ 425,000
	2024 - 2028	Exhaust Fans			$ 250,000
	2019 - 2020	Center Court Chiller Pumps	$ 26,000		
	2019 - 2020	RTUs	$ 1,240,000		
	2024 - 2028	RTUs			$ 175,000
Electrical	2021 - 2023	Main Switchboard Replacement		$ 168,826	
	2019	Thermal Inspections	$ 35,000		
	2021 - 2023	Arc Flash Study		$ 22,510	
	2019	Switch Exercise & Preventative Maintenance	$ 10,000		
	2019 thru 2024	LED Lighting & Controls	$ 2,233,333	$ 2,369,343	$ 2,589,045
	2019 - 2020	Fire Alarm	$ 900,000		
Plumbing	Health Life Safety (ASAP)	Thermostatic Mixing Valves (TMV)	$ 48,000		
	2019 - 2020	Domestic Cold/Hot Water Distribution and Circulation	$ 2,555,000		
	2024 - 2028	Domestic Hot Water Plants			$ 200,000
	2024 - 2028	Fire Protection			$ 1,550,000
		TOTALS:	**$ 10,142,333**	**$ 2,560,680**	**$ 6,819,045**
		$ 19,522,058			

Equipment Type	Equipment Tag	Service	Approximate Unit Age as of 2018 (Years)	ASHRAE Median Service Life (Years)
Space Heating Steam Boilers	B-1, B-2	Steam to Building	15	38
Domestic Hot Water Boilers		Half of Building - Located in Basement	16	10
		Half of Building - Located in Pool Equipment Rm.	2	10
Chillers		Science Wing	19	38
		Center Court	23	38
	CH-1, CH-2	Main	15	38
Pumps (Denotes In-House Tag Assignment)**	P-1	Science Wing UVs	19	25
	P-2	Science Wing UVs	19	25
	P-3	Science Wing Cooling Tower	19	25
	**P-UV1	Center-Court UVs	50	25
	**P-UV2	Center-Court UVs	50	25
	**P-FT1	Center-Court FTRs	50	25
	**P-FT2	Center-Court FTRs	50	25
	**P-CW	Center-Court Cooling Tower	23	25
	**P-CHW	Center-Court Chiller	23	25
	P-CH1	Main Chiller Primary CHW Loop	15	25
	P-CH2	Main Chiller Primary CHW Loop	15	25
	P-1	Main Chiller Secondary CHW Loop	15	25
	P-2	Main Chiller Secondary CHW Loop	15	25
	P-CT1	Main Chiller Cooling Tower	15	25
	P-CT2	Main Chiller Cooling Tower	15	25
Air Handling Units	AHU-S7	LRC - All Floors	50	30
	AHU-SC	Psych, C112, C117	50	30
	AHU-SD	TV Studio & Comp. Lab	50	30
	AHU-SE	Exercise Rm.	50	30
	AHU-SG	Pool Locker Rms.	50	30
	AHU-SH	Pool	50	30
	AHU-SJ	Pool	50	30
	AH-SK	Kitchen	50	30
	AH-SL	Faculty Dining	50	30
	AHU-SM	Girl's Gym	50	30
	AHU-SN	Girl's Gym	50	30
	AHU-SO	Girl's Gym	50	30
	AHU-SP	Girl's Gym	50	30
	AHU-S2	Multi-Purpose	67	30
	AHU-S1	Faculty Dining	67	30
	Copy Room	Copy Room	50	30
	Foyer	Foyer	50	30
	AH-1	1928 Original Classrooms	14	25
	AH-2	1928 Original Classrooms	14	25
	AH-3	1928 Original Classrooms	14	25
	AH-4	1928 Original Classrooms	14	25
	AH-5	1928 Original Classrooms	14	25
	AH-6	Auditorium	16	25
	AH-7	Cafeteria	16	25
	AHU-S11	North Basement Classrooms	4	25
Roof Top Units (Reference Report for Associated Tag)	10	Rm. 174 & Offices	34	15
	17	Band Room 154	24	15
	20	Band Rm. 158	24	15
	9	Office Near Xerox Rm.	23	15
	18	Choral Rm. 254	23	15
	2	Rm. 185 - Auto Shop	16	15
	4	Rm. 180 - Wood Shop	16	15
	5	Weight Room	16	15
	6	Rm 175 & Nearby Offices	16	15
	7	Rm. 177	16	15
	11	Rm. 169 - Food Lab	16	15
	12	Rm. 171	16	15
	13	Rm. 155, 157	16	15
	14	Rm. 161	16	15
	15	Bookstore	16	15
	19	Choral Rm. 258	13	15
	23	Rm's. C208, C215, C216, C217	10	15
	3	Offices, Kitchen/Living	9	15
Unit Ventilators		Center Court	50	20
		Science Wing	19	20
		Remainder	16	20
Heat Exchangers	*LRC-HX1	LRC AHU	50	20
	*LRC-HX2	LRC Fin Tube Radiators	50	20
	*CC-HX1	Center Court UVs	50	20
	*CC-HX2	Center Court Fin Tube Radiators	50	20
	*SW-HX	Science Wing UVs	19	20
	HX-1	Remainder of UVs and AHUs	16	20
	HX-2	Remainder of UVs and AHUs	16	20