Fairfield Public Schools Facilities Condition Assessment

Fairfield Warde High School
755 Melville Avenue
Fairfield, CT 06825

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EXECUTIVE SUMMARY

The goal of the Fairfield Public Schools is to provide a mechanical means of fresh air, air conditioning, and fire protection for all its school buildings in accordance with current codes and standards. DTC has been retained by the Town of Fairfield to conduct a Facility Condition Assessment Analysis Reports. The following is the assessment for the Fairfield Warde High School.

Property Details

This 317,827 SF building was built in 1955 and with additions/renovations in 2003 and 2006. It is a 2-story masonry building with its construction consisting of multiple medias, ranging from masonry to brick.

Scope of Work

The proposed scope of work for this existing Facility Condition Assessment Analysis Report is as follows:

- Meet with knowledgeable school staff for each facility to benefit from their input and to fully understand the characteristics of each school property beyond what is on existing plans. Documents and other materials
- Conduct on-site inspections
- Produce a Facility Condition Assessment Analysis Report
    - In-depth assessment of the facility as it relates to any operational deficiencies
    - Provide a floor and site plan of the facility building
    - Recommendations concerning the system(s) required to correct the operational deficiency
    - Estimated cost to include initial capital cost of the recommended system.

The team approach adopted for this scope of work included several activities to gather and share all the current information available for each facility prior to site visits. These activities included:

- Visit to the Fairfield Schools Maintenance Office to gather all existing MEP drawings for each facility to be studied.
- DTC developed a building operator questionnaire to be completed by the building staff to learn more about each facility and their operational challenges.
- The existing building automation system (BAS) drawings were shared to help the team understand building operation.
- Virtual meetings were held with Salvatore Moribito and Rob Procius to discuss the facilities and to facilitate information collection and site visit coordination.
- Virtual meetings were held with the Towns technical maintenance staff to identify all operational deficiencies and challenges at the schools.

Existing Mechanical Systems

The Fairfield Warde High School is a large sprawling building, coming in at 317,827 square feet, across two floors with a partial basement. An existing floor plan and site plan can be found in Appendix A and Appendix B respectively.

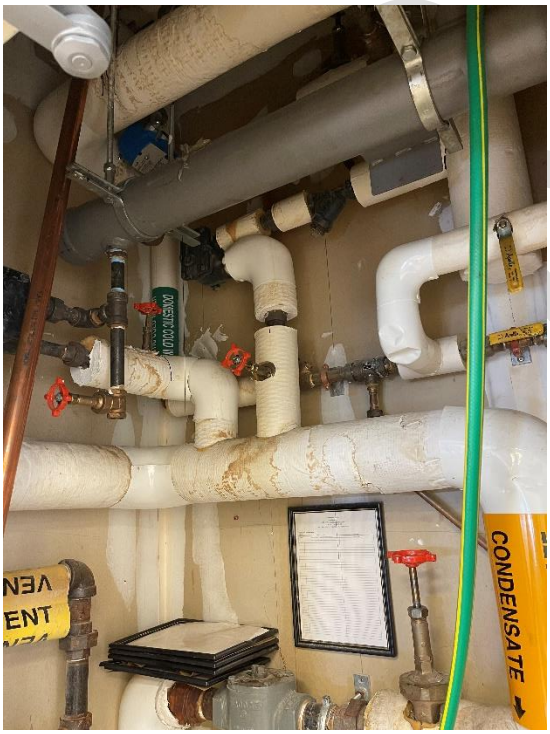
The school has a central hot water heating plant located in the basement level mechanical/boiler room. The heating plant consists of three large Easco cast iron boilers that are approximately 6.5 million BTUH each. The boilers were installed in 2015 and are in good to very good condition, the median service life of typical cast-iron boiler is 30 years. The boilers have dual fuel Power Flame burners that can use either natural gas or diesel oil for combustion but have been converted to natural gas only. Our understanding is that the third boiler is stand-by.

Hot water is circulated through the building by (3) three sets of two hot water pumps, one set located on the north end, one set located on the south end of the building, and one on the west end of the building, each pump has a variable speed drive to control flow and pressure based on the heating demand of the building. We assume that the pumps are configured as primary, stand-by arrangement and that each is sized for 100% of the flow. The median service life for centrifugal inline pumps is 20 years. There are several hot water piping loops that go out and serve the various areas of the building to offset the envelope heating load. There are pressure sensors located out in the piping loops that measure the system pressure and modulate the pump speeds to match the system demand. Terminal hot water heating equipment located at the building perimeter includes finned tube radiators, radiant panels, cabinet unit heaters and hot water convectors.

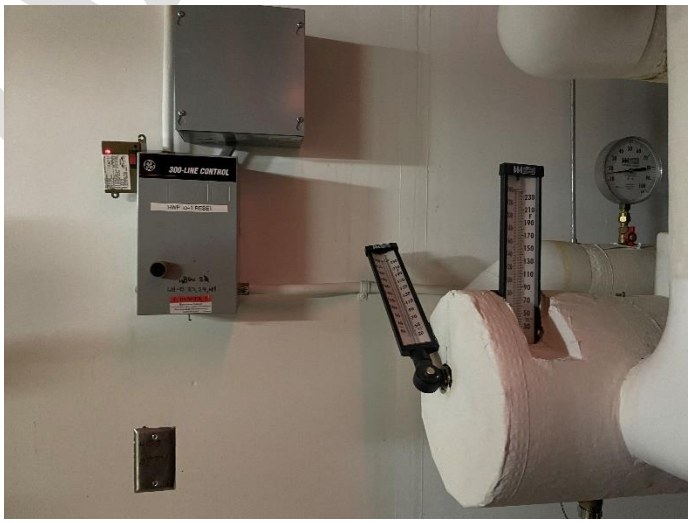
Easco Boiler #1

Easco Boiler #2

Easco Brooks Boiler #3



Perimeter Shell & Tube (No Tag)



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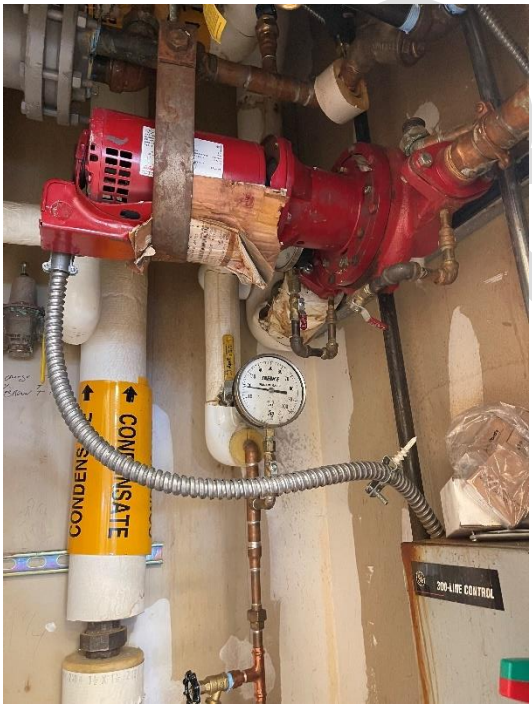


Perimeter Heating Pumps

Johnson Metasys Control Panel

Domestic hot water is produced by two Paterson-Kelly Mach gas fired water heaters with multiple hot water loops with fractional horsepower recirculation pumps. The condition and operation of these systems appears to be good. The median service life for this type of heater is 25 years

Domestic Hot Water Heater

Domestic Hot Water Heater

The roof is currently populated with most of the air handling equipment serving the school. There are a dozen condensing units located on the ground within various court yards. There are approximately thirty-five rooftop air conditioning units (RTU's), condensing units (CU's) and heating & ventilation units (HV's) of various sizes and capacities located on the roof of the school. There are also multiple make up air units (MUA's) located on the roof and a dedicated outdoor air system (DOAS) serving areas with high ventilation rates such as the cafeteria. The ages of the equipment vary, but most are in the 10-year range. The median service life of this type of equipment is 15 years.

Rooftop Packaged Air-cooled Hot-Water Heat Unit

Courtyard Air-Cooled Condensing Units

There are many mini split single room air conditioning systems scattered throughout the school. The mini split systems consist of an indoor evaporator located in the space to be cooled and a condensing unit located on the roof. These systems provide flexible room by room cooling capability. We observed equipment by a few different manufacturers and a few types of evaporators with some being wall mounted and some being ceiling cassettes. These systems are recommended to be replaced by central systems.

Rooftop Air-Cooled Condensing Unit and Packaged Rooftop Unit

There are many exhaust fans scattered throughout the building that serve toilets, MER's, science rooms, storage rooms, kitchens and other spaces that require ventilation. Most are small mushroom style down blast type and are typical for a school application.

There is an existing hybrid Johnson Controls/Alerton/ Automated Logic building automation system (BAS) that monitors and controls some of the building mechanical equipment.

Miscellaneous Exhaust Fans

Miscellaneous Exhaust Fans

Domestic Hot Water Storage Tanks

Existing Electrical Systems

The purpose of this site visit was to perform on-site observations, meet with knowledgeable school staff and to understand the current operation and maintenance of the entire school facility.

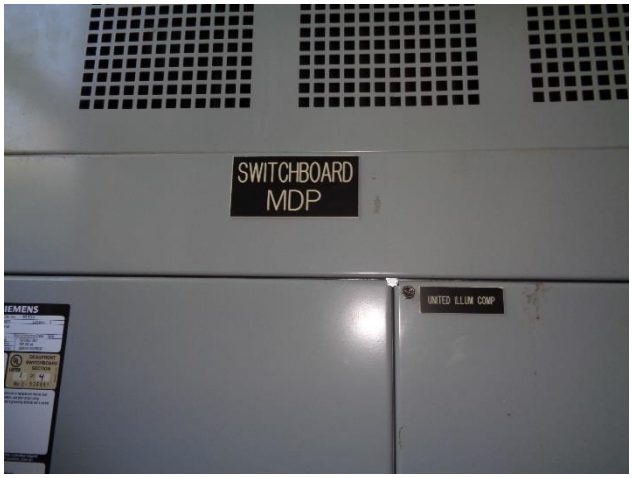
General:

There are two services to the building, one existing 400A main switchgear is on the first floor near an outdoor 750 kVA utility transformer. With another existing 1600A 480 Volt fused switch and Ground Fault Relay is in the basement. The electrical services generally consist of a 480V main disconnect, a main distribution panel section, 480/277V HVAC and Lighting branch circuit panels, step down transformers, and 208Y/120V main breaker distribution and branch circuit panels, serving equipment and receptacles. There were also branch circuit panels in corridors scattered around the building.

The existing electrical rooms are located on each floor to provide each floor with power with the main switchgear on the first floor near the utility transformer. Each electrical rooms generally consist of a 480V main lug panel, step down transformers, and 208Y/120V main breaker panels, with some electrical rooms having slightly equipment than others. There were also a few panels in corridors scattered throughout the building. The main 480Y/277 V 3-Phase electrical power is fed to distribution switchboards by an existing 750 kVA transformer.

Electrical:

It was observed that some original electrical equipment was nearing the end of its useful life and while beyond the scope of this study, we recommend planning begin for a phased replacement. Depending on the power requirements for the new mechanical equipment, the existing panels and switchgear may need to be replaced with new. The layout of the new power distribution panels, switchgear and step-down transformers will allow easier servicing and energy efficiency in the building. The new step-down transformers will have increased efficiency of operation and reduce operating costs.



Existing Switchboard

Existing Panelboards

Fire Alarm

Facility Condition Assessment Analysis

Our facilities condition assessment is based on our field observations during our site visit on September 8th, 2021. The school has an existing Johnson Metasys BAS for the conditioned areas. The Metasys system has operating and access issues that are slated for modification and improvements.

The majority of air conditioning equipment that serves the school installed on the roof and includes RTU's, exhaust fans and mini-split condensing units. The rooftop equipment viewed during the site visit appeared to be in average condition for their age and we did not note any obvious issues during the visit.

The packaged RTU air conditioning strategy is a modular and economical choice because it allows the building to be easily divided into zones for heating and air conditioning. Typically, schools are divided into zones based on the space programming requirements of the school.

Packaged RTU's are manufactured with the fans and cooling/heating components all in one self-contained enclosure. All the RTU's have direct expansion cooling (DX), with heating provided by gas heating coils. The process of conditioning additional ventilation air to the proper conditions requires larger DX equipment, some form of reheat and enhanced controls, this added equipment and complexity becomes very costly. A few of the RTU's at the school are more custom and are made specifically to deliver more outdoor ventilation air.

Based on all the sources of information available for the buildings air handling systems we can conclude that the there are two categories of RTU's, variable volume and constant volume types. Variable volume RTU's regulate the amount of air they deliver to the building based on the system demand. This variable capability provides better system control and energy efficiency because the system is only conditioning the amount of air to meet the system load. These types of systems run continuously during the occupied hours of the school to maintain space temperature control and provide continuous ventilation air for the occupants. The constant volume type RTU's are either on or off. In other words, they cycle to meet the space cooling or heating load based on temperature. The fans typically operate at one speed and the cooling/heating system turns on and off to maintain the space temperature. Constant volume systems do not maintain ventilation air to the spaces while in the off cycle.

Several areas of the building are cooled with mini-split systems. These types of air conditioning systems have an indoor evaporator and a rooftop condensing unit. The ventilation air for the occupants is provided by exhaust fans ducted to the individual spaces. This ventilation strategy presents some challenges because the air transferred to the spaces through the exhaust is not controlled. In other words, we do not know where it is coming from, air exhausted in this manner is drawn from everywhere in the building and takes the path of least resistance, which may be from undesirable locations. This replacement ventilation air cannot be filtered. This type of system also does not provide for the replacement of the exhausted air and may lead to negative pressurization in the spaces. It is typically challenging to control space temperature and relative humidity with mini-split air conditioners in an institutional environment. These types of systems should only be used in application that requires supplemental cooling when required.

Operational Deficiencies

The Fairfield Warde High School building systems are operated and maintained by the school custodial staff and the team of MEP technicians that work for the town. Operational deficiencies may include system equipment deficiencies, repair, and routine maintenance concerns, ease of use, and controllability of systems to name a few. The team developed a building operator questionnaire to help identify and understand the operational deficiencies at the school.

Two operational deficiencies were identified for the school and they are the BAS system, several older RTU's and fans approaching the end of their useful life.

Recommendations to Address the Operational Deficiencies

The Metasys Johnson Controls system is difficult to access due to older software versions loaded in the system and the processing speed of the networks headend. The Town currently has an ongoing BAS project that will ultimately address standardization of the building BAS and provide the required functionality for system operation. We believe that this ongoing controls project is required and will provide the Town the ability to see how the systems are operating in real-time and provide the functionality to adjust operations and setpoints.

The Town's goal to provide a mechanical means of providing fresh air and air conditioning for all areas of the school building in accordance with current codes and standards can be achieved. We recommend that the Town adopt a standard air conditioning and ventilation system strategy and apply it to all the buildings. The current codes and standards listed below prescribe the required quantities of fresh outdoor ventilation air for the various spaces found in school occupancies. These standards also prescribe additional system requirements to meet the current energy efficiency codes, system construction, and installation standards, operation and maintenance requirements, sound criteria, and safety standards. The advent of the COVID -19 pandemic has brought the requirement for increased ventilation air for the building occupants to the forefront.

The current adopted building codes for the State of Connecticut related to building ventilation are:

2018 Connecticut State Building Code, including supplements and referenced publications
2015 International Building Code with Connecticut Amendments
2015 International Mechanical Code with Connecticut Amendments
2015 International Energy Conservation Code with Connecticut Amendments
Connecticut Building Standard Guidelines for High Performance Building Standards
Within the 2015 International Mechanical Code with Connecticut Amendments ASHRAE 62.1, 2013, Ventilation for Acceptable Indoor Air Quality is adopted

The 2015 International Mechanical Code Section 403 “Mechanical Ventilation” prescribes the minimum ventilation air rates requirements for School Occupancy Classifications and the calculations used to verify compliance. Below is Table 403.3.1.1 Minimum Ventilation Rates

OCCUPANCY CLASSIFICATION	OCCUPANT DENSITY #/1000 FT² [a]	PEOPLE OUTDOOR AIRFLOW RATE IN BREATHING ZONE, R_p CFM/PERSON		AREA OUTDOOR AIRFLOW RATE IN BREATHING ZONE, R_a CFM/FT² [a]	EXHAUST AIRFLOW RATE CFM/FT² [a]
Education					
Art classroom[g]	20	10		0.18	0.7
Auditoriums	150	5		0.06	—
Classrooms (ages 5-8)	25	10		0.12	—
Classrooms (age 9 plus)	35	10		0.12	—
Computer lab	25	10		0.12	—
Corridors (see public spaces)	—	—		—	—
Day care (through age 4)	25	10		0.18	—
Lecture classroom	65	7.5		0.06	—
Lecture hall (fixed seats)	150	7.5		0.06	—
Locker/dressing rooms[g]	—	—		—	0.25
Media center	25	10		0.12	—
Multiuse assembly	100	7.5		0.06	—
Music/theater/dance	35	10		0.06	—
Science laboratories[g]	25	10		0.18	1.0
Smoking lounges[b]	70	60		—	—
Sports locker rooms[g]	—	—		—	0.5
Wood/metal shops[g]	20	10		0.18	0.5

ASHRAE Standard 62.1 2013 Ventilation for Acceptable Indoor Air Quality works in concert with the International Mechanical Code minimum ventilation rates and expands on the IMC. 62.1 provides guidance on documenting outdoor air quality at the building, the standard enhances the table 403.3.3.3. The standard also prescribes a comprehensive list of requirements for the ventilation air system to include:

Systems and equipment standards
Calculation procedure to verify compliance
System control requirements
Construction and start-up procedures for verification
Operation and Maintenance requirements for the system

The recommended system standard that satisfies the Town's goal to provide mechanical ventilation to all its school buildings in compliance with all current codes and standards is the dedicated outdoor rooftop unit (DOAS) in conjunction with the variable refrigerant flow (VRF) system. Both systems are flexible in design, provide for ease of installation, are energy efficient, and can be provided with controls and automation for use by the trained facilities staff. Together the DOAS and VRF make up the Dedicated Outdoor Air System (DOAS)

The DOAS rooftop unit can be configured in multiple ways to deliver the ventilation air via ductwork into the building. The DOAS air handler can be applied anywhere because the utility requirements and configuration is flexible. The units can be provided with packaged DX cooling. Heating can be provided as gas, hot water or electric, and reheat, for humidity control can be any of those options or hot gas reheat. Air filtration options can be selected to include high-efficiency particulate air filters (HEPA) to provide the highest-level indoor air quality to the occupants.

This DOAS system allows for precise conditioning for the outdoor ventilation air for the occupants while utilizing high-efficiency energy recovery to reduce energy consumption. The air from the system is delivered to the occupied zones and the return air is brought back to the unit to be exhausted through high-efficiency total energy recovery heat wheels. These devices are typically between 60 to 75 percent effective at recovering both sensible and latent heat.

The DOAS ventilation air approach provides an opportunity to reduce the quantity and size of the sheet metal ductwork required in the building due to the reduced air volumes as we are only supplying outdoor air. Therefore the ductwork is smaller which makes roof penetrations smaller, ceiling coordination is more manageable, and the sheet metal cost is reduced compared to a typical AC unit installation.

The VRF system condensing units can also be applied anywhere as they can be air-cooled, or water-cooled depending upon availability and the economics. The indoor evaporator units are also flexible as they can be selected to be floor mount, wall mount, ceiling mount cassette style or concealed in the ceiling space.

The VRF system can be designed and specified to provide 100% heating capacities at below zero outdoor temperatures which may help downsize or eliminate envelope perimeter heating systems and is installed with small refrigerant piping inside the ceiling cavities, providing individual zone temperature control. The part load cooling energy consumption of the system is very low and reduces energy consumption. The VRF system is a flexible system that can simultaneously heat and cool, on a summer morning a room with an east exposure can receive cooling while a room on the west may need a little heat, the same system can provide both with the proper system accessories.

The DOAS system is an excellent standardized air conditioning and ventilation solution because it operates at the minimum capacity to respond to the building ventilation and cooling loads. Good installation practices, testing adjusting and balancing, and commissioning are key activities to acquiring the most benefit from the DOAS system.

CONCEPTUAL COST ESTIMATE

Conceptual Cost Estimate Narrative

A conceptual cost estimate was prepared based on new construction for the proposed mechanical improvements to Fairfield Warde High School. Construction costs are estimated based on 4th quarter 2021 price indices using comparable pricing data.

Subtotal estimated capital cost (includes phasing premium and not escalation) is $18,018,000 to provide the proposed mechanical improvements. (See master spread cost estimate for detail) and includes HVAC, Electrical, Architectural Improvement and Fire Protection (as required). The HVAC cost includes replacement of isolated mini splits with new central systems.

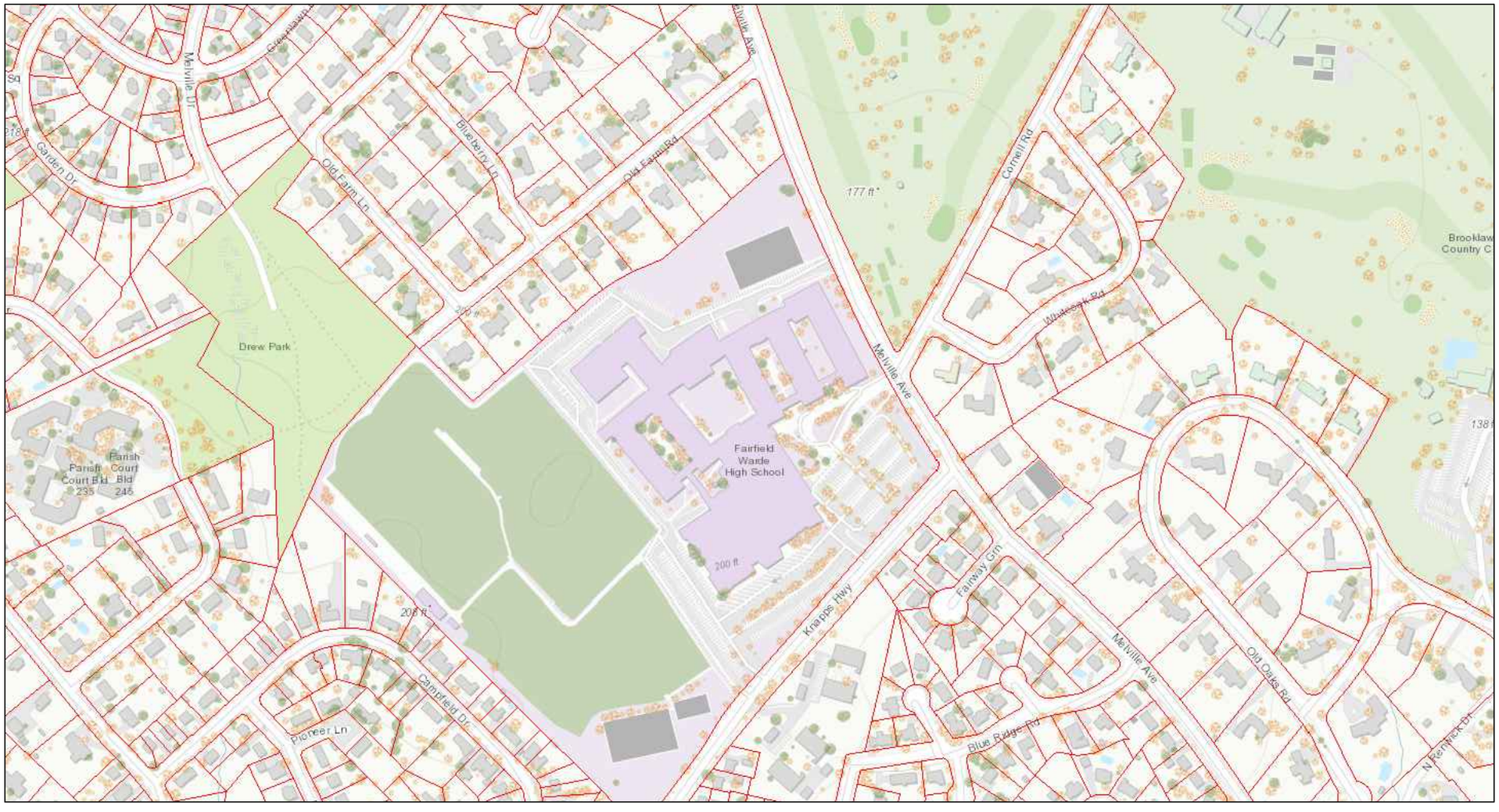
Conceptual cost estimates are inherently speculative due to the absence of design documents. We make significant assumptions and apply conservative contingencies to account for the risk of unknowns.

Key assumptions are that the existing ceiling is suspended and replaced in order to install ductwork, and coordinate supply / return air grills with a reflected ceiling plan. New 2x4 or 2x2 LED lighting installed in conjunction with a new ceiling grid. New equipment is roof mounted, and structural steel headers and transfer beams can be retrofit to support new equipment without the necessity of new columns and footings. Our estimate excludes lead paint and asbestos abatement.

The estimate includes all new local controls for the new equipment tied into the existing new BMS system which is being done via another procurement.

There are studies[1] on recommended contingencies based on the level of design. Each considers risk associated with the level of design, nature of a project, capital market conditions, etc. For this exercise we use 15% soft cost and 15% design contingency.

[1] American Society of Professional Estimators, American Institute of Architects MBA joint committee, Columbia University, Texas A&M University, Arizona State University, GSA, FHWA, and DOT.



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DTC PROJECT NUMBER: 20-250
DTC DRAWING FILE: ...\Site Plan Recovered

SCALE: NTS DRAWN BY: AS

DATE: CHECKED BY: GC

FAIRFIELD WARDE HIGH SCHOOL

SITE PLAN

FAIRFIELD
CONNECTICUT

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District Name:	FAIRFIELD PUBLIC SCHOOLS
Building Name:	Fairfield Warde High School
Address:	755 Melville Avenue Fairfield, CT 06825

Basement

Access Controlled Doors are displayed in ORANGE

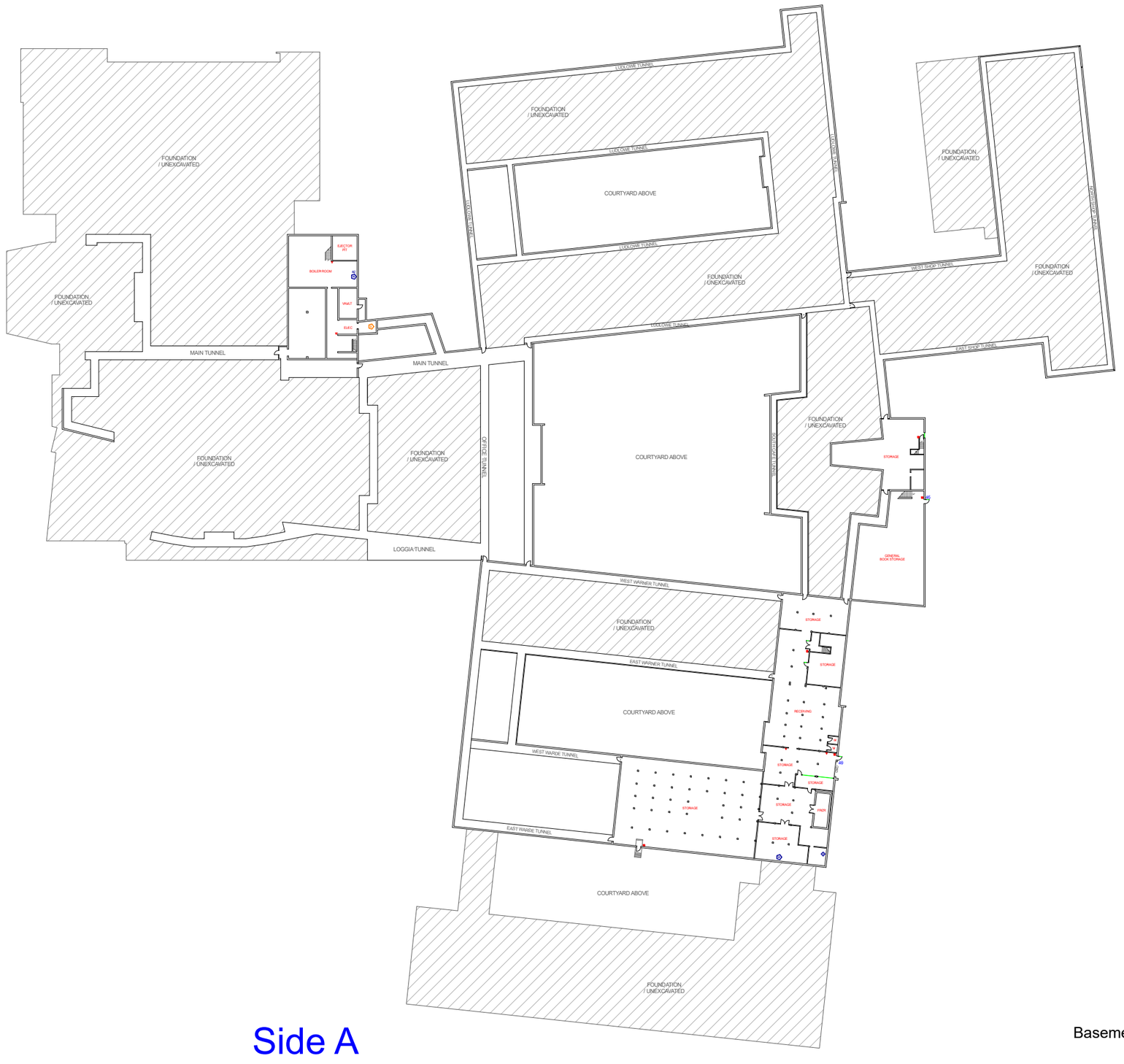
Side B

Legend

- Chair Lift
- M/W/T — Bathrooms: Mens, Womens, Unisex
- ST — Storage
- OHD — Overhead Door
- E — Elevator
- Emergency Phone
- KNOX — Knox Box
- W — Water Shutoff
- S — Sprinkler Shutoff
- E — Electrical Shutoff
- GAS — Gas Shutoff
- R — Ramp
- GEN — Emergency Generator
- FACP — Fire Alarm Control Panel
- FDC — Fire Dept. Connection
- FX — Fire Extinguisher

Side C

For Official Use Only



Side D

Basement Floor Plan

Side A

District Name:	FAIRFIELD PUBLIC SCHOOLS
Building Name:	Fairfield Warde High School
Address:	755 Melville Avenue Fairfield, CT 06825

1st Floor

Access Controlled Doors are displayed in ORANGE

Side B

Legend

- Chair Lift
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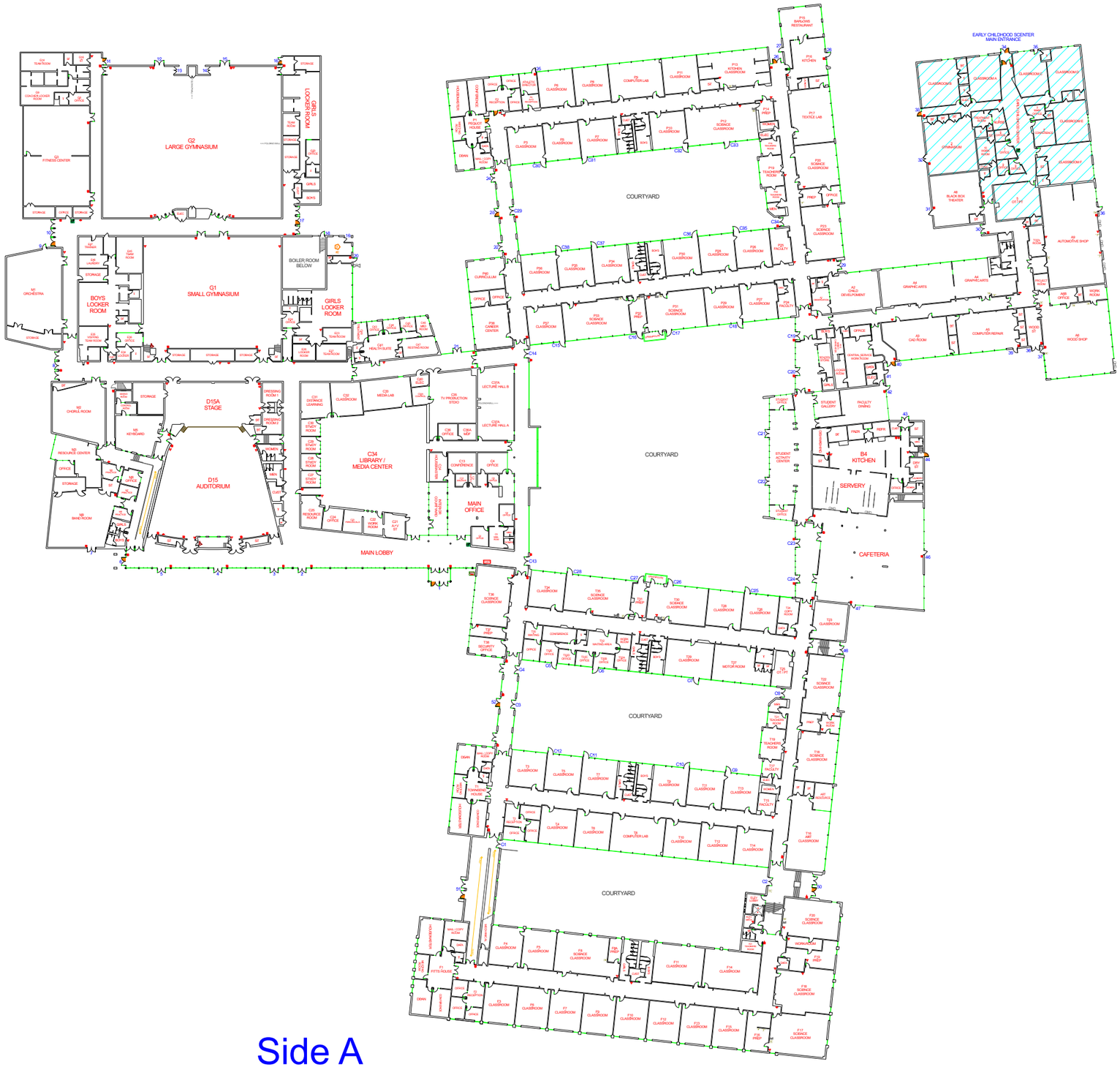
- ST — Storage
- OHD — Overhead Door
- E — Elevator
- Emergency Phone
- KNOX — Knox Box
- W — Water Shutoff
- S — Sprinkler Shutoff
- E — Electrical Shutoff
- GAS — Gas Shutoff
- R — Ramp
- GEN — Emergency Generator
- FACP — Fire Alarm Control Panel
- FDC — Fire Dept. Connection
- FX — Fire Extinguisher

BE SAFE TECHNOLOGIES INC

Side C

For Official Use Only



Side D

1st Floor Plan

Side A

District Name:	FAIRFIELD PUBLIC SCHOOLS
Building Name:	Fairfield Warde High School
Address:	755 Melville Avenue Fairfield, CT 06825

2nd Floor

Access Controlled Doors are displayed in ORANGE

Side B

Legend

- Chair Lift
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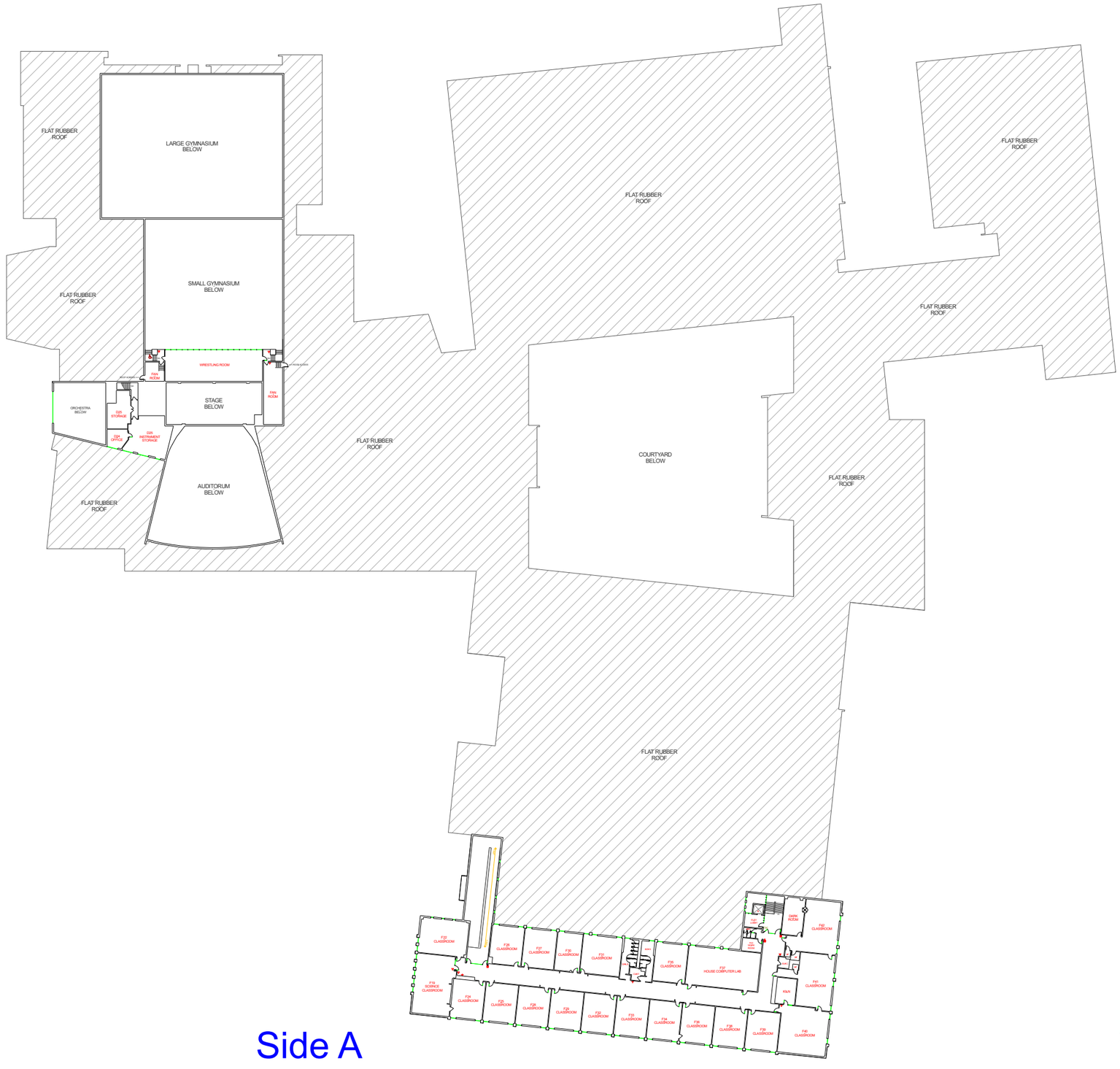
BE SAFE TECHNOLOGIES INC

Side C



Side D

2nd Floor Plan

Side A