Fairfield Public Schools Facilities Condition Assessment

Timothy Dwight Elementary School
1600 Redding Road
Fairfield, CT 06824

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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 Facility Condition Assessment Analysis Reports The following is the assessment for the Timothy Dwight Elementary School.

Property Details

The school is located at 1600 Redding Road in the town of Fairfield and is currently used as an elementary school. This 41,000 SF building was originally built in 1962 and has been renovated or has been added onto in the 1960's and 2000.

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 (2021) of the recommended system, including soft costs and contingencies.

The team approach adopted for this scope of work included several activities to gather and share all of 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, when available, 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

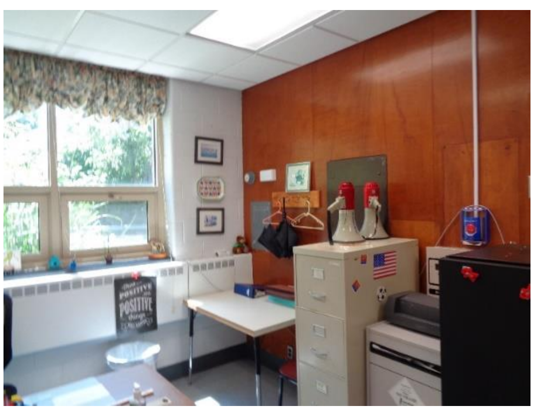
Existing Mechanical Systems

The Fairfield Timothy Dwight School is a 41,000 SF building that has been renovated over time undergoing two renovations over the life of the building, an existing floor plan and site plan can be found in Appendix A and Appendix B respectively.

The school has an existing central hot water heating plant that consists of two high efficiency Viessmann Vitorond 200 cast iron boilers. The boilers were installed in 2012 the boilers have an input rating of 2.5 million btu/hr. The boilers have dual fuel Riello burners that can use either natural gas or diesel oil for combustion. Each boiler has a fractional horsepower circulator pump for thermal control. Hot water is circulated through the building by two 7.5 horsepower base mounted pumps, these two pumps are configured so that either can serve the two hot water loops out to the building. The pumps are configured as primary stand-by arrangement and that each is sized for 100% of the flow, no variable speed drive were noted, and we assume that the pumps operate at constant volume. The median service life for base mounted pumps is 20 years and the median service life for the cast iron boilers is 30 years. Terminal hot water heating equipment located at the building perimeter includes finned tube radiators and cabinet unit heaters.

Existing Boilers in Boiler Room

Existing Hot Water Pumps



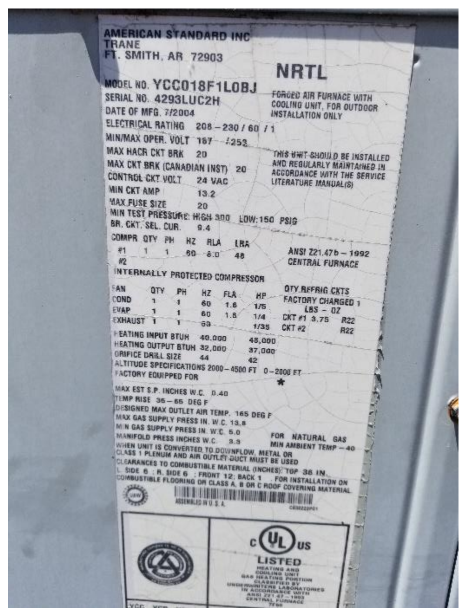
Existing Perimeter Heat

The domestic hot water for the school is provided by a 100-gallon AO Smith gas fired water heater with an input rating of 199,000 btu/hr, the water heater was manufactured in 2018 and is 3 years old. The typical service life for commercial water heaters is 10 yrs. There is one 110-degree hot water loop with fractional horsepower circulation pumps that serve the various areas of the school

There are six rooftop air conditioning units (RTU's) of various sizes and capacities located on the roof of the school. All of the RTU's have DX cooling and gas heat. The ages of the equipment vary but most are in the 10-year range. RTU-3 is 17 years old. The median service life of this type of equipment is 15 years.

Existing RTU's 4 and 5 to be replaced in 2021

Existing Kitchen Make-up and Exhaust



Existing RTU-3

There are six 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 grade or on the roof. These systems provide flexible room by room cooling capability. We observed equipment by a few different manufacturers and all evaporators are wall mounted and

Existing Rooftop Mini Split Condenser

Existing Wall Mounted Mini Split Condenser

There are exhaust fans scattered throughout the building that serve toilets, MER's, science rms, storage rms, kitchen and other spaces. Most are small mushroom style down blast type and some are the louvered penthouse type but all are typical for a school application.

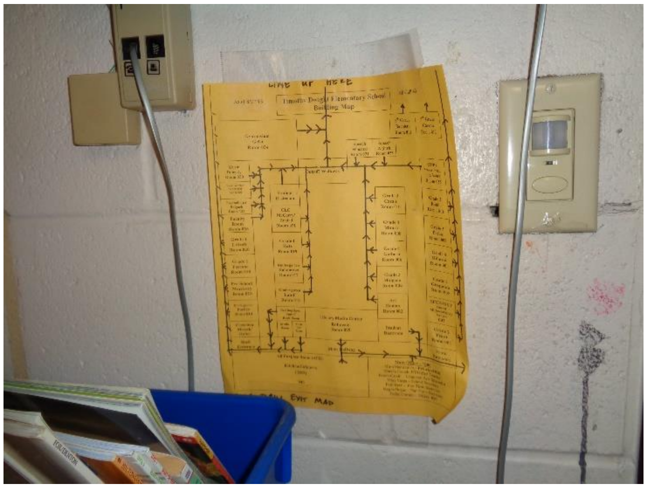
Existing Rooftop Exhaust Fan.

Existing Rooftop Equipment

There is an existing Automated Logic Building Automation/Johnson Controls system in the building. It was noted with the building custodian that access is available in the general storage room.

Existing Electrical Systems

The purpose of this site visit was to perform an on-site inspection, meet with knowledgeable school staff and gain an understanding of the current condition, operation and maintenance of the entire school facility. The main electrical service is located in the boiler room with HVAC equipment. The main electrical service entrance consists of one 120Y/208 V 1200A switchgear and MDP that distributes power to the entire building. There were also branch circuit panels in corridors scattered around the building. A two section 225A panel “Y” in boiler room supports heating and other systems. Two panels are on the roof which supply the roof top units and exterior outlets with power. There is no permanent emergency generator, the emergency egress lighting is powered by a battery backup fixtures. There is an outside receptacle and 200A manual transfer switch to panel “Y” for a portable roll up generator connection to feed panel “Y” during an extended utility outage such as wire out after an ice storm. Depending on the power requirements for the new mechanical equipment, the existing panels and switchgear may need to be replaced. New panel schedules should be typed and fitted reflecting correct updated circuiting on all panels.




WARNING
CAUTION SOLAR CIRCUIT

Facility Condition Assessment Analysis

Our facilities condition assessment is based on our field observations during our site visit on June 28th, 2021, and the multiple video conferences held with the Town staff that operate the building. This school has an existing hybrid BAS for the conditioned areas, but we were not able to access the system during our site visit. Our understanding is that the legacy system has operating and access issues that are slated for modification and improvements.

The majority of mechanical equipment that serves the school is mounted 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 strategy is a modular and economical choice because it allows the building to be easily divided into zones for heating and air conditioning. Schools are typically divided into zones based on the space programming.

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), heating is provided by natural gas. This type of equipment typically can only provide limited outside ventilation air to the spaces they serve. This limited capability is due to the DX cooling component of the equipment. The process of conditioning outdoor air to the proper conditions requires larger DX equipment, some form of reheat and enhanced controls, this added equipment and complexity becomes very costly.

Based on all of the sources of information available for the buildings air handling systems we can conclude that the units are constant volume type. 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.

A few areas of the school 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 a commercial environment. These types of systems should only be used in application that require supplemental cooling when required.

Operational Deficiencies

The Fairfield Dwight Elementary School building systems are operated and maintained by the school custodial staff and the team of MEP technicians that work for the town. Building operational deficiencies is a broad term and is dependent upon many factors. 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. We met with Dan Volza on the day of the site visit.

Operational deficiencies identified for the school are accessibility, the BAS system, The boiler piping configuration and the age of the hot water pumps.

Recommendations to Address the Operational Deficiencies

There are some new Automated Logic BAS controllers, but the legacy 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.

To address the boiler piping and pump concerns we recommend the town should engage a mechanical contractor, a testing company, and an engineer, to test the associated boiler equipment to confirm the current operational capacities and compare that against the equipment IO and M manuals. The information should be reviewed, and any system modifications and equipment repair and adjustments should be performed.

The Towns goal to provide a mechanical means to provide 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 (IMC) 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 FT^2 [a]	PEOPLE OUTDOOR AIRFLOW RATE IN BREATHING ZONE, R_p CFM/PERSON		AREA OUTDOOR AIRFLOW RATE IN BREATHING ZONE, R_a CFM/FT^2 [a]	EXHAUST AIRFLOW RATE CFM/FT^2 [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 IMC minimum ventilation rates and expands on their requirements. The standard provides guidance on documenting outdoor air quality at the building and additional ventilation calculation procedures to ensure compliance. The standard also prescribes a comprehensive list of requirements for the design, documentation and construction of ventilation air systems 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 system standard that we recommend meeting the Towns goal to provide mechanical ventilation at all of its school buildings in compliance with all current codes and standards is the dedicated outdoor air unit (DOA) in conjunction with the variable refrigerant flow (VRF) air conditioning system. Each of these systems are flexible in design, provide for ease of installation, are energy efficient and can be provided with controls and automation so that they can be operated by the trained facilities staff.

The DOA unit is located outdoors and can be configured in multiple ways to route the ventilation air ductwork into the building. The DOA can be applied at the school sites because the utility requirements and system configuration are flexible. The unit can be provided with packaged DX cooling, heating can be natural gas, hot water or electric. Reheat can be natural gas or refrigerant hot gas.

The VRF condensing units can also be applied at the school sites because they can be air cooled, or water cooled depending upon site utilities and economics. The internal cooling units are also flexible, they can be selected to be floor mount, wall mount, ceiling mount cassette style or concealed in the ceiling space.

Together the DOA and VRF make-up the Dedicated Outdoor Air System (DOAS)

This DOAS system allows for precise conditioning for the outdoor ventilation air for the occupants while utilizing high efficiency energy recovery equipment to reduce energy consumption. The fresh 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. The system is only designed to deliver the ventilation air volume, not the combined ventilation air and cooling air of traditional systems. The ductwork is smaller which makes roof penetrations smaller, ceiling coordination is more manageable, and the installed cost is reduced.

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. The system is installed with small refrigerant piping inside the ceiling cavities and provides 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 provides both.

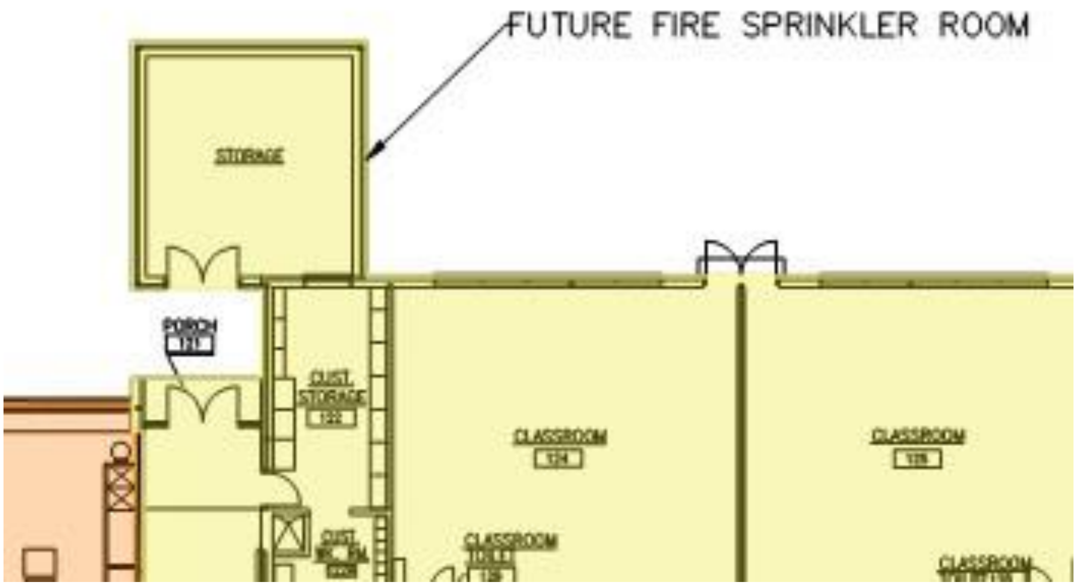
The DOAS system is an excellent standardized air conditioning and ventilation solution because it operates at the minimum capacity to respond to the building ventilation and cooling loads. Good installation practices, testing adjusting and balancing and commissioning are key to getting the most benefit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

The electrical infrastructure of the school may require updating to accommodate adding DOA unit and VRF air conditioning loads. The actual electrical system requirements are determined when the addition of DOAS systems is determined and is highly dependent upon how much of the school area is updated and if the construction is phased or all done at one time.

Fire Protection

The building currently does not have any fire protection, another of the Towns goals is to provide it for all schools. The design of the fire protection system is dependent on meeting the requirements of NFPA 13 Standard for the Installation of Sprinkler Systems and the available water pressure at the site to determine if it is sufficient to meet all requirements. The system requires a separate service entrance with the required valves, drains, test piping and fire department connection. We assume a fire pump is required for the report because it is the most conservative approach and requires more space for installation, piping, testing and servicing. During our visit we noted that there is not a lot of space within the building that could be used that would not upset the programming. We considered the existing mechanical room but there is not sufficient space for new fire protection equipment.

We propose using the existing storage space to house the future code fire protection equipment and piping.



ORDER OF MAGNITUDE/CONCEPTUAL COST ESTIMATE

Conceptual Cost Estimate Narrative

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

Subtotal estimated capital cost is $5,681,000 to provide the proposed mechanical improvements. (See master spread cost estimate for detail.) and includes HVAC, Electrical, Architectural Improvement and Fire Protection. The HVAC cost includes replacement of isolated mini splits with new central system.

The cost estimates include replacement of the electrical equipment including switchgear, transformers, and panels, etc. as part of the HVAC project.

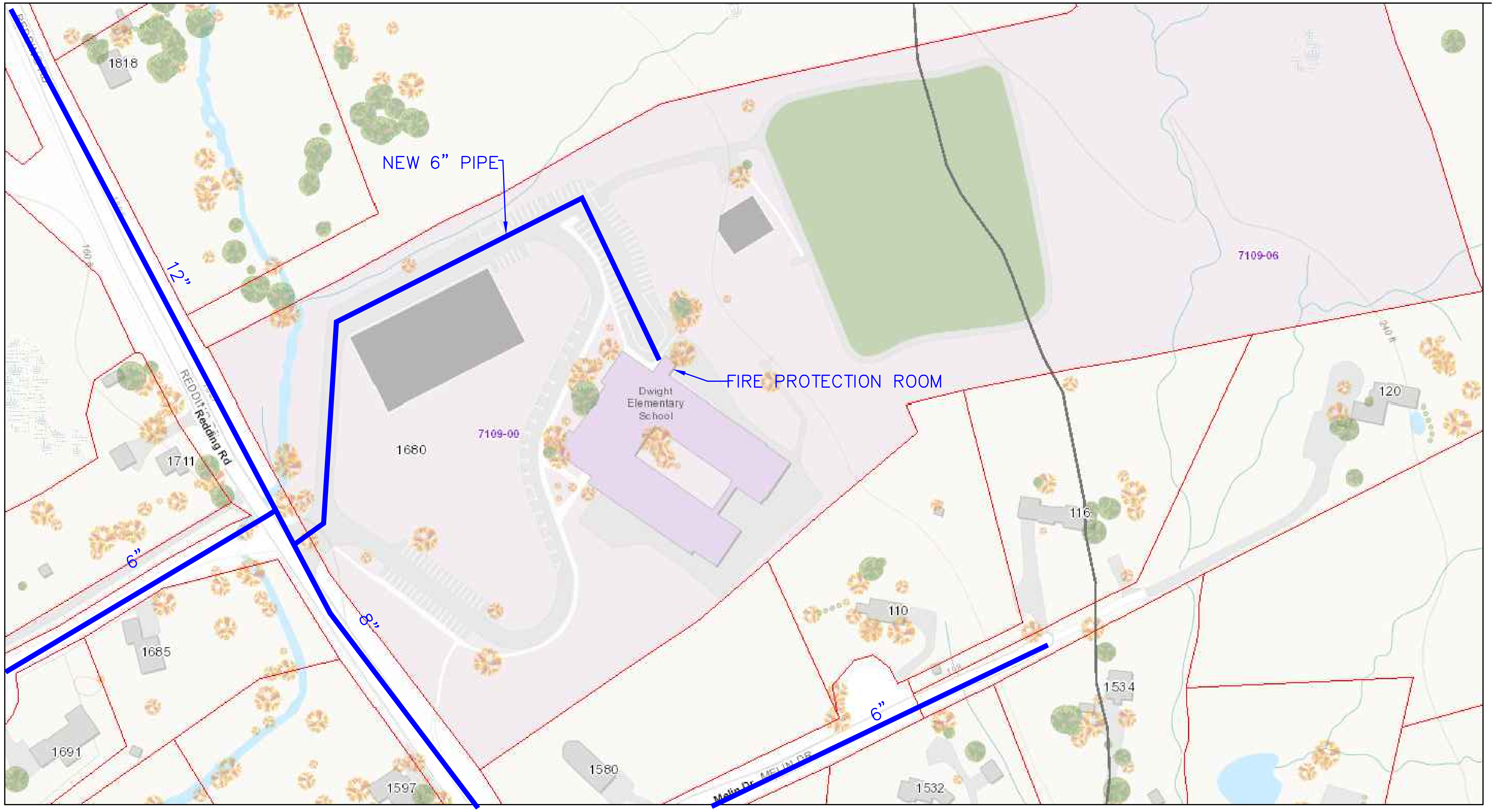
Conceptual cost estimates are inherently speculative due to the absence of design documents. We make significant assumptions and apply conservative contingencies to account for the risk of unknowns.

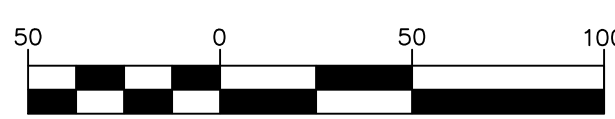
Key assumptions are that the existing ceiling is suspended and replaced in order to install ductwork, and coordinate supply / return air grills with a reflected ceiling plan. New 2x4 or 2x2 LED lighting installed in conjunction with a new ceiling grid. New equipment is roof mounted, and structural steel 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 costs 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

DWIGHT ELEMENTARY SCHOOL

SITE PLAN

FAIRFIELD
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EXISTING A/C

PROPOSED A/C

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PROJECT NORTH

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EXISTING FLOOR PLAN
DWIGHT ELEMENTARY SCHOOL

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