Paterson Public Schools – Phase II

Energy Savings Plan Rev.2

Project Number: ESG-Project # DPBWI00533

Paterson, New Jersey | March 19th, 2020

energy systems group

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SECTION 1. EXECUTIVE SUMMARY

Various energy conservation measures were evaluated in the development of this Energy Savings Plan (ESP). Energy Systems Group has performed field verifications, collected data and taken field measurements to ensure the development of the most cost-effective solutions as well as accurate savings calculations. Various solutions were reviewed with the school district's administration to develop a set of Energy Conservation Measures (ECMs) that allow the school district to address the facility's priority items while reducing the total annual energy spend for the District. This study expands upon the original energy audit conducted by NORESCO. The original audit information was used for building descriptions as well as an overall indication of the District needs.

Priority items include:

- Upgrade interior lighting throughout the 24 buildings with newer LED technology
- Install new Direct Digital Controls (DDC) with a unified web-based front-end system
- Replace Steam Traps in all steam buildings
- Tie existing electric and gas meters into new Building Management System
- Improve building leakage by upgrading Building Envelope

Energy Savings

Energy saving calculations performed in the development of this ESP was completed using Microsoft Excel worksheets with Bin weather data to accurately model the building systems. Additional spreadsheets were used for measures that are not affected by the weather, such as lighting savings. Energy savings have been provided electronically for ease of review. All of the energy savings calculations that have been performed are in accordance with the New Jersey Clean Energy Program Protocols to Measure Resource Savings.

Benefits

The measures investigated in this Energy Savings Plan could result in an annual utility savings of **5,098,595** kWh's of electricity and save **269,775** therms of natural gas. The total utility cost savings is **$20,310,452** over the life of the project **(20 years)**. Additionally, these energy savings and on site renewable energy production will result in a net reduction of greenhouse gases and will reduce the school district's carbon footprint by **12,422,723** lbs of CO_2 annually. All these savings are achieved while improving the classroom environment and renewing many items that have been in service beyond useful life expectancy.

SECTION 2. PROJECT DESCRIPTION

This Energy Savings Plan (ESP) addresses the following facilities. Any description in this report-stating district wide or similar refers only to the buildings listed below:

Paterson School District	
Academy of Earth and Space Sciences (Panther)	201 Memorial Drive, Paterson, NJ 07505
Dale Avenue	21 Dale Avenue, Paterson, NJ 07505
Department of Facilities	200 Sheridan Drive, Paterson, NJ 07502
District Central Offices	90 Delaware Avenue, Paterson NJ 07503
Early Learning Center	660 14th Avenue, Paterson, NJ 07501
Eastside High School	150 Park Avenue, Paterson, NJ 07501
Edward Kilpatrick	295-315 Ellison Street, Paterson, NJ 07501
John F. Kennedy High School	61-127 Preakness Avenue, Paterson, NJ 07502
New International High School	200 Grand Street, Paterson, NJ 07502
New Roberto Clemente School	482-506 Market Street, Paterson, NJ 07501
New Roberto K Center	512 Market Street, Paterson, NJ 07501
Norman S. Weir	152 College Boulevard, Paterson, NJ 07505
Rev. Dr. Martin Luther King Jr.	851 E. 28th Street, Paterson, NJ 07513
Roberto Clemente Elementary	434 Rosa Parks Boulevard, Paterson, NJ 07501
Rosa L. Parks School of Fine and Performing Arts	413 12th Avenue, Paterson, NJ 07514
Rutland Early Childhood Learning Center	823 East 28th Street, Paterson, NJ 07513
School 12	121 North Second Street, Paterson, NJ 07522
School 13	690 East 23rd Street, Paterson, NJ 07504
School 17	112 North 5th Street, Paterson, NJ 07522
School 18	51 East 18th Street, Paterson, NJ 07524
School 28	200 Presidential Boulevard, Paterson, NJ 07502
School 6	137 Carroll Street, Paterson NJ 07501
School 7	106 Ramsey Street, Paterson, NJ 07501
Silk City 2000 Academy	151 Ellison Street, Paterson, NJ 07505

Facility Descriptions

Academy of Earth and Space Sciences (PANTHER)

Academy of Earth and Space Sciences (PANTHER)

Background Information

Academy of Earth and Space Sciences (PANTHER) is located at 201 Memorial Drive in Paterson, NJ. This 27,854 ft^2 facility was originally built in 2004 and remains in fair condition. Academy of Earth and Space Sciences (PANTHER) is a single structure building with a ground level and a two-story planetarium.

Building Occupancy

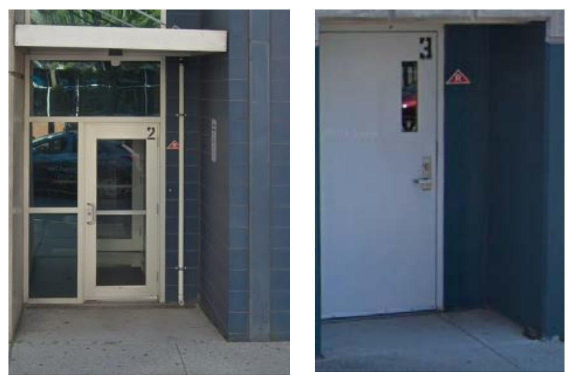
Approximate enrollment is 221 students with a full-time staff of 26 people, including frequent visitors. Full occupancy of the building is through the months of September to June. Partial occupancy of the building remains during the summer months.

<u>Hours of Operation</u>

- Monday through Friday 6:30 am to 5:00 pm (students/staff)
- Monday through Saturday 6:30 AM to 12:00 AM (custodial staff)
- Saturday and Sunday hours vary

Envelope

PANTHER is a single structure building with a two-story planetarium. The exterior wall of the building is a brick façade which is in good condition. The roof is flat with an EDMP overlay which is in good condition. The building has double pane, fixed, and single hung windows that cover approximately 40-50% of the facade. The building has three (3) single doors which are in good condition.

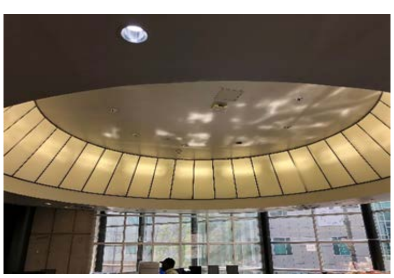


Building Envelope

Lighting

The majority of lighting fixtures throughout the building are fluorescent fixtures which contain 32W T8 lamps and F31 U-Tube fixtures. Some areas have recessed can fixtures and wall sconce fixtures with compact fluorescent plug in lamps. The fixtures are in good condition which provides a great opportunity for energy savings by retrofitting to LED technology.

<u>Lighting Controls:</u> The lighting in individual rooms are manually controlled via wall and sensor mounted switches.



Light Fixtures – Panther Library

Panther – Rooftop Unit

Mechanical Systems

HVAC Systems and Equipment: Heating for the building is provided by hot water generated by two (2) natural gas-fired boiler. This natural gas-fired boiler was installed during the original construction of the school and is expected to live its estimated service life.

Heating hot water is supplied to the baseboard heaters throughout the building by one (1) circulation pump (with in-line backup).

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
Boiler	Boiler Room	Building	Caravan	GG-399 HEC	2007	-	399 MBH

Additional heating is provided by the three (3) natural gas-fired constant volume rooftop handlers. These three (3) rooftop handlers also serve the building's cooling load.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
RTU-1	Roof	Building	Trane	YCD600AEHL2B8NH5-AB0D0FGH000M0	2003	81%	50 tons 800 MBH
RTU-2	Roof	Building	Trane	YCD301C3HGCA	2003	81%	25 tons 400 MBH
RTU-3	Roof	Building	Trane	YCD301C3HGCA	2003	81%	25 tons 400 MBH

Air Handling Systems: Ventilation of the building is facilitated by the existing three (3) rooftop units in addition to one (1) rooftop exhaust fan. The majority of the equipment appears or is assumed to be in good condition.

Panther Academy Domestic Hot Water Heater

Hot Water Systems

Domestic Hot Water: The building is supplied hot water by one (1) natural gas-fired hot water heater that is of standard efficiency. This hot water heater was installed during the original construction of the school and is expected to remain in operation for the remainder of its estimated service life.

Building Controls (HVAC Controls)

The building's equipment is controlled by self-contained local thermostats, controllers or switches. The building's rooftop units are controlled by a building management system that is exclusively operated by Trane technicians. The normal temperature set points for PANTHER are as follows:

Time Period	Heating Season	Cooling Season
Occupied Hours	**72°F**	**74°F**
Unoccupied Hours	**60°F**	**80°F**

Plug Load

The building's plug load consists of general office equipment, kitchen equipment, lab, and classroom equipment. Computers and classroom equipment are frequently left on, or on standby, and are therefore eligible for computer power management systems or software.

Refer to Appendix 4 for device quantities.

Panther – Plug Loads

Plumbing/Water System

The ESG team observed that all (11) faucets currently use high flow 2.0 gallon per minute (gpm) or higher and the showerheads are assumed standard and rated for 2.5 gpm or higher aerators that can be replaced with low flow aerators. Additionally, toilets and urinals located in the restroom areas have a rating of 1.6 and 1.0 gallons per flush, respectively.

Dale Avenue

Background Information

Dale Avenue is located at 21 Dale Ave in Paterson, NJ. This 61,931 ft^2 facility was originally built in 1890 and is in fair condition. Dale Avenue consists of one single structure building with the tallest portion being four (4) stories including the ground level.

Building Occupancy

Approximate enrollment is 364 students with 31 full-time staff members. The building is fully occupied September through June and is vacant during the summer months.

<u>Hours of Operation</u>

- Monday through Friday 6:30 am to 6:00 pm (students/staff)
- Weekend hours are varied.

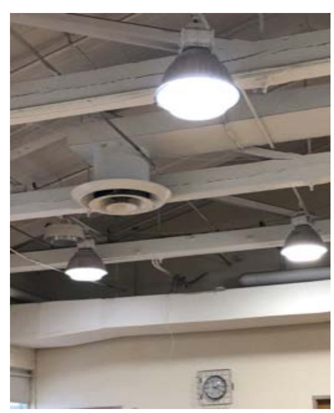
Building Envelope

Envelope

Dale Avenue is a single structure building with the tallest portion being four (4) stories. The building's exterior wall construction is a brick façade which appears to be in good condition. The roof of the building is sloped with shingles. The building has double pane, fixed, and single hung windows that cover approximately 50% of the exterior. These windows appear to be in good condition. The exterior doors include one (1) double door and thirteen (13) single doors that are in fair condition.

Lighting

The building is primarily lit by linear fluorescent fixtures which contain 32W T8 lamps. Fixtures throughout the building include individual fixtures with incandescent lamps, individual compact fluorescent lamps, and high bay fixtures.



Gymnasium Light Fixtures

The exterior lighting includes building mounted wall pack fixtures, flood fixtures along the overhang and pole mounted area light fixtures. These contain compact metal halide lamps. The fixtures are in good condition which provides a great opportunity for energy savings by retrofitting to LED technology.

<u>Lighting Controls:</u> The lighting fixtures are manually controlled via wall and sensor mounted switches.

Existing Boiler

Mechanical Systems

HVAC Systems and Equipment: The building is heated from low pressure steam that is provided to all classroom and office unit ventilators and air handlers. The low-pressure steam is supplied by two (2) natural gas-fired, standard-efficiency boilers. Steam from the boilers serve the classroom and office space unit ventilators. The age of the boilers is unknown (Boiler #1 appears to be circa 1993 and Boiler #2 appears to be circa 1996), but they appear to be in good working condition and are expected to operate throughout their life expectancy.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
Boiler 1	Boiler Room	Building	Smith	28A-13	1993	-	4180 MBH
Boiler 2	Boiler Room	Building	Smith	28A-13	1993	-	4180 MBH

Chiller

AHU

Air Conditioning is provided by one (1) 250-ton air-cooled chiller that is located behind the building. This chiller serves the classroom unit ventilators and two (2) Carrier air handlers. AHU-1 is located on the first floor in the building's mechanical room and AHU-2 is located above the gymnasium. The rated kilowatt input for this chiller is 856 kilowatts. Glycol circulates the building through a pump in the building's boiler room.

Additional cooling throughout the building is provided by twenty-five (25) window AC units. Ventilation throughout the building is managed from two (2) air handlers that service the classrooms, lounges, and office areas. These air handlers are approximately 14 years old and are expected to serve their full life expectancy.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
AHU-1	Mech Room	First & Second Floor	Carrier	39THWTA-N-AB	2003	-	-
AHU-2	Gymnasium	Gym	Carrier	-	2003	-	-

Domestic Hot Water Systems

The building is supplied domestic hot water by two (2) hot water heaters. An electric hot water heater is in the kitchen and serves the kitchen. A natural gas-fired hot water heater which is in the mechanical room and serves the entire building.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
Electric DWH	Kitchen	Kitchen	Bradford White	RE340T6-1NCWW	-	-	40 gal
DWH	External Mech Room	Building	Vanguard	-	-	-	50 gal 40 MBH

Building Controls (HVAC Controls)

The equipment in the building is controlled by standalone, local thermostats, controllers or switches. The air handler is controlled by a t.a.c AAM controller. The typical temperature set points for Dale Avenue are as follows:

Time Period	Heating Season	Cooling Season
Occupied Hours	**72°F**	**74°F**
Unoccupied Hours	**60°F**	**80°F**

Building Controls

Kitchen Equipment

The building has a warming kitchen that serves staff and students Monday through Friday.

Plug Load

The facility's plug load consists of general office equipment, kitchenette equipment, and general classroom equipment. Office equipment is always regularly left in the 'on' state allowing the individual machine to revert to the 'Sleep' mode based on an internal timer.

Refer to Appendix 4 for device quantities.


Building Plug Load

Plumbing/Water System

The ESG team observed that all (46) faucets currently use high flow 2.0 gallon per minute (gpm) or higher and the showerheads are assumed standard and rated for 2.5 gpm or higher aerators that can be replaced with low flow aerators. Additionally, toilets and urinals located in the restroom areas have a rating of 1.6 and 1.0 gallons per flush, respectively.

Department of Facilities

Background Information

The Department of Facilities is located at 200 Sheridan Drive in Paterson, NJ. This 55,525 ft^2 facility was originally built in 1950 and is in fair condition. The Department of Facilities acts as general storage for the district and houses food services and office space.

Building Occupancy

Approximately 70 full-time or part-time employees year-round.

Hours of Operation

- Monday through Friday 6:00 am to 10:00 pm (students/staff)
- Sunday 11:00 am to 3:00 pm

Building Envelope

Envelope

The building is constructed of composite walls with a brick façade, the tallest section of the building is two (2) stories. This building has flat roofs with an EPDM overlay that appears to be in good condition. The building has double pane, fixed, and single hung windows that appear to be in good condition. There is approximately ten (10) exterior doors and three (3) loading doors which are all in poor condition.

Lighting

The building is primarily lit by linear fluorescent fixtures and corresponding electronic ballast which contain 32W T8 lamps. The exterior lighting includes building mounted wall pack fixtures. These fixtures contain compact metal halide and cobra lamps. The fixtures are in good condition which provides a great opportunity for energy savings by retrofitting to LED technology.

Lighting Controls: The lighting fixtures are manually controlled via wall and sensor mounted switches.

Interior Light Fixtures

Reznor Unit Heater

Mechanical Systems

HVAC Systems and Equipment: The Department of Facilities heating is space specific throughout the building. There are multiple natural gas-fired furnaces, seven (7) 20-foot infrared space heating poles and four (4) natural gas-fired blowers.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
Gas Unit Heaters (3)	Warehouse	Locker Rooms	Dayton	4LX60	2015	-	200 MBH
Infrared Gas Heaters (7)	Warehouse	Warehouse	Sun Star	-	2015		75 MBH
Furnace	Warehouse	Warehouse		PDMU-PB30W152A	-	80%	152 MBH

The building is heated and cooled by four (4) constant volume rooftop HVAC units that serve the food service area and facilities offices with cooling and heating. These units are in good condition and are expected to live their estimated life expectancy.

There are also three (3) split units that serve specific spaces including the food service office space and conference room.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
RTU-1	Roof	Director Office	York	DAYA-F024070C	-	81%	2 tons 70 MBH
RTU-2	Roof	Facilities	Trane	YCD151C3HABB	-	81%	12.5 tons 250 MBH
RTU-3	Roof	Admin Areas	York	DAYA-F030N070c	-	81%	2.5 tons 70 MBH
RTU-4	Roof	Food Services	Trane	YHC0723A3RHA27C	-	81%	6 tons 150 MBH

Domestic Hot Water Systems

The warehouse area is supplied domestic hot water by two (2) electric water heaters. The office area is supplied domestic hot water by one (1) natural gas-fired water heater.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
DWH 1 &2	Restroom	Hot Water	AO Smith	ECL 30 200	-	99%	30 gal 4500 watts
DWH 3	Restroom	Office Area	Vanguard	5AU70		80%	33 MBH

Building Controls (HVAC Controls)

Building controls consist of standalone, local thermostats, controllers or switches.

The typical set points for the Department of Facilities are as follows:

Time Period Heating	Heating Season	Cooling Season
Occupied Hours	78°F	70°F
Unoccupied Hours	70°F	80°F

Trane Thermostat

Plug Load

The facilities plug load consist of general office, kitchen, and warehouse equipment. This plug load includes a refrigerated vending machine, refrigeration units, electronic time clock, a commercial copy machine and various printer and computer systems.

Refer to Appendix 4 for device quantities.

Building Plug Load

Plumbing/Water System

The ESG team observed that all (8) faucets currently use high flow 2.0 gallon per minute (gpm) or higher and the showerheads are assumed standard and rated for 2.5 gpm or higher aerators that can be replaced with low flow aerators. Additionally, toilets and urinals located in the restroom areas have a rating of 1.6 and 1.0 gallons per flush, respectively.

District Central Offices

District Central Offices

Background Information

The District Central Office(s) is located at 90 Delaware Avenue in Paterson, NJ. This 113,385 ft^2 facility was originally built in 1926 and is in fair condition. The District Central Offices have three floors that mainly consist of office space and a shared kitchen. The kitchen is shared with a private catering company.

Building Occupancy

Approximately 300 full-time or part-time staff members occupy the building. The building is occupied year-round.

Hours of Operation

- Monday through Friday 6:30 am to 6:00 pm.
- The building is at full occupancy year round.

Envelope

The building is constructed of composite walls with a brick and concrete façade. The building is three stories tall. This includes a basement, ground level and two (2) floors. This building has flat roofs with an EPDM overlay that appears to be in good condition. The building envelope is covered with approximately 60% of double pane, fixed, or sliding metal frame windows that all appear to be in good condition. The building has one (1) overhead door, two (2) single doors, and two (2) sets of double doors which also appear to be in good condition.

Lighting

The building is primarily lit by linear fluorescent fixtures which contain 32W T8 lamps. Fixtures throughout the building include individual fixtures with incandescent lamps, while some areas have fixtures with compact fluorescent plug in lamps.

The exterior lighting includes building mounted wall pack fixtures, flood fixtures along the overhang and pole mounted area light fixtures. These contain compact metal halide lamps.

The fixtures are in good condition which provides a great opportunity for energy savings by retrofitting to LED technology.

Lighting Controls: The interior lighting is manually controlled by wall switches. The exterior lighting is controlled by mechanical time clocks to switch lights on and off.

Mechanical Systems

HVAC Systems and Equipment: Steam is provided to the first-floor lobby radiators by one (1) natural gas fired low pressure boiler. This boiler is located in the basement boiler room. Condensate from the boiler is recovered and distributed by one (1) condensate unit that is powered by one (1) 1/3HP pump.

Space specific heating is provided by seventeen (17) gas-fired roof top units. These units serve floor one through floor three. Placement of the units are varied based on administrative offices and cubicle floors.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
Boiler	Boiler Room	First Floor Lobby	Well McLain	688	2012		1701 MBH

Cooling for the building is provided by twenty (20) constant volume roof top units and four (4) condensing split system units. The age of these roof top units is unknown, but they are no older than 20 years. The District Central Offices have a server room that is temperature controlled by four (4) 7-ton CRAC units.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
Split Unit 1	Ground Level	-	York	HBH-T120AE	-	-	-
Split Unit 2	Ground Level	-	York	HBH-T120AE	-	-	-
Split Unit 3	Ground Level	-	MagicAire	240-BRX-3-B	-		-
Split Unit 4	Ground Level	-	Trane	TTA072C300A0	-	80%	6 tons
ACCU(s) (4 total)	Ground Level	Server Room	Leibert	DCSF083-P	2009	81%	7 tons

Ventilation of the building is provided by the twenty (20) roof top units and eight (8) roof-top exhaust fans. The building exhaust fans vary from 1/3 to 5HP. The roof top units serve the office areas while the exhaust fans serve the restrooms and general building space.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
RTUs (20 total)	Roof	Building	Carrier	-	1997	81%	2 – 30 tons 74 MBH - 425 MBH

Refer to Appendix 8 for a detailed list of HVAC equipment at the site.

Domestic Hot Water Systems

Domestic Hot Water

The building is supplied domestic hot water by one (1) electric hot water heater. This hot water heater is rated for 4500 watts and holds 120-gallons. This domestic heater is outdated and could be replaced with a new, high efficiency, condensing domestic water heater.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
DWH	Boiler Room	Hot Water	AO Smith	ECT 120 200	-	-	120 gal 3500 watts

Building Controls (HVAC Controls)

The boiler can be controlled using a Tekmar one stage control with early start. Currently there are no sensors communicating with the boiler, so it is controlled manually. The building's roof-top units communicate with programmable thermostats. The remaining equipment within the building is controlled manually.

Kitchen Equipment

The kitchen utilizes both electric and gas cooking equipment. Various types of refrigeration equipment are present including walk-in coolers and a walk-in freezer. Standard refrigerators and ice machines are also present. The kitchen has two exhaust hood systems, with one being used for warming only and the other being used for cooking.

Plug Load

The facility's plug load consists of general office equipment, kitchenette equipment and server room equipment.

Refer to Appendix 4 for device quantities.

Plumbing/Water System

The ESG team observed that all (40) faucets currently use high flow 2.0 gallon per minute (gpm) or higher and the showerheads are assumed standard and rated for 2.5 gpm or higher aerators that can be replaced with low flow aerators. Additionally, toilets and urinals located in the restroom areas have a rating of 1.6 and 1.0 gallons per flush, respectively.

Early Learning Center

Background Information

The Early Learning Center is located at 660 14^{th} Avenue in Paterson, New Jersey. This 14,001 ft^2 facility was originally built in 1960 and is in fair condition. The Early Learning Center consists of two (2) stories including an auditorium, office area, classroom space, and a kitchen.

Building Occupancy

Approximate enrollment is 75 students with a staff of 15 full-time or part-time employees. The building is fully occupied September through June. Partial occupy occurs during the summer months.

Hours of Operation

- Monday through Friday 6:30 am to 6:00 pm (students/staff)
- Saturday – No use and Sunday 11:00 am to 3:00 pm

Envelope

The building is constructed of composite walls with a brick façade that appears to be in good condition. The windows that cover about 30-40% of the facade consist of mostly double pane, fixed, and single hung windows. The windows appear to be in good condition. There is approximately one (1) set of double doors and seven (7) single doors, all which appear to be in good condition.

Lighting

The building is primarily lit by linear fluorescent fixtures which contain 32W T8 lamps. Fixtures throughout the building include individual fixtures with incandescent lamps, while some areas have fixtures with compact fluorescent plug in lamps. The exterior lighting includes flood lights.

Approximately half of the fixtures are eligible for retrofitting to new LED technology. Original and damaged fixtures may need to be replaced with new LED fixtures. The fixtures are in good condition which provides a great opportunity for energy savings by retrofitting to LED technology.

Lighting Controls: The building's interior and exterior lighting is manually controlled.

Mechanical Systems

__HVAC Systems and Equipment:__ Heating hot water is provided to the building by six (6) natural gas-fired boiler. The boilers serve the first-floor unit ventilators and four (4) constant volume roof-top units. The boilers appear to be in good working condition.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
Boilers (6 Total)	Boiler Room	First Floor	Hydrotherm	-	2003		250 MBH

Hot water is distributed throughout the building by three (3) constant volume pumps powered by 3/4HP motors. The three (3) constant volume pumps appear to be in good condition and are expected to remain in service for the remainder of their life expectancy.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
Pumps (3 total)	Boiler Room	First Floor	Baldor	VL1307	-	68%	3/4HP

There are four (4) roof-top units with DX cooling coils that serve the second floor. Individual window AC units serve the bottom floor classrooms and the kitchen.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
RTU (4 total)	Roof	Second Floor Classrooms	Trane		2016		200 MBH

Ventilation of the building is provided by exhaust fans which are located on the roof and throughout the facility. These exhaust fans serve the restrooms, the auditorium, office areas, classroom space and kitchen.

Domestic Hot Water

Refer to Appendix 8 for a detailed list of HVAC equipment at the site.

Domestic Hot Water Systems

The building is supplied domestic hot water by one (1) natural gas-fired hot water heater. This hot water heater is rated for 75MBH and holds 98-gallons. This boiler is not of standard efficiency and should be replaced with a high efficiency condensing gas-fired domestic hot water heater.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity

DWH	Boiler Room	Building	AO Smith	BT 100 112	-	-	98 gal 75.1 MBH

Building Controls (HVAC Controls)

Building controls consist of standalone, local thermostats, controllers or switches. The boiler is manually controlled. Early Learning Center typical set points are:

Time Period Heating	Heating Season	Cooling Season
Occupied Hours	72°F	74°F
Unoccupied Hours	60°F	80°F

Kitchen Equipment

The building has a heating kitchen which provides meals during the school week.

Plug Load

The facility's plug load consists of general office equipment, kitchenette equipment, and general classroom equipment.

Refer to Appendix 4 for device quantities.

Building Plug Load

Plumbing/Water System

The ESG team observed that all (11) faucets currently use high flow 2.0 gallon per minute (gpm) or higher and the showerheads are assumed standard and rated for 2.5 gpm or higher aerators that can be replaced with low flow aerators. Additionally, toilets and urinals located in the restroom areas have a rating of 1.6 and 1.0 gallons per flush, respectively.

Eastside High School

Background Information

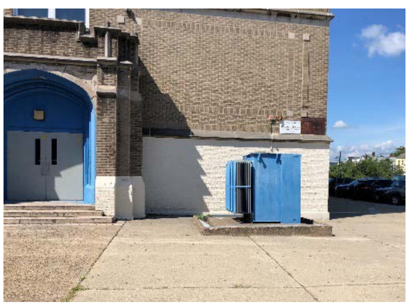
Eastside High School is located at 150 Park Ave in Paterson, NJ 07501. This 379,619 ft^2 facility was originally built in 1927 and is in fair condition. Eastside High School consists of four (4) floors of classroom space, office space, kitchen areas, cafeteria, and lounge space.

Building Occupancy

Approximate enrollment is 2000 students with 180 full-time staff. Full occupancy of the building is through the months of September to June. Partial occupancy occurs during the summer months.

<u>Hours of Operation</u>

- Monday through Friday 6:30 am to 5:00 pm (students/staff)
- A second janitorial staff is present until 12 AM Monday through Friday
- Weekend hours are varied



Building Envelope

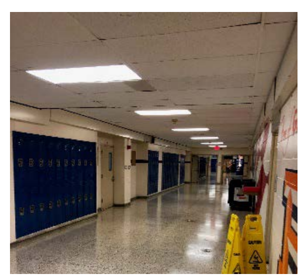
Envelope

The building has multiple structures, the tallest structure being four (4) stories including the ground level. The original and new additions of the building are constructed of composite walls with a brick façade. The building has flat roofs with an EPDM overlay that appears to be in good condition. Windows cover approximately 65-75% of the façade. The building windows may be double paned, fixed, or single hung. There are eleven (11) double doors and thirteen (13) single doors that are in fair condition.

Lighting

The building is primarily lit by linear fluorescent fixtures which contain 32W T8 or T12 lamps. Fixtures throughout the building include individual fixtures with incandescent lamps, high bay fixtures, while some areas have fixtures with compact fluorescent plug in lamps.

Exterior lighting includes building mounted wall pack fixtures, flood fixtures along the overhang and pole mounted area light fixtures. These contain compact metal halide lamps. The fixtures are in good condition which provides a great opportunity for energy savings by retrofitting to LED technology.



Light Fixtures
Eastside H.S

Lighting Controls: The interior light fixtures are manually controlled via wall switches or sensor mounted switches. The exterior light fixtures are controlled by mechanical time clocks and wall switches.

Mechanical Systems

HVAC Systems and Equipment: The building's heated hot water is provided by eight (8) natural gas fired boilers. The building has two mechanical rooms, that each occupy four boilers. The newly built mechanical room houses newer boilers that are in good working condition. The original mechanical room has later-model boilers that are in working condition.

Existing Boilers

Circulation pump motors move the heated water throughout the building. There are four (4) circulation pumps in use, all which are powered by either a 30HP or 20 HP motor. Half of these pumps are said to have VFDs, they have not been installed to communicate with the pumps.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
Boilers-1, 2, 3, 4 4 total	New Wing Boiler Room	New Building	Aerco	BMK3000	2015	-	3000 MBH
Boilers-1, 2, 3, 4 4 total	Old Boiler Room	Old Building	Aerco	BMK2000	2007	-	2000 MBH

Air conditioning throughout the building is provided by one (1) rooftop unit located above the old wing cafeteria. The new

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
RTU	Café Roof	Cafeteria	Trane	RAUCC254 CX13A	2003	-	25 tons

There are nine (9) split units, eight of them are located above the cafeteria. These units serve the cafeteria, specific classrooms and office areas.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
Split Unit	Roof	Room 109	YORK	HCBA-F060SA	-	9 EER	5 tons
Split Unit (8 Total)	Café Roof	Cafeteria	Mitsubishi	PU36EK	2016	8 EER	3 tons

Several components of the building's cooling equipment were either offline, or inoperable. This includes one (1) condensing unit (new wing) and one (1) cooling tower (old wing) which were intended to service the new wing and the original wing. There are three (3) chillers and two (2) chilled water pumps located in the original built mechanical room. The appearance indicates this equipment has been inoperable for several years.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
Pump 1 &2 (2 total)	New Boiler Room	New Building	WEG	020180T3E256TC	-	93%	740 gpm 20HP
Pump 2 & 3 (2 total)	Old Boiler Room	Old Building	AO Smith	E548	-	81%	680 gpm 30HP

Ventilation throughout the original building is provided by unit ventilators in the classrooms, lounges and office areas. The new wing utilizes an air handler which uses heating hot water from the basement mechanical room for building heating. The new wing also utilizes one (1) 100 HP supply fan, and two (2) return fans of 3HP and 2HP.The supply fan is equipped with a VFD, while rooftop exhaust fans used for general building loads currently run on constant speed. The kitchen utilizes a standalone commercial vent hood.

Unit Ventilator

Hot Water Heaters

Domestic Hot Water Systems

The building is supplied domestic hot water by three (3) natural gas-fired hot water heaters. The original building has one (1) hot water heater that is attached to a combined storage capacity of 115-gallons. This hot water heater is in good condition and is expected to last the remainder of its life expectancy. The new building addition has two (2) newer hot water heaters which are expected to last the remainder of their life expectancy.

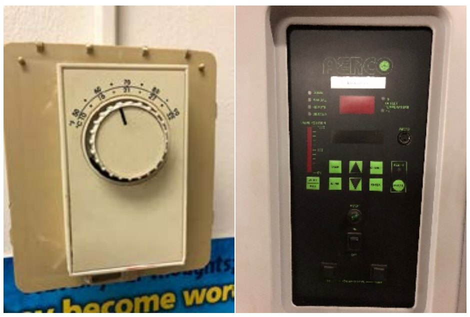
Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
DHW-1	New Wing Boiler Room	New Building	Rheem- Rudd	GX90-550A	2015	-	550 MBH
DHW-2	New Wing Boiler Room	New Building	Rheem- Rudd	GX72-250A	2015	-	250 MBH
DHW-3	Old Boiler Room	Old Building	AO Smith	BTR-199 118	2017	-	199 MBH

Building Controls (HVAC Controls)

Manual control of the boilers is done by the janitorial staff who physically heat check each room every two (2) hours in order to maintain classroom temperature during inoccupancy. The lead custodian is on call 24/7 to turn on the boilers if the temperature drops below 29°F during a weekday or 25°F on a weekend. Unit Ventilators are controlled using thermostats located in classrooms and offices. Rooftop units are controlled using local thermostats. The remaining equipment in the building is controlled by standalone local thermostats and switches.

The typical temperature set points for Eastside High School are as follows:

Time Period Heating	Heating Season	Cooling Season
Occupied Hours	72°F	N/A
Unoccupied Hours	60°F	N/A



Building Controls

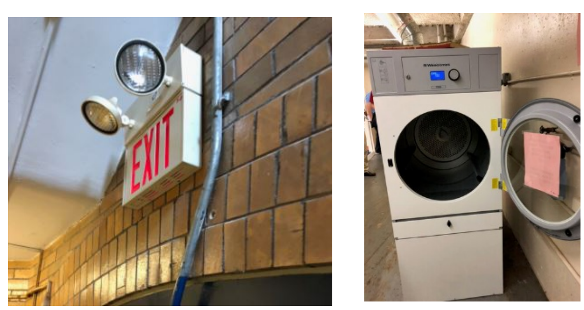
Kitchen Equipment

Eastside High School has a culinary arts kitchen, warming kitchen and a bakery. Kitchen equipment in the school includes many refrigeration units, gas and electric appliances, kitchen hoods and ice makers.

Plug Load

There is general office and café equipment throughout the building. There are also gas-fired and electric meal prep equipment, a clothes washer and dryer as well as a number of refrigeration equipment in the kitchen. There is a refrigerated vending machines in the building that are not controlled and run 24/7.

Refer to Appendix 4 for device quantities.



Building Plug Load

Plumbing/Water System

The ESG team observed that all (53) faucets currently use high flow 2.0 gallon per minute (gpm) or higher and the showerheads are assumed standard and rated for 2.5 gpm or higher aerators that can be replaced with low flow aerators. Additionally, toilets and urinals located in the restroom areas have a rating of 1.6 and 1.0 gallons per flush, respectively.

Edward Kilpatrick

Background Information

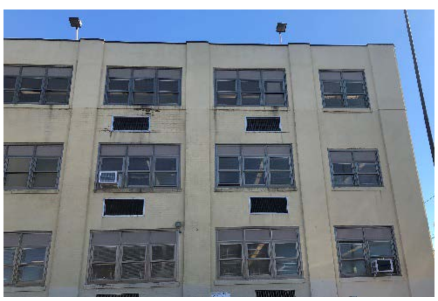
The Edward Kilpatrick School is located at 295-315 Ellison Street in Paterson, NJ. This 51,521 ft^2 facility was originally built in 1974 and is in fair condition. The Edward Kilpatrick School is a three-story building consisting of classroom space, office areas and a cafeteria.

Building Occupancy

Approximate enrollment is 425 students with 28 full-time staff members. Partial occupancy occurs during the summer months.

Hours of Operation

- Monday through Friday 6:30 am to 5:00 pm (students/staff)
- A second janitorial staff is present until 12 AM Monday through Friday
- Saturday – No use and Sunday 11:00 am to 3:00 pm



Envelope

The building is constructed of composite walls with a brick façade. The building façade is in good condition. The building has a ground level and two floors. The roof is slopped with shingles. The building consists of mostly double pane, fixed and sliding windows. Windows cover approximately 50-60% of the façade and appear to be in good condition. There is approximately five (5) single doors and three (3) sets of double doors which are in good condition.

Lighting

The building is primarily lit by linear fluorescent fixtures which contain 32W T8 lamps with corresponding ballast. The fixtures are in good condition which provides a great opportunity for energy savings by retrofitting to LED technology.

Lighting Controls: The interior lighting is controlled manually by wall switches.

Mechanical Systems

HVAC Systems and Equipment: The building is heated by two (2) natural gas-fired boilers. The boilers are approximately forty-five (45) years old and are in working condition. Heating hot water is provided to the building unit ventilators by two (2) constant volume pumps connected to 3 HP motors. These pumps are in working condition and are expected to operate for the remainder of their life expectancy.


Existing Boilers

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
Boiler (2 total)	Boiler Room	Building	Weil-McClain	R10.9G015	1974	80%	2540 MBH
Pumps (2 total)	Boiler Room	Building	Baldor	JMM3211T	-	83%	3HP

There is one (1) 3-ton split unit serving administrative areas and unit ventilators in each classroom that provide additional cooling.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
Split Unit	Ground Level	Admin Area	Mitsubishi	PUZ-A36NHA6	-	7.6 EER	3 tons

Ventilation of the building is provided by forty-eight (48) unit ventilators and six (6) rooftop exhaust fans. The unit ventilators serve classroom and office areas. The exhaust fans serve bathrooms and general building spaces.

Refer to Appendix 8 for a detailed list of HVAC equipment at the site.

Domestic Hot Water Systems

The building is supplied domestic hot water by one (1) 80-gallon natural gas-fired hot water heater, rated for a heating capacity of 250 MBH. This hot water heater is approximately 11 years old and should be replaced with a high efficiency gas-fired water heater.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
DWH	Boiler Room	Building	Bradford White	D8PT2503N	2007	-	80 gal 250 MBH

Building Controls (HVAC Controls)

Manual control of the boilers is done by the janitorial staff who physically heat check each room every two (2) hours in order to maintain classroom temperature during inoccupancy. The lead custodian is on call 24/7 to turn on the boilers if the temperature drops below 29°F during a weekday or 25°F on a weekend. Unit Ventilators are controlled using thermostats located in classrooms and offices. Rooftop units are controlled using local thermostats. The remaining equipment in the building is controlled by standalone local thermostats and switches.

Thermometer

Kitchen Equipment

A warming kitchen serves lunch to the students and staff Monday through Friday.

Plug Load

Edward Kilpatrick's plug load consists of general office equipment, kitchenette equipment, and classroom equipment. There is a gas-powered generator located at this facility for backup power. The generator is rated for 45 kW. The generator has not been used in several years.

Refer to Appendix 4 for device quantities.

Building Plug Load

Plumbing/Water System

The ESG team observed that all (53) faucets currently use high flow 2.0 gallon per minute (gpm) or higher and the showerheads are assumed standard and rated for 2.5 gpm or higher aerators that can be replaced with low flow aerators. Additionally, toilets and urinals located in the restroom areas have a rating of 1.6 and 1.0 gallons per flush, respectively.

John F. Kennedy High School

Background Information

John F. Kennedy High School is located at 61-127 Preakness Ave in Paterson, NJ. This 337,135 ft^2 facility was originally built in 1963 and is in fair condition. John F. Kennedy High School consists of three (3) floors of classroom space, office space, two (2) gymnasiums, an auditorium, two (2) cafeterias and a kitchen.

Building Occupancy

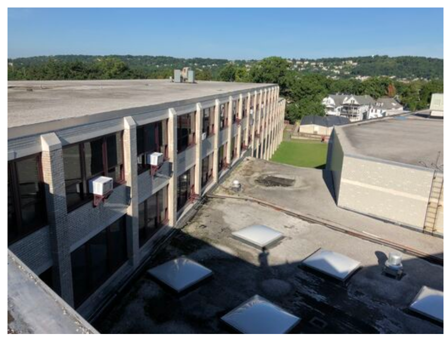
Approximate enrollment is 2,308 students with a full-time staff of 210. Full occupancy is during the months of September to July. Partial occupancy occurs during the summer.

Hours of Operation

- Monday through Friday 6:30 am to 5:00 pm (students/staff)
- A second janitorial staff is present until 12 AM Monday through Friday
- Saturday and Sunday have varied hours

Envelope

The building is constructed of composite walls with a brick façade. The building is three stories tall. This includes a ground level and two (2) floors. This building has flat roofs with an EPDM overlay that appears to be in good condition. The building envelope is covered with approximately 60% of double pane, fixed, or sliding metal frame windows that all appear to be in good condition. The building has thirty-five (35) double doors and six (6) single doors which also appear to be in good condition. ESG did find precautions about asbestos in the building.



Building Envelope

Light Fixtures at John F. Kennedy High School

Lighting

The building is primarily lit by linear fluorescent fixtures which contain 32W T8 lamps. Fixtures throughout the building include individual fixtures with incandescent lamps, interior and exterior Hi Bay fixtures, while some areas have fixtures with compact fluorescent plug in lamps. The fixtures are in good condition which provides a great opportunity for energy savings by retrofitting to LED technology.

The exterior lighting includes building mounted wall pack fixtures. These fixtures contain compact metal halide lamps.

Lighting Controls: The interior and exterior lights are manually controlled via wall switches and sensor mounted switches.

Existing Steam Boilers

Mechanical Systems

HVAC Systems and Equipment: The building is heated by steam provided from three (3) low pressure steam boilers. The boilers are located in the boiler room. Boiler-1 and Boiler-2 were installed in 1999. Boiler-3 was installed in 1963. One of the boiler is not being used anymore.

Three (3) circulation pumps ran by 2HP motors collect and return condensate to boilers. Additional heating is supplied to the administrative offices by a hot water exchanger and one (1) pump powered by a 5HP motor.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
Boiler-1	Boiler Room	Building	Cleaver-Brooks	CBL 200 400 015	1999	-	13,400 MBH output
Boiler-2	Boiler Room	Building	Cleaver-Brooks	CBL 200 200 015	1999	-	6,695 MBH output
Boiler-3	Boiler Room	Building	Cleaver-Brooks	CB 760-350	1963	-	12,025 MBH output
Pump-1	Boiler Room	Condensate Return	WEP	00236OS3EJ PR56J-S	-	78.5%	2HP -gpm
Pump-2	Boiler Room	Hot Water Return	Marathon	5VH145TTD R5543AD	-	-	1.5HP 9 gpm
Pump-3	Boiler Room	Main Wing Heat Exchanger	WEG	00518OP3E1 84JP	-	87.5%	5HP 116 gpm

ESG observed poor pipe and valve insulation within the steam distribution system.

Steam is used by the building's unit ventilators, the Gymnasium's four (4) air handlers, the Locker Room's two (2) air handlers, Print Shop's one (1) air handler, the Band Room's one (1) air handler, and the three (3) rooftop units serving the TV Studio and Auditorium. The air handler's serving the gymnasium, locker room, and band room require a bucket lift to access.

Uninsulated Pipes – John F. Kennedy High School

Existing Rooftop Units

There are three (3) rooftop units that provide cooling to the school's auditorium and studio. Two (2) units serve the auditorium while one (1) unit serves the school's studio. These rooftop units are approximately thirteen (13) years old. Additional cooling is provided by five (5) spilt AC units to the administrative offices, three (3) mini-split units to the Library, and eight (8) mini-split units to the main cafeteria.

The air handlers and rooftop units provide ventilation for those specific areas in conjunction with approximately fifty (50) rooftop exhaust fans that serve the kitchen, hallways, bathrooms, and general building spaces.

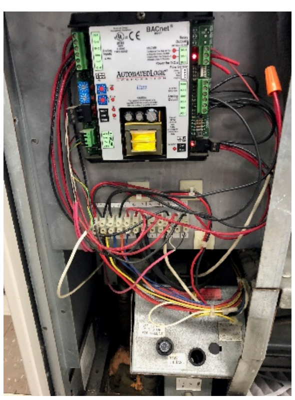
Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
Split Unit AC (2 total)	Roof	Nurse/ Admin Office	York	HEHB-T090AA	-	-	7.5 tons
Split Unit AC-2	Roof	Nurse/ Admin Office	Luxaire	HBBA-F030SE	-	-	2.5 tons
Split Unit AC-3	Roof	Nurse/ Admin Office	Luxaire	HABA-T060SA	-	-	5 tons
Split Unit AC-4	Roof	Health Office	Lenox	HS19-S11U-3D	-	-	-
RTU-1	Roof	TV Studio	Trane	TFH181C30BCA	2003	-	-
RTU-2	Roof	Auditorium	Trane	SSHFC55F6457C 7BD1001A0	2003	-	55 tons
RTU-3	Roof	Auditorium	Trane	SSHFC55F6457C7 BD1001A0	2003	-	55 tons

Domestic Hot Water Systems

The building is supplied domestic hot water by one (1) natural gas-fired hot water heater. This water heater also supplies the heat exchanger for the building's hot water heating coils. This hot water heater is about 13 years old and is in good working condition.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
DWH	Boiler Room	Building	Lochinvar	CWN0985PM	2005	-	985 MBH

Building Controls (HVAC Controls)


BMS System

The building has an automated building management system (BMS) that is not operational currently. The equipment is operated manually using local controllers, switches, and thermostats. The typical temperature set points for John F. Kennedy High School are as follows:

Time Period Heating	Heating Season	Cooling Season
Occupied Hours	72°F	N/A
Unoccupied Hours	60°F	N/A

Plug Load

There is general office and café equipment throughout the building. There is multiple vending machines which currently operate 24/7. There are a number of computers throughout the building in classrooms, office areas as well as computer labs. Some of these were noted to be in idle mode or left on while not in use.

Building Plug Load

Refer to Appendix 4 for device quantities.

Plumbing/Water System

The ESG team observed that all (105) faucets currently use high flow 2.0 gallon per minute (gpm) or higher and the showerheads are assumed standard and rated for 2.5 gpm or higher aerators that can be replaced with low flow aerators. Additionally, toilets and urinals located in the restroom areas have a rating of 1.6 and 1.0 gallons per flush, respectively.

New International High School

Background Information

New International High School is located at 200 Grand Street in Paterson, NJ. This 121,275 ft^2 facility was originally built in 2001 and is in fair condition. New International High School consists of two (2) floors of classroom space, office space and an all-purpose room.

Building Occupancy

Approximate enrollment is 520 students with a full-time staff of 55. Full occupancy is during the months of September to July. Partial occupancy occurs during the summer.

Hours of Operation

- Monday through Friday 6:30 am to 5:00 pm (students/staff)
- A second janitorial staff is present until 12 AM Monday through Friday
- Saturday and Sunday have varied hours

Envelope

The building consists of three (3) stories including the ground level. The exterior wall construction is brick façade which is in good condition. This building has flat roofs with an EPDM overlay that appears to be in good condition. Windows cover approximately 50-60% of the façade. Windows on the building are mostly double pane, fixed, and single hung. The windows are in good condition. There are approximately nine (9) double doors, and four (4) single doors, all in fair condition.

Building Envelope

Light Fixtures

Lighting

The building is primarily lit by linear fluorescent fixtures which contain 32W T8 lamps. Fixtures throughout the building include individual fixtures with incandescent lamps, or high bay fixtures while some areas have fixtures with compact fluorescent plug in lamps. The fixtures are in good condition which provides a great opportunity for energy savings by retrofitting to LED technology.

The exterior lighting includes pole-hung cobra head light fixtures and large flood light fixtures.

Lighting Controls: The interior and exterior lights are manually controlled via wall switches and through the central BMS.

Mechanical Systems

HVAC Systems and Equipment: The building is heated by two (2) natural gas-fired boilers. The boilers appear to be in good condition and are expected to last the remainder of their life expectancy. Circulation pumps provide heating hot water throughout the building. There are two (2) constant volume circulation pumps that are powered by two (2) 15HP motors.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
Boiler-1	Boiler Room	Building	AO Smith	-	2001	-	5862 MBH
Boiler-2	Boiler Room	Building	AO Smith	-	2001	-	5862 MBH
Pump-1 & 2	Boiler Room	Building	Emerson	A441	2001	93%	15 HP 500 gpm

There are five (5) heating energy recovery units that serve the schools four (4) rooftop units to utilize the building's heating load.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
RTU-1	Roof	Gym	York	XTO-057X090 -HDMK046A	2001	-	-
RTU-2	Roof	Cafeteria	York	XTO-048X066 -HDKH046A	2001	-	-
RTU-3	Roof	-	York	XTO-048X057 -HDJHO40A	2001	-	-
RTU-4	Roof	Auditorium	York	XTO-054X081 -HDLJ046A	2001	-	-
ERU-1	Roof	Building	Semco	FV4000V-6RN2AA	2001	-	2HP S 1.5HP E
ERU-2	Roof	Building	Semco	FV2000V-6RN2AB	2001	-	1.5HP S .75HP E
ERU-3	Roof	Building	Semco	FV1500H-6RN2AA	2001	-	7.5 HP S 7.5HP E
ERU-4	Roof	Building	Semco	FV1500H-6RN2AA	2001	-	-
ERU-5	Roof	Building	Semco	FV2000V-6RN2AB	2001	-	1.5HP S 1.5HP E

Cooling is provided to the building's rooftop units and classroom fan coils units through one (1) 350-ton air-cooled chiller. Chilled water is circulated by two (2) chilled water pumps powered from two (2) 30HP motors. There are four (4) constant volume roof-top air handling units that cool and ventilate the gymnasium, auditorium and cafeteria. Each rooftop air handler has a supply fan motor. Individual rooms like classrooms are cooled by fan coil units. This equipment is approximately fifteen (15) years old.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
CH-1	Roof	Building	York	YCAV0357SA 46VAABXTOXXXXL	2001	11.7 EER	342.9 tons
CW-Pump-1 & 2 (2 total)	Roof	Building	Baldor	EM4104T	2001	91.1%	30HP gpm

Ventilation of the building is provided by one (1) make up air unit that serves the kitchen, and sixteen (16) rooftop exhaust fans that serve classrooms, locker rooms, laboratories, and bathrooms. Ventilation of the gymnasium, cafeteria, and auditorium is provided by the four (4) roof-top units.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
MAU-1	Roof	Kitchen	Captive Aire	A2-I350-G15	2001	-	7,600 cfm 3 HP

Domestic Hot Water Systems

The building is supplied domestic hot water by one (1) natural gas-fired hot water heater located in the building's boiler room. There is also two (2) hot water storage tanks that each hold 318 gallons in the boiler room.

Storage Tanks

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
DWH	Boiler Room	Building	Lochinvar	-PFN1002PM	-	-	1000 MBH 636 gal

Building Controls (HVAC Controls)

The building has basic HVAC controls from an Automated Logic BMS system that controls and monitors the building's mechanical equipment. The BMS remotely controls classroom fan coils units, exhaust fans, rooftop units, the make up air unit, and energy recovery units. The boiler, hot water pumps, chiller and chilled water pumps are operated automatically and the BMS only monitors this equipment. Remaining equipment is controlled using standalone controllers and switches. The temperature set points are as follows:

Building Controls

Time Period Heating	Heating Season	Cooling Season
Occupied Hours	72°F	74°F
Unoccupied Hours	60°F	80°F

Kitchen Equipment

The warming kitchen utilizes both electric and gas cooking equipment. Various types of refrigeration equipment are present including walk-in coolers and a walk-in freezer. Standard refrigerators and ice machines are also present.

Plug Load

The facility's plug load consists of general office equipment, kitchenette equipment, and general classroom equipment.

Refer to Appendix 4 for device quantities.

Building Plug Load

Plumbing/Water System

The ESG team observed that all (59) faucets currently use high flow 2.0 gallon per minute (gpm) or higher and the showerheads are assumed standard and rated for 2.5 gpm or higher aerators that can be replaced with low flow aerators. Additionally, toilets and urinals located in the restroom areas have a rating of 1.6 and 1.0 gallons per flush, respectively.

New Roberto Clemente School

Background Information

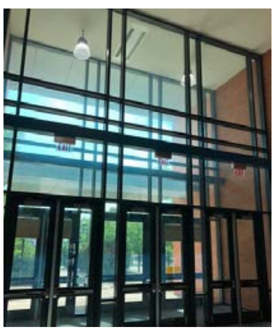
The New Roberto Clemente School is located at 482-506 Market Street in Paterson NJ. This 124,834 ft^2 facility was originally built in 2001 and is in good condition. New Roberto Clemente School consists of classroom space, office areas, a gymnasium, a cafeteria/auditorium and a media center.

Building Occupancy

Approximate enrollment is 682 students with a fulltime staff of 56. Full occupancy is during the months of September to June. Partial occupancy occurs during the summer months.

Hours of Operation

- Monday through Friday 6:30 am to 5:00 pm (students/staff)
- A second janitorial staff is present until 12 AM Monday through Friday
- Saturday and Sunday have varied hours



Building Envelope

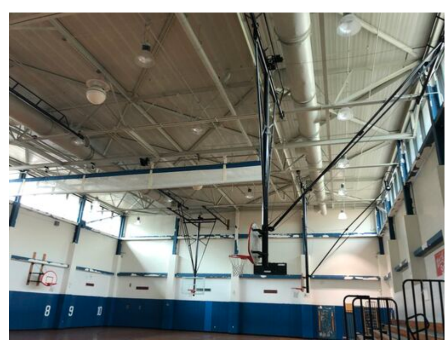
Envelope

The building consists of multiple sections with the tallest being two stories. The exterior wall construction is brick façade which is in good condition. The building and it's additions have flat roofs with an EPDM overlay that appears to be in good condition. Windows cover approximately 60-70% of the façade. Windows on the building are mostly double pane, fixed, and single hung. The windows are in good condition. There are approximately eight (8) double doors, and five (5) single doors, all in fair condition.

Lighting

The building is primarily lit by linear fluorescent fixtures which contain 32W T8 lamps. Fixtures throughout the building include individual fixtures with incandescent lamps, or metal halide high bay fixtures while some areas have fixtures with compact fluorescent plug in lamps.
The exterior lighting includes wall pack fixtures, compact fluorescent or metal halide lamps.

Lighting Controls: The interior lights are manually controlled via wall switches. The exterior lighting is controlled by switches and mechanical time clocks.



Gymnasium Light Fixtures

Mechanical Systems

HVAC Systems: Heating hot water is provided to the building from two (2) natural gas-fired water tube boilers that are in the boiler room. These boilers serve the unit ventilators and radiators throughout the building. They are in good working condition and are expected to live the remainder of their life expectancy.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
Boiler-1	Boiler Room	Building	Cleaver-Brooks	LNICR4-G-30	2016	-	7531 MBH
Boiler-2	Boiler Room	Building	Cleaver-Brooks	LNICR4-G-30	2016	-	7531 MBH
Pump-1 & 2 2 Total	Boiler Room	Building	Emerson	638029A	2004	93.6%	25 HP 650 GPM


Boiler

Hot water is dispersed by two (2) circulation pumps powered by two (2) 25HP motors. The pumps each have a VFD to regulate the system's differential pressure. These pumps are in good condition and are expected to live the remainder of their life expectancy.

The chiller plant equipment consists of one (1) chiller, four (4) chilled water pumps and four (4) 40HP motors. The chilled water pumps each have a VFD to regulate system differential pressure. There is one (1) cell cooling tower with two (2) 40-hp fan motors. Chilled water is dispensed to the building's unit ventilators and rooftop air handler cooling coils which provide cooling to the classrooms, administrative offices, gymnasium and auditorium. Additional cooling is provided by six (6) 2-ton split condensing units which serve specific office and classroom areas.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
CH-1	Boiler Room	Building	York	YK CF CF Q7 - CP F	2004	.31 kw/ton	400 tons
CW-Pumps 1, 2, 3 & 4 4 Total	Chiller Room	Building	Emerson	638031	2004	94%	40HP 1000 GPM
CT-1	Roof	Chilled Water	Evapco	LRT 8-124	2004	93.6%	198 tons
Split Units (6 total)	Boiler Room	-	York	H2RC024S06A	2004	-	2 tons

Building ventilation is provided by five (5) constant volume air handlers, and ten (10) exhaust fans.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
AHU-1	Roof	Classrooms	York	CP 530 SWSI AF 40 15 460	2004	-	45 tons

AHU-2	Roof	Classrooms	York	CP 860 SWSI AF 40 20 460	200 4	-	70 tons
AHU-3	Roof	Admin Offices	York	CP 680 SWSI AF 40 15 460	200 4	-	56 tons
AHU-4	Roof	Auditorium	York	CP 530 SWSI AF 40 20 460	200 4	-	45 tons
AHU-5	Roof	Gym	York	CP 530 SWSI AF 40 20 460	200 4	-	45 tons

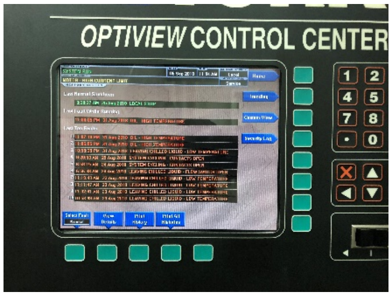
Domestic Hot Water Systems

Domestic hot water for the building is provided by two (2) natural gas-fired hot water heaters. These hot water heaters were installed in 2015. There is also one (1) electric hot water heater that serves the building's kitchen. The age of this heater is unknown. These three (3) boilers are of standard efficiency and should be replaced with newer, high efficiency water heaters.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
DHW- 1 & 2	Boiler Room	Building	Rheem-Rudd	G100-200	2015	-	100 gal 199 MBH
DHW-3	Kitchen	Kitchen	Vanguard	3WA76	2008	-	80 gal 2 x 4500 watts

Building Controls (HVAC Controls)

The HVAC systems and equipment are controlled by a web-based Building Management System (BMS). Mechanical equipment including exhaust fans, domestic hot water heaters, and the boilers are controlled through the BMS. The BMS does not control the boilers, but it does monitor them. The BMS can set equipment schedules and setpoints but at this time there is issues with integrating the BMS to control and communicate with the equipment. The temperature set points are as follows:



Building Controls

Time Period Heating	Heating Season	Cooling Season
Occupied Hours	72°F	74°F
Unoccupied Hours	60°F	80°F

Kitchen Equipment

The warming kitchen utilizes both electric and gas cooking equipment. Various types of refrigeration equipment are present including walk-in coolers and a walk-in freezer. Standard refrigerators and ice machines are also present.

Kitchen Equipment

Plug Load

The facility's plug load consists of general office equipment, kitchen equipment, and general classroom equipment.

Refer to Appendix 4 for device quantities.

Plumbing/Water System

The ESG team observed that all (50) faucets currently use high flow 2.0 gallon per minute (gpm) or higher and the showerheads are assumed standard and rated for 2.5 gpm or higher aerators that can be replaced with low flow aerators. Additionally, toilets and urinals located in the restroom areas have a rating of 1.6 and 1.0 gallons per flush, respectively.

New Roberto Clemente K-Center

Background Information

The New Roberto Clemente K-Center is located at 512 Market Street in Paterson, NJ. This 8,000 ft^2 facility was originally built in 1995 and is in good condition. The New Roberto Clemente K-Center consists of one story with classroom space, office space, and a kitchen area.

Building Occupancy

Approximate enrollment is 75 students with a fulltime and part-time staff of 12. Full occupancy is during the months of September to June. Partial occupancy occurs during the summer months.

<u>Hours of Operation</u>

- Monday through Friday 6:30 am to 5:00 pm (students/staff)
- Saturday and Sunday no use

Envelope

The building is constructed of concrete masonry units with a brick façade. The façade is in good condition. The building has flat roofs with an EPDM overlay that appears to be in good condition. Windows cover approximately 50-60% of the façade. Windows on the building are mostly double paned and they are in good condition. There are approximately three (3) single doors that are all in good condition.

Lighting

Existing Light Fixtures

The building is primarily lit by linear fluorescent fixtures which contain 32W T8 lamps. The exterior lighting includes building mounted wall pack fixtures. The fixtures are in good condition which provides a great opportunity for energy savings by retrofitting to LED technology.

<u>Lighting Controls:</u> The interior light fixtures are manually controlled via wall switches or sensor mounted switches.

Existing Rooftop Unit

Mechanical Systems

HVAC Systems and Equipment: Heating, ventilation and cooling is provided by five (5) constant volume rooftop units and two (2) exhaust fans. The exhaust fans run by either a ¼ or 1/3 HP motor. Four rooftop units serve the classrooms while one unit serves other general building space. These units are of standard efficiency and in good condition.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
RTU 1, 2, 3 & 4 (4 Total)	Roof	Classrooms	Trane	YHC063A3R ZA1SH0C0A1B2 B004	2004	81% 13 EER	125 MBH 5 tons
RTU- 5	Roof	Building	Trane	SFHFF20EPH 36A2AD1D01A0 SE0G00L0NRT07 060SS	2004	80% 9.5 EER	220 MBH 20 tons

Domestic Hot Water Systems

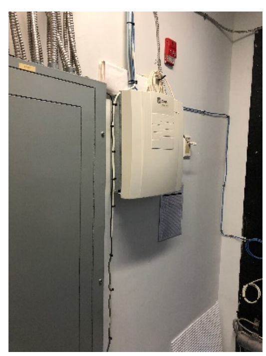
The building is supplied domestic hot water by a gas-fired storage tank water heater. This 75-gallon unit is not of standard efficiency and should be replaced with a high efficiency domestic hot water heater.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
DWH	Mech Room	Building	AO Smith	GDV 75	2004	-	55 MBH 75 Gal

Building Controls (HVAC Controls)

The building has a building management system (BMS). All HVAC equipment for the building is tied into this system. The remaining equipment is controlled by standalone switches and local thermostats. The typical set points for the New Roberto Clemente K-Center are as follows:

Time Period Heating	Heating Season	Cooling Season
Occupied Hours	72°F	74°F
Unoccupied Hours	60°F	80°F



Building Controls

Kitchen Equipment

The warming kitchen utilizes both electric and gas cooking equipment. Various types of refrigeration equipment are present including coolers and a freezer. Standard refrigerators and ice machines are also present.

Plug Load

The building's plug load consists of general office equipment, kitchen warming and cooling equipment, and classroom equipment.

Refer to Appendix 4 for device quantities.

Plumbing/Water System

The ESG team observed that all (4) faucets currently use high flow 2.0 gallon per minute (gpm) or higher and the showerheads are assumed standard and rated for 2.5 gpm or higher aerators that can be replaced with low flow aerators. Additionally, toilets and urinals located in the restroom areas have a rating of 1.6 and 1.0 gallons per flush, respectively.

Norman S. Weir

Background Information

Norman S. Weir School is located at 152 College Boulevard in Paterson, NJ. This 67,943 ft^2 facility was originally built in 1981 and is in good condition. Norman S. Weir School is a single structure building with classroom space, office space, a warming kitchen, gymnasium, and pool.

Building Occupancy

Approximate enrollment is 296 students with a fulltime staff of 28. Full occupancy of the building is during the months of September to June. Partial occupancy occurs during the summer months.

Hours of Operation

- Monday through Friday 6:30 am to 5:00 pm (students/staff)
- A second janitorial staff is present until 12 AM Monday through Friday
- Saturday and Sunday no use

Envelope

The building is constructed of concrete masonry units with a brick façade. The façade is in good condition. The building is a single structure with the tallest section being three (3) stories. The building has flat roofs with shingling overlay that appears to be in good condition. Windows cover approximately 35-45% of the façade. Windows on the building are mostly double pane, fixed or single hung. The windows appear to be in good condition. There are approximately five (5) double doors and one (1) single door, all in good condition.

Building Envelope

Lighting

The building is primarily lit by linear fluorescent fixtures which contain 32W T8 lamps, and Hi Bay fixtures. The fixtures are in good condition which provides a great opportunity for energy savings by retrofitting to LED technology.

Lighting Controls: The lighting in individual rooms are manually controlled via wall switches. The classrooms and office areas are equipped with bi-level switching where 2 or 3 lamps may operate at a time. The exterior lighting is controlled by a timeclock.

Mechanical Systems

HVAC Systems and Equipment: Classroom and office spaces are heated and cooled by Airedale unit ventilators with DX cooling. Each unit is rated for 36 MBH of heating and cooling. The existing Airedale units should be upgraded with high-efficiency supply fan motors.

One (1) gas-fired constant volume rooftop air handler with DX cooling coils cools and heats the cafeteria. Ventilation and space heating for the gymnasium, hallways, and pool are provided by three (3) natural gas-fired constant volume heating ventilation units. The age of this equipment is unknown but appear to be in good working condition.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
RTU-1	Roof	Cafeteria	Trane	YHd300F4RV	-	-	200 MBH
HVU-1	Roof	Gym	Renzor	RPB-200	-	-	200 MBH
HV-3	Roof	Pool	Renzor	RPB-200	-	-	200 MBH
HV-2	Roof	Hallway	Renzor	RPB-200	-	-	200 MBH

Ventilation for classrooms, lounge and office areas are provided by Airdale units. One (1) air handler provides ventilation for the cafeteria. Additional ventilation is provided by three (3) constant volume exhaust fans located on the rooftop. EF-1 is for the pool area. EF-2 / EF-3 are for the bathroom and hallways. These exhaust fans run by either a ½ or 1HP motor.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
AHU	Roof	Cafeteria	Trane	YHd300F4RV	-	81.5%	25 ton 350 MBH

Domestic Hot Water Systems

Domestic hot water for the building and pool is provided by a three-stage natural gas-fired boiler. Once chemically treated, hot water for the pool flows through a heat exchanger before it is motor pumped into the pool. The gas-fired boiler has surpassed its life expectancy and should be replaced with a new, high efficiency boiler.

Hot Water Boiler

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
Boiler	Boiler Room	Building Hot Water	Hydrotherm	-	1989	-	320 MBH
Pump	Emerson	Pool	Dayton	5PXF1A	-	-	5 HP

Building Controls (HVAC Controls)

The building equipment is controlled using standalone, local thermostats, controllers and switches. The temperature set points are as follows:

Time Period Heating	Heating Season	Cooling Season
Occupied Hours	72°F	74°F
Unoccupied Hours	60°F	80°F

Kitchen Equipment

The warming kitchen utilizes both electric and gas cooking equipment. Various types of refrigeration equipment are present including coolers and a freezer. Standard refrigerators and ice machines are also present.

Building Plug Load

Plug Load

The building's plug load consists of general office equipment, kitchen warming and cooling equipment, and classroom equipment.

Refer to Appendix 4 for device quantities.

Plumbing/Water System

The ESG team observed that all (24) faucets currently use high flow 2.0 gallon per minute (gpm) or higher and the showerheads are assumed standard and rated for 2.5 gpm or higher aerators that can be replaced with low flow aerators. Additionally, toilets and urinals located in the restroom areas have a rating of 1.6 and 1.0 gallons per flush, respectively.

The pool at Norman S. Weir is open Monday through Friday 7AM – 4PM. The pool loses a large quantity of heat from evaporation. Covering the pool when not in use will reduce thermal losses and make-up water use.

Rev. Dr. Martin Luther King Jr.

Background Information

Rev. Dr. Martin Luther King Jr. (School 30) is located at 851 E. 28th Street in Paterson, NJ. This 107,168 ft^2 facility was originally built in 1980. An addition to the building was constructed in 1999. Rev. Dr. Martin Luther King Jr. School consists of classroom space, office space, a cafeteria, gymnasium and an auditorium.

Building Occupancy

Approximate enrollment is 870 students with a fulltime staff of 68. Full occupancy of the building is during the months of September to June. Partial occupancy occurs during the summer months.

<u>Hours of Operation</u>

- Monday through Friday 6:30 am to 5:00 pm (students/staff)
- A second janitorial staff is present until 12 AM Monday through Friday
- Saturday and Sunday have varied hours

Building Envelope

Envelope

The building is constructed of concrete masonry units with a brick façade. The façade is in good condition. The building is a single structure with the tallest section being three (3) stories. The original building has flat roofs with shingling while the new addition has an EDMP overlay. The roof appears to be in good condition. Windows cover approximately 50-60% of the façade. Windows on the building are mostly double pane, fixed or single hung. The windows appear to be in good condition. There are approximately ten (10) double doors and fifteen (15) single doors, all in good condition.

Lighting

The building is primarily lit by linear fluorescent fixtures which contain 32W T8 lamps. Fixtures throughout the building include individual fixtures with incandescent lamps, or high bay fixtures while some areas have fixtures with compact fluorescent plug in lamps. The fixtures are in good condition which provides a great opportunity for energy savings by retrofitting to LED technology.

<u>Lighting Controls:</u> The lighting throughout the building is manually controlled by wall mounted switches.

Mechanical Systems

HVAC Systems and Equipment: Heating hot water for the building is provided by two (2) natural gas-fired boilers. The boilers were installed with the original building construction and have surpassed their life expectancy. They are in poor condition.

Heated hot water is distributed throughout the building by two (2) constant volume pump powered by two (2) 7.5HP motors. The constant volume pumps are in good working condition.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
Boiler-1 & 2 (2 Total)	Boiler Room	Building	Cleaver-Brooks	CB-800-125	1978		8.136 MBH
Pump-1 & 2 (2 Total)	Boiler Room	Building	Baldor	M3311T	-	88.5%	7.5 HP

Supplemental heating for the gym, cafeteria and auditorium is provided by three (3) Trane rooftop units with a combined heating capacity of 200 MBH. Classrooms within the newly added addition receive heat from eleven (11) York rooftop units each with 36 MBH of heating capacity. The age of the Trane units is unknown, but the York units are approximately 17 years old.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
RTU- 1-11 (11 Total)	New Roof	New Classrooms	York	D1NH024N03606C	1999	10.5 EER	2 tons 36 MBH
RTU-A	Gym Roof	Gym	Trane	TCH180B400HA		9.9 EER	15 tons
RTU-B	Old Roof	Old Building	Trane	TCH150D40BBA		9.8 EER	12.5 tons
RTU-C	Old Roof	Old Building	Trane	TCH480A40L2B 6JH1ABC000H		10.3 EER	40 tons

The building is conditioned with eleven (11) York rooftop units. Ten units (10) each provide 3-tons and one (1) unit provides 2-tons of direct expansion space cooling. The gymnasium, cafeteria and auditorium are cooled by five (5) Trane rooftop units. A singular 60-ton air cooled condensing unit and eight (8) spilt units also provide cooling to the building and individual spaces. Most of the building's cooling equipment appears to be in working condition; although, some equipment will soon reach their life expectancy.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
Split Units 1 & 2 (2 Total)	Gym Roof	Gym	Trane	2TTB3030 A1000AA	2004	12 EER	2.5 tons 1/8 HP
ACCU-1	Gym Roof	Gym	-	-	2004	-	-
ACCU-3	Cafeteria Roof	Cafeteria	Trane	RAUCC604 BX13OOD	2004	11 EER	60 tons 1HP
ACCU(s)	Old Roof	Old Building	Trane	2TTA0048A	2004	10 EER	4 tons

(2 total)				4000AA			¼ HP
ACCU(s) (3 Total)	Old Roof	Old Building	Luxaire	HABA-F018SE	-	10 EER	2 tons

Ventilation is provided by the classroom unit ventilators, approximately twenty-five (25) exhaust fans, and fifteen (15) air handling units. The exhaust fans that serve restrooms, locker rooms, laboratories and the kitchen are located on the roof of the building.

Domestic Hot Water Systems

Domestic Hot Water

The building is supplied domestic hot water by a gas-fired domestic hot water heater with a heating capacity of 985 MBH. There are also two (2) electric hot water heaters. These hot water heaters are located in the boiler room of the building. These units should be replaced and upgraded with new, high efficiency domestic hot water heaters,

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Capacity
DWH-1	Boiler Room	Building	Copper-Fin	CWN0987PM	2015	985 MBH
DWH-2	Boiler Room	Building	AO Smith	ECT 66 210	2012	66 gal 4500 watt

Building Controls (HVAC Controls)

Manual control of the boilers is done by the janitorial staff who physically heat check each room every two (2) hours in order to maintain classroom temperature during in-occupancy. The lead custodian is on call 24/7 to turn on the boilers if the temperature drops below 29°F during a weekday or 25°F on a weekend. Unit Ventilators are controlled using thermostats located in classrooms and offices. Rooftop units are controlled using local thermostats. The remaining equipment in the building is controlled by standalone local thermostats and switches. The typical temperature set points for the school are as follows:

Time Period Heating	Heating Season	Cooling Season
Occupied Hours	72°F	74°F
Unoccupied Hours	60°F	80°F

Kitchen Equipment

The kitchen utilizes both electric and gas cooking equipment. Various types of refrigeration equipment are present including walk-in coolers and a walk-in freezer. Standard refrigerators and ice machines are also present. The kitchen equipment is in good working condition.

Plug Load

The building's plug load consists of general office equipment, kitchen warming and cooling equipment, and classroom equipment.

ESG observed to following significant plug load technologies:

Refer to Appendix 4 for device quantities.

Plumbing/ Water Systems

The ESG team observed that all (40) faucets currently use high flow 2.0 gallon per minute (gpm) or higher and the showerheads are assumed standard and rated for 2.5 gpm or higher aerators that can be replaced with low flow aerators. Additionally, toilets and urinals located in the restroom areas have a rating of 1.6 and 1.0 gallons per flush, respectively.

Roberto Clemente Elementary

Background Information

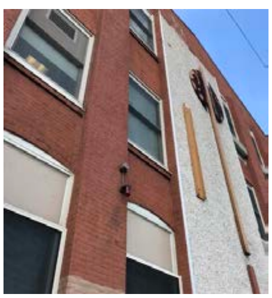
Roberto Clemente Elementary school is located at 257 Summer Ave in Newark, NJ. This 41,967 ft^2 facility was originally built in 1975 and is three stories tall. Roberto Clemente Elementary school consists of classroom space, office space, a library, gymnasium, computer rooms and a kitchen.

Building Occupancy

Approximate enrollment is 340 students with a fulltime staff of 22. Full occupancy of the building is during the months of September to June. The building is vacant during the summer months.

<u>Hours of Operation</u>

- Monday through Friday 6:30 am to 5:00 pm (students/staff)
- A second janitorial staff is present until 12 AM Monday through Friday
- Saturday and Sunday have varied hours



Building Envelope

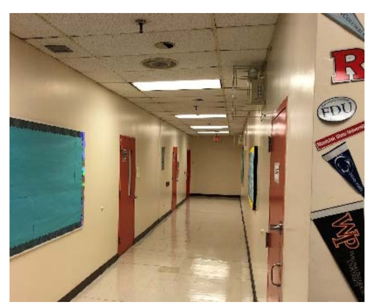
Envelope

The building is constructed of concrete masonry units with a brick façade. The façade is in good condition. The building is a single structure that is three (3) stories. The building has flat roofs with shingling. The roof appears to be in good condition. Windows cover approximately 45-55% of the façade. Windows on the building are mostly double pane, fixed or single hung. The windows appear to be in good condition. There are approximately two (2) double doors and one (1) single door, all in fair condition.

Lighting

The building is primarily lit by linear fluorescent fixtures which contain 32W T8 lamps. Fixtures throughout the building include individual fixtures with incandescent lamps, or high bay fixtures while some areas have fixtures with compact fluorescent plug in lamps. Exterior lighting includes large flood lamps. The fixtures are in good condition which provides a great opportunity for energy savings by retrofitting to LED technology.

<u>Lighting Controls:</u> The interior and exterior lighting for the building is manually controlled by wall mounted switches.



Light Fixtures

Mechanical Systems


Air Conditioning Unit

HVAC Systems and Equipment: Roberto Clemente Elementary does not have a central heating system. Heating for the building is provided by unit ventilators though electric resistance heating coils. The gymnasium and cafeteria are also heated by electrical resistance through one (1) constant volume air handler. This air handler is located in the basement.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
AHU	Mech Room	-	Nesbitt	WA18J4	-	87.5%	-

The classrooms and many areas are conditioned by self-contained unit ventilators equipped with heating and cooling coils. Refrigerant is pumped to the air handler. There is one (1) chiller that provides 80 tons of cooling that is located in the mechanical room of the building. The common areas of the building are cooled by the use of (1) condensing unit which is located outside the school. The chiller system was installed in 2002 and is expected to remain in working condition for its life expectancy.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
Chiller	Mech Room	Building	McQuay	WGZ080AW 27-ER10	2002		80 ton
AC-U	Ground Level	-	McQuay	ACD085A27 BY	-	80%	67,000 cfm 1.5 HP

Ventilation for classrooms and general areas are provided by the unit ventilators and multiple exhaust fans. The gymnasium and cafeteria are ventilated by the air handler.

Domestic Hot Water Systems

The building is supplied domestic hot water by an electric hot water heater. This 4500 watt 50-gallon electric hot water heater was installed in 2015. This equipment is in good condition and of standard efficiency.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
HWH	Mech Room	Building	Rheem Ruud	ES50-18-G-1	2015		50 gal 4500 watt

Building Controls (HVAC Controls)

The mechanical equipment in the building is controlled manually. Unit ventilators are controlled with classroom stationed thermostats. Lighting and any remaining equipment for the building is controlled by standalone controllers or switches. The typical temperature set points for the Roberto Clemente Elementary school are as follows:

Time Period Heating	Heating Season	Cooling Season
Occupied Hours	72°F	74°F
Unoccupied Hours	60°F	80°F

Building Controls

Kitchen Equipment

The kitchen utilizes both electric and gas cooking equipment. Various types of refrigeration equipment are present including coolers and a walk-in freezer. Standard refrigerators and ice machines are also present.


Walk-in Freezer

Plug Load

The building's plug load consists of general office equipment, kitchen warming and cooling equipment, and classroom equipment.

ESG observed to following significant plug load technologies:

Refer to Appendix 4 for device quantities.

Plumbing/Water System

The ESG team observed that all (27) faucets currently use high flow 2.0 gallon per minute (gpm) or higher and the showerheads are assumed standard and rated for 2.5 gpm or higher aerators that can be replaced with low flow aerators. Additionally, toilets and urinals located in the restroom areas have a rating of 1.6 and 1.0 gallons per flush, respectively.

Rosa L. Parks School of Fine and Performing Arts

Background Information

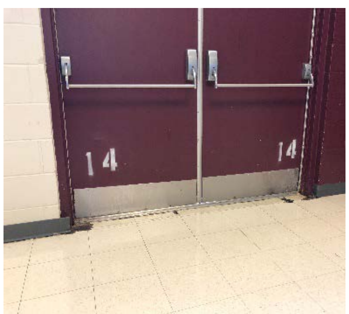
Rosa L. Parks School of Fine and Performing Arts school is located at 413 12th Avenue in Paterson, NJ. This 52,777 ft^2 facility was originally built in 1986. Rosa L. Parks School of Fine and Performing Arts school consists of classrooms, office space, a cafeteria and an auditorium.

Building Occupancy

Approximate enrollment is 265 students with a fulltime staff of 35. Full occupancy of the building is during the months of September to June. The building is vacant during the summer months.

Hours of Operation

- Monday through Friday 6:30 am to 5:00 pm (students/staff)
- A second janitorial staff is present until 12 AM Monday through Friday
- Saturday and Sunday have varied hours



Building Envelope

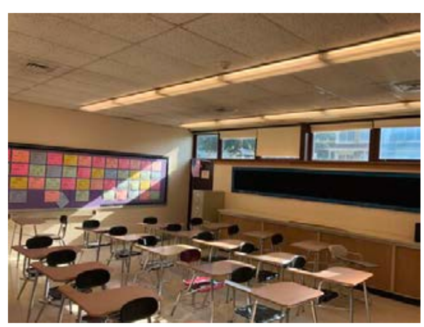
Envelope

The building is constructed of concrete masonry units with a cinderblock exterior. The façade is in good condition. The building is a single structure that is two (2) stories. The building has flat roofs with shingling. The roof appears to be in good condition. Windows cover approximately 50-60% of the façade. Windows on the building are mostly double pane, fixed or single hung. The windows appear to be in good condition. There are approximately three (3) double doors and two (2) single doors, all in fair condition.

Lighting

The building is primarily lit by linear fluorescent fixtures which contain 32W T8 lamps. Fixtures throughout the building include individual fixtures with incandescent lamps, interior and exterior Hi Bay fixtures, while some areas have fixtures with compact fluorescent plug in lamps. The exterior lighting includes food fixtures. These fixtures are in good condition which provides a great opportunity for energy savings by retrofitting to LED technology.

Lighting Controls: The interior and exterior lights are manually controlled via wall switches and sensor mounted switches.



Classroom Lighting

Mechanical Systems

HVAC Systems and Equipment: The building HVAC system includes eleven (11) constant volume rooftop units, one (1) constant volume make-up air units and six (6) exhaust fans. This system equipment provides a total DX cooling tonnage of 80-tons and a heating capacity 1600MBH by natural gas. The system could run more efficiently by installing new replacement units.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
RTU-A	Lower Roof	Classrooms	Trane	YHC036A4R	2004	12 EER 81%	3 ton 96 MBH
RTU-B	Lower Roof	Classrooms	Trane	YHC048A4R	2004	12 EER 81%	4 ton 96 MBH
RTU-C	Lower Roof	Classrooms	Renzor		2004	-	-
RTU-D	Lower Roof	Classrooms	Trane	YHC060A4R	2004	11.8 EER 81%	5 ton 130 MBH
RTU-E	Lower Roof	Classrooms	Trane	YHC063AA4R	2006	11.8 EER 81%	5 ton 130 MBH
RTU-3	Lower Roof	Classrooms	Trane	YHC063AA4R	2006	11.8 EER 81%	5 ton 130 MBH
RTU-F	Lower Roof	Cafeteria/ Auditorium	Carrier	48TMF016-501AA	2014	9.5 EER 81%	15 ton 223 MBH
RTU-1	Upper Roof	Cafeteria/ Auditorium	Trane	YCD420B4P M6D2D---	2014	81%	35 ton 600 MBH
RTU-G	Upper Roof	Cafeteria/ Auditorium	Renzor	-	-	-	-
RTU-H	Upper Roof	Cafeteria/ Auditorium	Trane	YCD036C4L ABE	-	12 EER 81%	3 ton 96 MBH
RTU-I	Upper Roof	Cafeteria/ Auditorium	Trane	-	-	-	-
MUA-1	Lower Roof	Classrooms	Greenheck	KSU-109-0-2-4	-	-	1/3 HP

The independent cooling system includes three (3) split system condensers that provide an additional 5-tons of cooling. These split condensers are located on the roof and they condition specific office areas and classrooms within the art wing. The installation date for these condensing units is unknown.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
Split Unit-1	Lower Roof	Classrooms	Carrier	38YCC018440	-	9.5 EER	1.5 ton
Split Unit-2	Lower Room	Classrooms	Carrier	38YCC018440	-	9.5 EER	1.5 ton
Split Unit-3	Upper Roof	Classrooms	Mitsubishi	R410A	-	10 EER	2 ton

Building ventilation is provided by seven (7) exhaust fans ran by either ¼ or 1/3 Hp motors. Classroom ventilation is provided by nine (9) Airedale units ran by ¾ HP motors.

Hot Water Heater

Domestic Hot Water Systems

The building is supplied domestic hot water by one (1) natural gas-fired hot water heater. This hot water heater is approximately 16 years old and is not of standard efficiency. This domestic hot water heater should be replaced with a new, high efficiency condensing domestic water heater.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
HWH	Basement MER	Building	Lochinvar	RWN225	2003	-	80 gal 225 MBH

Building Controls (HVAC Controls)

The HVAC systems and equipment are controlled by local thermostats. The building's remaining equipment is controlled by standalone controllers and switches. The typical temperature set points for the Rosa L. Parks School for Fine and Preforming Arts are as follows:

Time Period Heating	Heating Season	Cooling Season
Occupied Hours	72°F	74°F
Unoccupied Hours	60°F	80°F

Thermostat

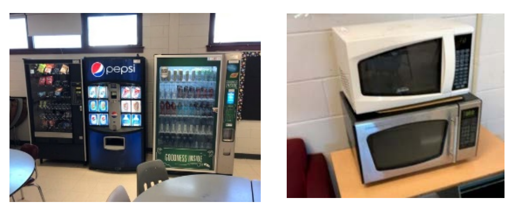
Kitchen Equipment

The kitchen utilizes both electric and gas cooking equipment. Various types of refrigeration equipment are present including walk-in coolers and a walk-in freezer. Standard refrigerators and ice machines are also present.

Plug Load

The building's plug load consists of general office equipment, kitchen warming and cooling equipment, and classroom equipment.

Refer to Appendix 4 for device quantities.



Building Plug Load

Plumbing/Water System

The ESG team observed that all (15) faucets currently use high flow 2.0 gallon per minute (gpm) or higher and the showerheads are assumed standard and rated for 2.5 gpm or higher aerators that can be replaced with low flow aerators. Additionally, toilets and urinals located in the restroom areas have a rating of 1.6 and 1.0 gallons per flush, respectively.

Rutland Early Childhood Learning Center

Background Information

Rutland Early Childhood Learning Center is located at 823 East 28th Street in Paterson, NJ. This 10,373 ft^2 facility was originally built in 1947. Rutland Early Childhood Learning Center consists of one (1) floor of office space and classrooms.

Building Occupancy

The current enrolled students and staff members is unknown. Full occupancy of the building is during the months of September to June. The building is vacant during the summer months.

Hours of Operation

- Monday through Friday 6:30 am to 6:00 pm (students/staff)
- Saturday and Sunday have no set hours

Envelope

The building is constructed of concrete masonry units with concrete exterior. The façade is in good condition. The building is a single structure with one (1) level. The building's roof is dome-shaped with an EDMP overlay but there is a flat section of the roof that holds HVAC equipment. The roof appears to be in good condition. Windows cover approximately 40-50% of the façade. Windows on the building are mostly double pane, fixed or single hung. The windows appear to be in good condition. There is approximately one (1) double door and six (6) single doors, all in good condition.

Lighting

The building is primarily lit by linear fluorescent fixtures which contain 32W T8 lamps. Some areas have fixtures with compact fluorescent plug in lamps. The exterior lighting includes building mounted wall pack fixtures. These fixtures contain compact metal halide lamps. The fixtures are in good condition which provides a great opportunity for energy savings by retrofitting to LED technology.

Lighting & controls: The building's interior and exterior lights are controlled manually by wall and senor mounted switches.

Mechanical Systems

HVAC Systems: The building HVAC system consist of five (5) constant volume gas-electric rooftop units. This system equipment provides a total DX cooling tonnage of 40-tons and a heating capacity 860 MBH by natural gas. This system would prove more efficient by replacing the existing gas-electric rooftop units with high efficiency units.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
RTU-1	Roof	Building	Trane	YCD150C3HCBA	1999	9.6 EER 81%	12.5 ton 250 MBH
RTU-2	Roof	Building	Trane	YCD060C3HCBE	1999	14 EER 81%	5 ton 130 MBH
RTU-3	Roof	Building	Trane	YCD075C3HCBE	1999	11.2 EER 81%	7.5 ton 200 MBH
RTU-4	Roof	Building	Trane	YCD150C3HCBA	1999	9.6 EER 81%	12.5 ton 250 MBH
RTU-5	Roof	Building	Trane	YCC024F1L0BG	1999	9.1 EER 78 %	2 ton 32 MBH

Ventilation is provided by two (2) exhaust fan motors ran by 1/3 Hp motors.

Domestic Hot Water Systems

The building is supplied domestic hot water by one (1) natural gas-fired hot water heater. This gas-fired hot water heater was installed in 2015. The building would benefit by replacing this water heater with a new, high efficacy condensing water heater.

Domestic Hot Water

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
DHW-1	Mech Closet	Building	Whirlpool	N50T60-403	-	-	50 gal 40 MBH

Building Controls (HVAC Controls)

The HVAC system is controlled by zoned system thermostats. The remaining equipment is controlled by standalone switches. The typical temperature set points for the Rutland Early Childhood Learning Center are as follows:

Time Period Heating	Heating Season	Cooling Season
Occupied Hours	72°F	74°F
Unoccupied Hours	65°F	80°F

Plug Load

The building's plug load consists of general office equipment, food warming/cooling equipment and classroom equipment. There is no kitchen in the building but microwaves and refrigerators in the building are used by staff.

Refer to Appendix 4 for device quantities.

Plumbing/Water System

The ESG team observed that all (7) faucets currently use high flow 2.0 gallon per minute (gpm) or higher and the showerheads are assumed standard and rated for 2.5 gpm or higher aerators that can be replaced with low flow aerators. Additionally, toilets and urinals located in the restroom areas have a rating of 1.6 and 1.0 gallons per flush, respectively.

School 12

Background Information

School 12 is located at 121 North Second Street in Paterson, NJ. This 72,686 ft^2 facility was originally built in 1913. School 12 consists of four (4) floors consisting of office space, classrooms, a gymnasium, library, and cafeteria.

Building Occupancy

Approximate enrollment is 559 students with a fulltime staff of 44. Full occupancy of the building is during the months of September to June. The building is vacant during the summer months.

<u>Hours of Operation</u>

- Monday through Friday 6:30 am to 5:00 pm (students/staff)
- A second janitorial staff is present until 12 AM Monday through Friday
- Saturday and Sunday have varied hours

Envelope

The building is constructed of concrete masonry units with a brick facade. The façade is in good condition. The building is a single structure that is four (4) stories. The building has a flat roof with an EDMP overlay. The roof appears to be in good condition. Windows cover approximately 45-55% of the façade. Windows on the building are mostly double pane, fixed or single hung. The windows appear to be in good condition. There are approximately nine (9) double doors that are all in fair condition.

Building Envelope

Lighting

The building is primarily lit by linear fluorescent fixtures which contain 32W T8 lamps. The exterior lighting includes have fixtures with compact fluorescent plug in lamps and building mounted wall pack fixtures. These fixtures contain compact metal halide lamps. The parking lot is lit with high pressure sodium parking flood lights. These fixtures are in good condition which provides a great opportunity for energy savings by retrofitting to LED technology.

<u>Lighting Controls:</u> The interior and exterior lights are manually controlled by wall mounted switches.

Mechanical Systems

HVAC Systems: The entire building is provided heated hot water by two (2) natural gas-fired low pressure steam boilers rated for a heating capacity of 4330 MBH. Steam is supplied to the radiators in the classrooms. Heating hot water from the heat exchangers is supplied to the building unit ventilators (which are also located in the same classrooms as the radiators) and one (1) air handler by two (2) constant volume circulation pumps powered by 15 HP motors. The circulation pumps are in good condition and should last the remainder of their life expectancy. The gymnasium houses the air handler used for its own heating. There are two (2) pumps each powered by a 1HP motor located beside the air handler in a Hot Box.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
Boiler-1 & 2 (2 total)	Boiler Room	Building	Weil-McClain	1394	1993	-	4330 MBH
Pump- 1 & 2 (2 total)	Boiler Room	Building	A.O Smith	P48k2EB7	-	-	¾ HP
AHU	Gym	Building	Marathon	AVD56T34F 5344B	-	-	1HP
HW Pump 1 & 2 (2 total)	Boiler Room	Building	Baldor	M2513T-8	-	82%	15HP

The building does not have a central cooling system. Specific spaces and offices are conditioned by seven (7) split system condensing units. The library and administrative offices are provided air conditioning from these units.

Ventilation for the building is assisted by the unit ventilators and exhaust fans. The unit ventilators serve classroom space, the computer room and office areas. Ventilation for the gymnasium is carried out by an air handler.

Refer to Appendix 8 for a detailed list of HVAC equipment at the site.

Domestic Hot Water

Domestic Hot Water Systems

The entire building is provided heated hot water from two (2) natural gas-fired hot water heaters. Each heater has a heating capacity of 40 MBH. The age of these heaters is unknown. These domestic hot water heaters are not of standard efficiency and should be replaced with high efficiency domestic hot water heaters.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
DWH-1	Boiler Room	Building	AO Smith	BFG6150T403N OV	2010	-	50 gal 40 MBH
DWH-2	Boiler Room	Building	AO Smith	BFG6150T403N OV	2010		50 gal 40 MBH

Building Controls

Building Controls (HVAC Controls)

Manual control of the boilers is done by the janitorial staff who physically heat check each room every two (2) hours in order to maintain classroom temperature during inoccupancy. The lead custodian is on call 24/7 to turn on the boilers if the temperature drops below 29°F during a weekday or 25°F on a weekend. Unit Ventilators are controlled using thermostats located in classrooms and offices. The remaining equipment in the building is controlled by standalone local thermostats and switches. The typical temperature set points for School 12 are as follows:

Time Period Heating	Heating Season	Cooling Season
Occupied Hours	72°F	N/A
Unoccupied Hours	60°F	N/A

Kitchen Equipment

The kitchen utilizes both electric and gas cooking equipment. Various types of refrigeration equipment are present including coolers and freezers. Standard refrigerators and ice machines are also present. The kitchen equipment is in good working condition.

Plug Load

The building's plug load consists of general office equipment, kitchen equipment and classroom equipment.

Refer to Appendix 4 for device quantities.

Building Plug Load

Plumbing/Water System

The ESG team observed that all (18) faucets currently use high flow 2.0 gallon per minute (gpm) or higher and the showerheads are assumed standard and rated for 2.5 gpm or higher aerators that can be replaced with low flow aerators. Additionally, toilets and urinals located in the restroom areas have a rating of 1.6 and 1.0 gallons per flush, respectively.

School 13

Background Information

School 13 is located at 690 East 23rd Street in Paterson, NJ. This 94,091 ft^2 facility was originally built in 1926. School 13's original structure is three (3) stories tall and has since constructed a new addition consisting of two (2) stories.

Building Occupancy

Approximate enrollment is 590 students with a fulltime staff of 46. Full occupancy of the building is during the months of September to June. The building is vacant during the summer months.

Hours of Operation

- Monday through Friday 6:30 am to 5:00 pm (students/staff)
- A second janitorial staff is present until 12 AM Monday through Friday
- Saturday and Sunday have varied hours

Envelope

The original building and its addition are constructed of concrete masonry units with a brick facade. The façade is in good condition. The building's original structure is three (3) stories tall but has since constructed a new addition consisting of two (2) stories. The building has a flat roof with an EDMP overlay. The roof appears to be in good condition. Windows cover approximately 45-55% of the façade. Windows on the building are mostly double pane, fixed or single hung. The windows appear to be in good condition. There is approximately one (1) double door and five (5) single doors that are all in fair condition.

Building Envelope

Lighting

The building is primarily lit by linear fluorescent fixtures which contain 32W T8 lamps. Fixtures throughout the building include individual fixtures with incandescent lamps while some areas have fixtures with compact fluorescent plug in lamps. The exterior lighting includes wall spot fixtures. These fixtures are in good condition which provides a great opportunity for energy savings by retrofitting to LED technology.

Lighting Controls: The interior and exterior lights are manually controlled by wall and sensor mounted switches.

Mechanical Systems

HVAC Systems: The building uses two (2) natural gas-fired boilers that supply steam for unit ventilators and two (2) constant volume air handlers for heat. The installation date for the boilers is around 2000 and they appear to be in poor condition. The air handlers each serve either the cafeteria or the gymnasium. Condensate is automatically returned to the boilers by two (2) pumps ran by 1/3HP motors.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
Boiler- 1 & 2 (2 Total)	Boiler Room	Building	Eastmond & Sons	ESP100	2000		4200 MBH
Pump 1 & 2 (2 Total)	Boiler Room	Boiler	Skidmore	C48H2EC11	-	-	1/3 HP
AHU-1	Ground Level	Cafeteria	Trane	TSCA010U0C	-	-	Steam
AHU-2	Original Building Roof	Gym	Trane	TSCA014U0C	-	-	Steam

The building classrooms are conditioned by individual window AC units. The library and computer room are served by two (2) 2.5-ton split systems along with two (2) 3.5-ton air-cooled condensers. One (1) Mitsubishi .7-ton split unit serves the gym office. These five (5) split units should be replaced with high efficiency replacement units. Additionally, there is one (1) 1-ton Mammoth split unit that services B4/5, and is relatively new and in good condition.

The new addition is conditioned from eleven (11) roof-top units with DX cooling coils. Nine (9) roof-top units have a cooling capacity of 4 tons and 2 (two) roof-top units have a cooling capacity of 6 tons. The existing rooftop units are not of standard efficiency and should be replaced with new, high efficiency rooftop units.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
Split Unit 1 &2 (2 Total)	Original Building Roof	Computer Room/ Library	Mitsubishi	PUG30CKC	-	10.5 EER	2.5 ton
ACCU 1 & 2 (2 Total)	Original Building Roof	Computer Room/ Library	Trane	2TTB0042A 1000AA	-	10 EER	3.5 ton
Split Unit	Ground Level	Gym Office	Mitsubishi	MU09TW	-	10.1 EER	.7 ton

Ventilation for the building is provided by unit ventilators and roof-top exhaust fans

Domestic Hot Water Systems

There building is provided heated hot water through one (1) natural gas-fired hot water heater. This hot water heater was installed ±2010 and is in good working condition.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
DWH	Boiler Room	Building	AO Smith	BTH 120 100	2008		100 gal 120 MBH

Building Controls (HVAC Controls)

Building Controls

Manual control of the boilers is done by the janitorial staff who physically heat check each room every two (2) hours in order to maintain classroom temperature during inoccupancy. The lead custodian is on call 24/7 to turn on the boilers if the temperature drops below 29°F during a weekday or 25°F on a weekend. Unit Ventilators are controlled using thermostats located in classrooms and offices. The remaining equipment in the building is controlled by standalone local thermostats and switches. The typical temperature set points for School 13 are as follows:

Time Period Heating	Heating Season	Cooling Season
Occupied Hours	72°F	74°F
Unoccupied Hours	65°F	80°F

Plug Load

The building's plug load consists of general office equipment, kitchen equipment and classroom equipment.

Refer to Appendix 4 for device quantities.

Plumbing/Water System

The ESG team observed that all (41) faucets currently use high flow 2.0 gallon per minute (gpm) or higher and the showerheads are assumed standard and rated for 2.5 gpm or higher aerators that can be replaced with low flow aerators. Additionally, toilets and urinals located in the restroom areas have a rating of 1.6 and 1.0 gallons per flush, respectively.

Plug Load

School 17

Background Information

School 17 is located at 112 North 5th Street in Paterson, NJ. This 17,520 ft^2 facility was originally built in 1891. School 17 consists of two (2) stories with classroom space, office areas and warming kitchen.

Building Occupancy

Approximate enrollment is 140 students with a fulltime staff of 12. Full occupancy of the building is during the months of September to June. The building is vacant during the summer months.

<u>Hours of Operation</u>

- Monday through Friday 6:30 am to 6:00 pm (students/staff)
- Saturday and Sunday have varied hours

Envelope

Building Envelope

The building is constructed of concrete masonry units with a brick facade. The façade is in good condition. The building's structure is two (2) stories tall. The building has a sloped roof that is shingled. The roof appears to be in good condition. Windows cover approximately 45-55% of the façade. Windows on the building are mostly double pane, fixed or single hung. The windows appear to be in good condition. There are approximately eleven (11) double doors and thirteen (13) single doors that are all in fair condition.

Lighting

The building is primarily lit by linear fluorescent fixtures which contain 32W T8 lamps. Fixtures throughout the building include individual fixtures with compact fluorescent plug in lamps. The exterior lighting includes wall pack fixtures with metal halide and CFL lights. These fixtures are in good condition which provides a great opportunity for energy savings by retrofitting to LED technology.

<u>Lighting Controls:</u> The interior and exterior lights are manually controlled by wall and sensor mounted switches.

Mechanical Systems

HVAC Systems: The building is heated from (2) natural gas-fired boilers that supply steam for the building's unit ventilators. The installation date for the boilers is 1996, and they appear to be in good working condition. Condensate is collected and returned by a new single tank receiver with two (2) new pumps (installed spring 2019).

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
Boiler- 1 & 2 (2 Total)	Boiler Room	Building	AO Smith	28-A-10	1996	-	3172 MBH
Pumps 1, 2, 3 (3 total)	Boiler Room	Boiler Condensate	Baldor	34K83-2534	-	79%	1/3HP

There is no central cooling system in the school. Individual classrooms and office areas are conditioned by window AC units. Ventilation for the building is provided by the building's unit ventilators.

Refer to Appendix 8 for a detailed list of HVAC equipment at the site.

Domestic Hot Water Systems

Heated hot water is provided by one (1) natural gas-fired boiler with a storage capacity of 119-gallons and a heating capacity of 120 MBH. This boiler was installed ±2010. This boiler is not of standard efficiency and should be replaced with a high efficiency gas water heater.

Domestic Hot Water

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
HWH	Boiler Room	Building	AO Smith	BTR 120 118	2010	-	119 gal 120 MBH

Building Controls (HVAC Controls)

The equipment in the building is controlled by standalone, local thermostats, controllers or switches. The typical temperature set points for School 17 are as follows:

Time Period Heating	Heating Season	Cooling Season
Occupied Hours	72°F	N/A
Unoccupied Hours	60°F	N/A

Plug Load

The building's plug load consists of general office equipment, kitchen equipment and classroom equipment.

Refer to Appendix 4 for device quantities.

Computer Room

Plumbing/Water System

The ESG team observed that all (11) faucets currently use high flow 2.0 gallon per minute (gpm) or higher and the showerheads are assumed standard and rated for 2.5 gpm or higher aerators that can be replaced with low flow aerators. Additionally, toilets and urinals located in the restroom areas have a rating of 1.6 and 1.0 gallons per flush, respectively.

School 18

Background Information

School 18 is located at 51 East 18th Street in Paterson, NJ. This 94,276 ft^2 facility was originally built in 1937. School 17 consists of the (3) stories of classroom space, office space, an auditorium and a warming kitchen.

Building Occupancy

Approximate enrollment is 1064 students with a fulltime staff of 75. Full occupancy of the building is during the months of September to June. The building is vacant during the summer months.

<u>Hours of Operation</u>

- Monday through Friday 6:30 am to 5:00 pm (students/staff)
- A second janitorial staff is present until 12 AM Monday through Friday
- Saturday and Sunday have varied hours

Envelope

Unsealed AC Unit

The building is constructed of concrete masonry units with a brick facade. The façade is in good condition. The building's structure is three (3) stories tall. The building has a sloped roof that is shingled. The roof appears to be in good condition. Windows cover approximately 55-65% of the façade. Windows on the building are mostly double paned and appear to be in good condition. There are approximately eight (8) double doors and three (3) single doors that are all in fair condition.

Lighting

The building is primarily lit by linear fluorescent fixtures which contain 32W T8 lamps. Fixtures throughout the building include individual fixtures with incandescent lamps, high sodium high-bay fixtures and some areas have fixtures with compact fluorescent plug in lamps. These fixtures are in good condition which provides a great opportunity for energy savings by retrofitting to LED technology.

<u>Lighting Controls:</u> The building's interior lights are manually controlled by wall and sensor mounted switches.

Mechanical Systems

Gas-Fired Boilers

HVAC Systems: The building is heated from (2) natural gas-fired boilers that supply Hot water to the building's unit ventilators. The boilers were installed in 2001.

Heated hot water is moved throughout the building by two (2) constant volume pumps each pump is powered by a 10HP motor. Eight (8) constant volume and standby water pumps distribute heating hot water and domestic hot water throughout the school. These pumps serve the building's unit ventilators, baseboard heaters, and rooftop air handlers.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
Boiler- 1 & 2 (2 total)	Boiler Room	Building	Weil-McClain	1888	2001	-	5845 MBH
Pump- 1 & 2 (2 total)	Boiler Room	Primary	Baldor	EM3313T	-	92%	10HP
Pump- 3 & 4 (2 total)	Boiler Room	HW Secondary & Standby	Baldor	JMM3211T	-	82.5%	3HP 90 gpm
Pump- 5 & 6 (2 total)	Boiler Room	HW Secondary & Standby	Century	E294	-	-	3HP 65 gpm
Pump- 7 & 8 (2 total)	Boiler Room	HW Secondary & Standby	Baldor	JMM3311T	-	85.5%	7.5HP 250 gpm
Pump- 9 &10 (2 total)	Boiler Room	HW Secondary & Standby	Baldor	JMM3211T	-	82.5%	3HP 120 gpm

There is no central cooling system in the school. Individual classrooms and office areas are conditioned by window AC units.

Ventilation for the building is provided by the building's unit ventilators and thirteen (13) exhaust fans. The building has two (2) air handlers that provide ventilation and heat to the auditorium and cafeteria. The installation date for the air handlers is unknown but they appear to be in working condition.

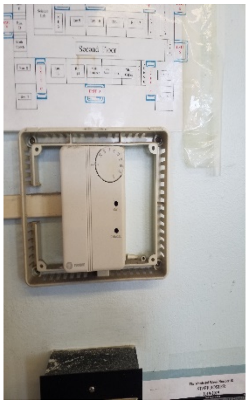
Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
AHU- 1 & 2 (2 total)	Roof	Cafeteria/Gym	Trane	-	1999	-	-

Domestic Hot Water Systems

Heated hot water is provided by one (1) 80-gallon natural gas-fired boiler with a heating capacity of 200 MBH. This boiler was installed ±2015. This boiler should be replaced with a new, high efficiency condensing gas water heater.

Domestic Hot Water

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
HWH	Boiler Room	Building	Bradford White	D80T1993N	2015	-	80 gal 199 MBH



Building Controls

Building Controls (HVAC Controls)

Manual control of the boilers is done by the janitorial staff who physically heat check each room every two (2) hours in order to maintain classroom temperature during inoccupancy. The lead custodian is on call 24/7 to turn on the boilers if the temperature drops below 29°F during a weekday or 25°F on a weekend. Unit Ventilators are controlled using thermostats located in classrooms and offices. The remaining equipment in the building is controlled by standalone local thermostats and switches. The typical temperature set points for School 18 are as follows:

Time Period Heating	Heating Season	Cooling Season
Occupied Hours	72°F	N/A
Unoccupied Hours	60°F	N/A

Plug Load

The building's plug load consists of general office equipment, kitchen equipment and classroom equipment.

Building Plug Load

Refer to Appendix 4 for device quantities.

Plumbing/Water System

The ESG team observed that all (32) faucets currently use high flow 2.0 gallon per minute (gpm) or higher and the showerheads are assumed standard and rated for 2.5 gpm or higher aerators that can be replaced with low flow aerators. Additionally, toilets and urinals located in the restroom areas have a rating of 1.6 and 1.0 gallons per flush, respectively.

School 28

Background Information

School 28 is located at 200 Presidential Boulevard in Paterson, NJ. This 104,417 ft^2 facility was originally built in 1962. School 28 consists of three (3) stories of classroom space, office space, a gymnasium, an auditorium and a cafeteria.

Building Occupancy

Approximate enrollment is 267 students with a fulltime staff of 42. Full occupancy of the building is during the months of September to June. The building is vacant during the summer months.

Hours of Operation

- Monday through Friday 6:30 am to 5:00 pm (students/staff)
- A second janitorial staff is present until 12 AM Monday through Friday
- Saturday and Sunday have varied hours

Envelope

Building Envelope

The building is constructed of concrete masonry units with a brick facade. The façade is in good condition. The building is a single structure with the tallest section being three (3) stories tall. The building has a flat roof with an EDMP overlay. The roof appears to be in good condition. Windows cover approximately 60-70% of the façade. Windows on the building are mostly double paned, single hung or fixed and appear to be in good condition. There are approximately eleven (11) double doors and fifteen (15) single doors that are all in fair condition.

Lighting

Hallway Lighting

The building is primarily lit by linear fluorescent fixtures which contain 32W T8 lamps. Fixtures throughout the building include individual fixtures with incandescent lamps, high pressure sodium fixtures and some areas have fixtures with compact fluorescent plug in lamps. The exterior lighting includes high pressure sodium fixtures. These fixtures are in good condition which provides a great opportunity for energy savings by retrofitting to LED technology.

Lighting Controls: The building's interior lights are manually controlled by wall and sensor mounted switches.

Gas Fired Boiler

Mechanical Systems

HVAC Systems: The building is heated from (2) natural gas-fired boilers that supply steam to the building's unit ventilators. The boilers were installed ±2002 and appear to be in good working condition. Heated hot water is moved throughout the building by two (2) constant volume pumps each pump is powered by a 10HP motor.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
Boiler- 1 & 2 (2 Total)	Boiler Room	Building	AO Smith	28A-SW-17	2002	-	5525 MBH
Pumps- 1 & 2 (2 Total)	Boiler Room	Building	AO Smith	07-360339-01-OJ	-	85%	10 HP 525 gpm

Additionally, there are five (5) air handlers that heat the auditorium, gymnasium, locker room, and cafeteria. Two of these units serve the cafeteria; these units are approximately 7 years and are in good working condition. The remaining two units that serve the gymnasium and auditorium appear to be original to the building and may have outlived their estimated service life.

There is no central cooling system in the school. Individual classrooms and office areas are conditioned by window AC units.

Ventilation for the building is provided by the building's unit ventilators and eighteen (28) exhaust fans. The cafeteria and gymnasium are ventilated by their appropriate air handlers.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
HV-1	Penthouse Mech.	Auditorium	AAF-Unit Wagner-Motor	B 5-50	-	-	7.5HP 9 MBH
HV-2	Penthouse Mech.	Gym	AAF- Unit Reliance- Motor	B 6-64	-	82.5%	5 HP 18.865 MBH
RTU- 1&2 (2 total)	Cafeteria	Cafeteria	Trane- Unit Baldor- Motor	-	-	89.5%	5 HP
HV-3	Penthouse Mech.	Locker Room	AAF- Unit Industrial Motor				1/3 HP

Hot Water Heater

Domestic Hot Water Systems

Domestic hot water for the building is provided by two (2) hot water heaters. A single natural gas-fired hot water heater supplies the general building load. This gas-fired boiler is in the building room and has a heating capacity of 399 MBH. The kitchen is provided heated water by an electric water heater. This electric water heater is in the kitchen and has 4500 total watts. The gas-fired heater was installed in ±2003 while the electric heater was installed in ±2007. Both hot water heaters should be replaced with new, high efficiency water heaters,

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
HWH-1	Boiler Room	Building	Lochinvar	-	2003	-	399 MBH
HWH-2	Mech Room	Back Up Load	Vanguard	3WA73	2007	-	50 gal 4500 watt

Building Controls

Building Controls (HVAC Controls)

Manual control of the boilers is done by the janitorial staff who physically heat check each room every two (2) hours in order to maintain classroom temperature during inoccupancy. The lead custodian is on call 24/7 to turn on the boilers if the temperature drops below 29°F during a weekday or 25°F on a weekend. Unit Ventilators are controlled using thermostats located in classrooms and offices. The remaining equipment in the building is controlled by standalone local thermostats and switches. The typical temperature set points for School 28 are as follows:

Time Period Heating	Heating Season	Cooling Season
Occupied Hours	72°F	N/A
Unoccupied Hours	60°F	N/A

Plug Load

The building's plug load consists of general office equipment, kitchen equipment and classroom equipment.

ESG observed to following significant plug load technologies:

Refer to Appendix 4 for device quantities.

Plumbing/Water System

The ESG team observed that all (59) faucets currently use high flow 2.0 gallon per minute (gpm) or higher and the showerheads are assumed standard and rated for 2.5 gpm or higher aerators that can be replaced with low flow aerators. Additionally, toilets and urinals located in the restroom areas have a rating of 1.6 and 1.0 gallons per flush, respectively.

School 6

Background Information

School 6 is located at 137 Carroll Street in Paterson NJ. This 97,248 ft^2 facility was originally built in 1921. School 6 consists of a ground level and three (3) stories of classroom space, office space, an auditorium, a gymnasium and a cafeteria.

Building Occupancy

Approximate enrollment is 432 students with a fulltime staff of 41. Full occupancy of the building is during the months of September to June. The building is vacant during the summer months.

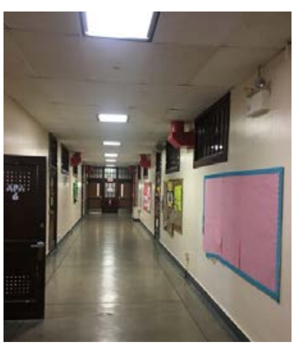
<u>Hours of Operation</u>

- Monday through Friday 6:30 am to 5:00 pm (students/staff)
- A second janitorial staff is present until 12 AM Monday through Friday
- Saturday and Sunday have varied hours

Building Envelope

Envelope

The building is constructed of concrete masonry units with a brick facade. The façade is in good condition. The building is a single structure that is three (3) stories tall. The building has a flat roof with an EDMP overlay. The roof appears to be in good condition. Windows cover approximately 60-70% of the façade. Windows on the building are mostly double paned, single hung or fixed and appear to be in good condition. There are approximately three (3) double doors and six (6) single doors that are all in fair condition.



Light Fixtures

Lighting

The building is primarily lit by linear fluorescent fixtures which contain 32W T8 lamps. Fixtures throughout the building include individual fixtures with incandescent lamps, high pressure sodium lamps and fixtures with compact fluorescent plug in lamps. The exterior lighting includes flood lamps. These fixtures are in good condition which provides a great opportunity for energy savings by retrofitting to LED technology.

<u>Lighting Controls:</u> The building's interior lights are manually controlled by wall and sensor mounted switches. The exterior lighting is controlled by mechanical time clocks.

Boiler

Mechanical Systems

HVAC Systems: The building is heated from (2) natural gas-fired boilers that supply hot water to the building's unit ventilators. The boilers appear to be in good working condition and should serve their life expectancy. Heated hot water is moved throughout the building by three (3) constant volume pumps each pump is powered by a 15HP motor. Additionally, there are three (3) constant volume air handlers that serve and heat either the auditorium, gymnasium and cafeteria. The age of these air handlers in unknown but they appear to be in good working condition.

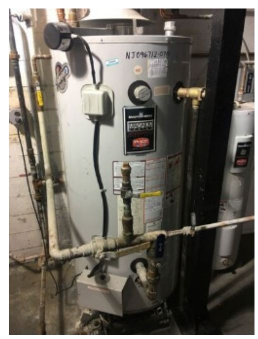
Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
Boiler- 1 & 2 (2 Total)	Boiler Room	Building	AO Smith	4500A-17	2002	-	7309 MBH
Pumps- 1, 2 & 3	Boiler Room	Building	Baldor	M2513T	-	75%	15 HP 500 gpm

There is no central cooling system in the school. Individual classrooms and office areas are conditioned by window AC units.

Ventilation for the building is provided by the building's unit ventilators and roof-top exhaust fans. The auditorium, cafeteria and gymnasium are ventilated by their appropriate air handlers.

Domestic Hot Water Systems

Domestic hot water for the building is provided by three (3) hot water heaters. This includes two (2) natural gas-fired hot water heaters. One of these gas-fired hot water heaters has a heating capacity of 250 MBH and was installed in ±2005. The other gas-fired heater has a heating capacity of 40 MBH and was installed in ± 2014. The remaining hot water heater is an electric and was installed in ±2002. The electric water heater is disconnected and not in use. These three (3) hot water heaters are not of standard efficiency and should be replaced with new, high efficiency hot water heaters.



Domestic Hot Water

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
HWH-1	Boiler Room	Building	AO Smith	GCV50300	2014	-	40 MBH
HWH-2	Boiler Room	Building	Bradford White	D80T2503NA	2005	-	250 MBH
HWH-3	Boiler Room	Building	AO Smith	MI40S6DS13	2002	-	40 gal 6000 watts

Building Controls (HVAC Controls)

The HVAC systems and equipment are controlled by a Building Management System (BMS), which is reported to have communication issues with the building equipment. The remaining equipment in the building is controlled by standalone local thermostats and switches. The typical temperature set points for School 6 are as follows:

Time Period Heating	Heating Season	Cooling Season
Occupied Hours	72°F	N/A
Unoccupied Hours	60°F	N/A

Plug Load

The building's plug load consists of general office equipment, kitchen equipment and classroom equipment.

Refer to Appendix 4 for device quantities.

Plumbing/Water System

The ESG team observed that all (32) faucets currently use high flow 2.0 gallon per minute (gpm) or higher and the showerheads are assumed standard and rated for 2.5 gpm or higher aerators that can be replaced with low flow aerators. Additionally, toilets and urinals located in the restroom areas have a rating of 1.6 and 1.0 gallons per flush, respectively.

School 7

Background Information

School 7 is located at 106 Ramsey Street in Paterson, NJ. This 48,835 ft^2 facility was originally built in 1919. School 7 consists of two (2) floors of office space, classroom space and a cafeteria.

Building Occupancy

Approximate enrollment is 247 students with a fulltime staff of 29. Full occupancy of the building is during the months of September to June. The building is vacant during the summer months.

<u>Hours of Operation</u>

- Monday through Friday 6:30 am to 5:00 pm (students/staff)
- A second janitorial staff is present until 12 AM Monday through Friday
- Saturday and Sunday have varied hours

Envelope

The building is constructed of concrete masonry units with a brick facade. The façade is in good condition. The building is a single structure with the tallest section being two (2) stories tall. The building has a flat roof with an EDMP overlay. The roof appears to be in good condition. Windows cover approximately 55-65% of the façade. Windows on the building are mostly double paned, single hung or fixed and appear to be in good condition. There are approximately five (5) double doors and two (2) single doors that are all in fair condition.

Lighting

The building is primarily lit by linear fluorescent fixtures which contain 32W T8 lamps. Fixtures throughout the building also include fixtures with compact fluorescent plug in lamps.

<u>Lighting Controls:</u> The building's interior lights are manually controlled by wall and sensor mounted switches.

Mechanical Systems

HVAC Systems: The building is heated from (2) low pressure boilers that supply steam to the building's unit ventilators. Each boiler is rated for a heating capacity of 5124MBH. The boilers appear to be in good working condition and should serve their life expectancy. Condensate is collected and returned by three (3) 1/3HP motors.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
Boiler-1 & 2 (2 total)	Boiler Room	Building	Weil-McClain	1688	1996	-	5124 MBH
Pumps- 1, 2, 3,4 & 5 (5 total)	Boiler Room	Steam System	A.O Smith	P48K2EB7	-	-	.5 HP

Existing Boiler

There is no central cooling system in the school. Individual classrooms and office areas are conditioned by window AC units. The third floor is conditioned by (1) 2-ton split unit that was installed in ±2010. This unit should be replaced with a new, high efficiency unit.

Ventilation for the building is provided by the building's unit ventilators and two (2) roof-top exhaust fans.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
Split Unit	Lower Roof	Classrooms	Trane	2TTA2042B 30000AA	2003	12 EER	4 tons

Domestic Hot Water Systems

Domestic hot water is provided by one (1) natural gas-fired hot water heater rated for a heating capacity of 199MBH. This hot water heater was installed in ±2010 and is expected to operate for the remainder of its life expectancy.

Hot Water Heater

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
HWH	Boiler Room	Building	Rheem-Ruud	G91-200-1	2010	-	91 gal 199 MBH

Building Controls (HVAC Controls)

The building's mechanical equipment is controlled by standalone local thermostats and switches. The typical temperature set points for School 7 are as follows:

Time Period Heating	Heating Season	Cooling Season
Occupied Hours	72°F	N/A
Unoccupied Hours	60°F	N/A

Plug Load

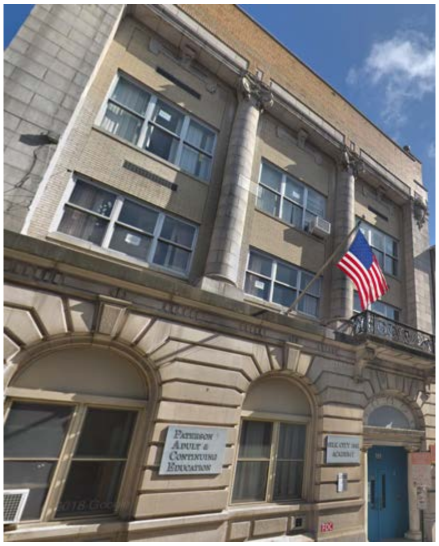
The building's plug load consists of general office equipment, kitchen equipment and classroom equipment.

Refer to Appendix 4 for device quantities.

Plumbing/Water System

The ESG team observed that all (13) faucets currently use high flow 2.0 gallon per minute (gpm) or higher and the showerheads are assumed standard and rated for 2.5 gpm or higher aerators that can be replaced with low flow aerators. Additionally, toilets and urinals located in the restroom areas have a rating of 1.6 and 1.0 gallons per flush, respectively.

Silk City 2000 Academy



Background Information

Silk City 2000 Academy is located at 151 Ellison Street in Paterson, NJ. This 31,117 ft^2 facility was originally built in 1908. Silk City 2000 Academy consists of four (4) stories of office space, classroom space and a cafeteria.

Building Occupancy

Approximate enrollment is 96 students with a fulltime staff of 18. The building is fully occupied year-round.

<u>Hours of Operation</u>

- Monday through Friday 6:30 am to 5:00 pm (students/staff)
- A second janitorial staff is present until 12 AM Monday-Friday
- Saturday and Sunday have varied hours

Envelope

The building is constructed of concrete masonry units with a concrete facade. The façade is in good condition. The building is a single structure that is four (4) stories tall. The building has a flat roof with an EDMP overlay. The roof appears to be in good condition. Windows cover approximately 40-50% of the façade. Windows on the building are mostly double paned, single hung or fixed and appear to be in good condition. There is approximately one (1) double door and one (1) single door, both doors are in good condition.

Building Envelope

Light Fixtures

Lighting

The building is primarily lit by linear fluorescent fixtures which contain 32W T8 lamps. Fixtures throughout the building include individual fixtures with incandescent lamps and fixtures with compact fluorescent plug in lamps.

<u>Lighting Controls:</u> The building's interior lights are manually controlled by wall and sensor mounted switches.

Mechanical Systems

HVAC Systems: The building is heated by one (1) low pressure boiler that supplies steam to the building's unit ventilators. This boiler is rated for a heating capacity of 2403MBH. The boiler was installed in 2016 and is a high-efficiency model.

Designation	Location	Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
Boiler	Boiler Room	Building	Smith	28HE-8	2016	-	2403 MBH

Gas-fired Heater

The cooling of the building is broken up into 3 sections with 3 separate split systems. The 15-ton split system services the basement, the 12-ton split system services the right side of the building, and the 19-ton split system services the left side of the building. Individual classrooms and office areas are conditioned by window AC units. Conditioning is provided by three (3) roof-top units with DX cooling coils and one (1) split unit. The roof-top units are approximately 21 years old and are in good working condition. The split unit is also in good working condition.

Ventilation for the building is provided by three (3) constant volume air handlers and two (2) rooftop exhaust fans.

Designation	Location	Floor/Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
AC RTU-1	Roof	Basement	McQuay	ALP015D	-	11.4 EER	15 tons
AC RTU-2	Roof	Right Side Of Building	McQuay	ALP012D	-	11.4 EER	12 tons
AC RTU-3	Roof	Left Side Of Building	McQuay	ALP019D	-	11.4 EER	19 tons
Split Unit	Roof	-	Carrier	CA5560VHD2	-	10 EER	5 tons
AHU-1	Basement	Basement	McQuay	LSL111CV	-	-	5 HP
AHU-2 & 3 (2 Total)	Floor 1 MER	Right/Left Side Of Building	McQuay	LSL108CV	-	-	5 HP

Domestic Hot Water Systems

Heated hot water is provided by one (1) 120-gallon electric heater with a rated heating capacity of 4,500 watts. The age of this heater is unknown, but it should be replaced with a new, high efficiency domestic hot water heater.

Designation	Location	Serves	Manufacturer	Model/Make	Date	Efficiency	Capacity
HWH	Boiler Room	Building	AO Smith	DEN 120 110	-	-	120 gal 4500 W

Building Controls (HVAC Controls)

Building Controls

The building equipment is controlled by standalone local thermostats and switches. The typical temperature set points for Silk City 200 Academy are as follows:

Time Period Heating	Heating Season	Cooling Season
Occupied Hours	72°F	74°F
Unoccupied Hours	60°F	80°F

Plug Load

The building's plug load consists of general office equipment, kitchen equipment and classroom equipment.

Refer to Appendix 4 for device quantities.

Plumbing/Water System

The ESG team observed that all (21) faucets currently use high flow 2.0 gallon per minute (gpm) or higher and the showerheads are assumed standard and rated for 2.5 gpm or higher aerators that can be replaced with low flow aerators. Additionally, toilets and urinals located in the restroom areas have a rating of 1.6 and 1.0 gallons per flush, respectively.

Utility Baseline Analysis

NOTE: The billing information was provided by a 3rd party engineering firm, CHA Consulting.

Electric

Electrical energy is provided to Paterson Public Schools from Public Service Enterprise Group (PSE&G). PSE&G, which is the electric transport company and BGS Electric Supply, is the commodity supplier. In the event BGS is not the supplier then PSE&G is the default supplier. The electric utility measures consumption in kilowatt-hours (kWh). One kWh usage is equivalent to 1000 watts running for one hour.

There are two primary electric rates used by the building at Paterson Public Schools, the General Lighting & Power (GLP) and the Large Power & Lighting Service-Secondary (LPLSS) rate, the only exception being JFK high school which has the LPLS Primary rate.

Natural Gas

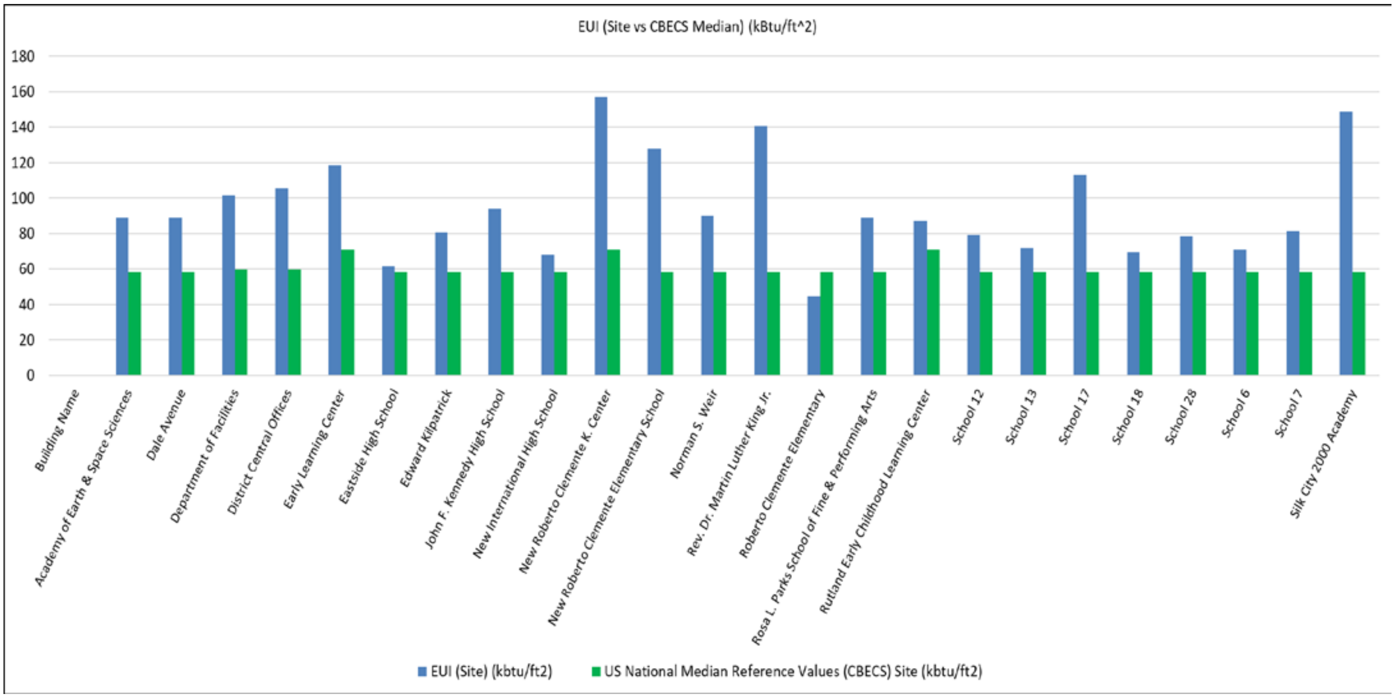
Paterson Public School's natural gas commodity supplier and delivered by Public Service Enterprise Group (PSE&G). The gas utility PSE&G measures consumption in cubic feet x 100 (CCF) and converts the quantity into therms of energy. The district buildings fall under the General Service (GSG) or Large Volume Service (LVG) Rate structure for natural gas.

Energy Usage Summary

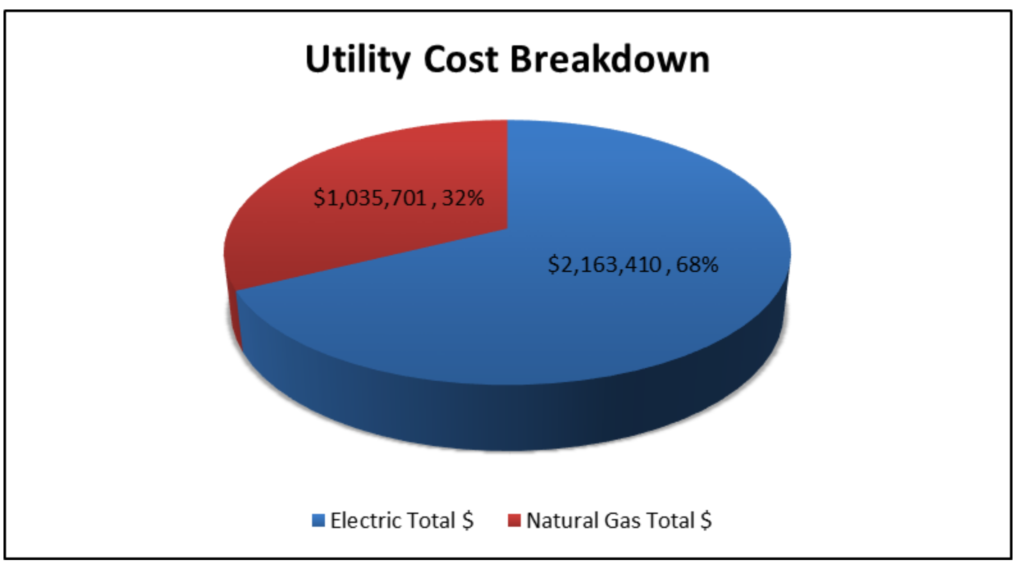
Paterson Public Schools Energy Summary Analysis Table

Baseline Data		Electric			Natural Gas			Electric	NG	Total
Facility Name	Square Feet	Annual kw	Annual kWh	Electric Total $	Therms	Total $	Total Utility Cost	EUI - Pre (kBtu/ft2)	EUI - Pre (kBtu/ft2)	EUI - Pre (kBtu/ft2)
Academy of Earth & Space Sciences	27,854	1,064.7	288,676	44,097	14,900	11,857	$55,954	35.37	53.49	88.86
Dale Avenue	61,931	2,214.3	612,774	76,293	34,222	25,025	$101,319	33.77	55.26	89.03
Department of Facilities	55,525	1,950.3	519,434	67,731	38,669	34,303	$102,034	31.93	69.64	101.57
District Central Offices	113,385	7,507.1	2,018,422	272,299	50,503	43,503	$315,802	60.76	44.54	105.30
Early Learning Center	14,001	811.3	145,805	23,709	11,631	9,692	$33,401	35.54	83.08	118.62
Eastside High School	379,619	8,972.0	2,274,132	247,941	156,980	138,036	$385,977	20.45	41.35	61.80
Edward Kilpatrick	51,521	1,518.1	365,668	41,927	29,038	23,996	$65,923	24.22	56.36	80.58
John F. Kennedy High School	337,135	8,087.6	2,276,538	241,010	238,333	203,664	$444,674	23.05	70.69	93.74
New International High School	121,275	7,163.3	1,435,431	172,224	33,447	29,373	$201,596	40.40	27.58	67.98
New Roberto Clemente K. Center	8,000	696.0	218,160	31,070	5,124	4,823	$35,894	93.07	64.05	157.13
New Roberto Clemente Elementary School	124,834	5,703.2	2,267,867	221,300	82,102	64,384	$285,684	62.00	65.77	127.77
Norman S. Weir	67,943	2,805.3	677,411	72,853	37,926	30,668	$103,521	34.03	55.82	89.85
Rev. Dr. Martin Luther King Jr.	107,168	3,160.3	904,200	119,351	119,860	100,232	$219,583	28.80	111.84	140.64
Roberto Clemente Elementary	41,967	2,828.8	546,452	50,888	-	0	$50,888	44.44	-	44.44
Rosa L. Parks School of Fine & Performing Arts	52,777	2,599.0	753,178	87,538	21,221	17,375	$104,913	48.71	40.21	88.92
Rutland Early Childhood Learning Center	10,373	726.4	100,640	21,279	5,624	5,279	$26,558	33.11	54.21	87.33
School 12	72,686	1,053.9	300,236	32,542	47,226	40,395	$72,936	14.10	64.97	79.07
School 13	94,091	1,768.0	437,074	55,748	52,702	47,295	$103,043	15.85	56.01	71.87
School 17	17,520	453.6	140,000	19,149	15,007	12,871	$32,020	27.27	85.66	112.93
School 18	94,276	2,779.6	552,323	60,133	46,596	38,618	$98,751	20.00	49.43	69.42
School 28	104,417	2,479.0	673,684	64,190	58,977	51,289	$115,479	22.02	56.48	78.50
School 6	97,248	1,503.3	484,361	50,527	52,319	47,209	$97,736	17.00	53.80	70.80
School 7	48,835	1,332.8	236,790	37,106	31,568	25,835	$62,941	16.55	64.64	81.19
Silk City 2000 Academy	31,117	1,504.6	376,350	52,505	33,431	29,978	$82,483	41.28	107.44	148.72
Totals	**2,135,498**	**71,812**	**18,683,286**	**$ 2,163,410**	**1,217,409**	**$ 1,035,701**	**$3,225,446**			

Paterson Public Schools Energy Use Index (EUI) Analysis



The pie chart below shows the distribtuion of these two energy source costs relative to the entire District energy consumption. At 68% of the total consumption, electricity comprises a larger share of the energy costs.



Paterson Public Schools Utility Cost Breakdown

Marginal Rates

For the purposes of determining how energy conservation measures will affect the utility bill, it is important to understand what portions of the cost can be saved. In general, there are costs associated with utility bills that are fixed and independent of usage, such as the monthly meter charge. For example, in the case of a monthly meter charge, this charge often exists even if the energy usage were zero. An energy conservation measure often cannot produce a cost savings on this portion of the bill. The utility rate structure must, therefore, be analyzed to determine what portion of the bill a cost savings can be produced using a specific energy conservation measure. For the purposes of this report, the blended average utility rate is the total cost divided by the total energy units. The effective rate is the portion of the bill effected by energy saving or the applied energy conservation measure.

The utility rates identified below were used for purposes of calculating the dollar effect of the energy savings for the district.

Electric

The effective supply kWh rate is the most recent in the baseline period. The effective transport $/kWh and $/kW demand rates are based on the most recent utility tariff rates as of 09/07/18. The total effective $/kWh rate is the summation of the supply and transport effective rates. For simplification an Average Effective $/kWh rate was determined by averaging the summer and annual effective $/kWh rates and is used for calculations. Summer rate is considered months June through September. The total summer billed demand rate is the annual demand rate plus the summer demand rate. Rates shown include New Jersey Sales and Use Tax (SUT). A simplified weighted average $/kW demand is used as the effective rate for savings calculations. It was calculated by taking the summation of the annual $/kW demand times 8/12 plus the total summer $/kW demand times 4/12.

Building Name	Rate	Meter #	Account #	Peak Monthly (kW)	Annual (kW)	Baseline Consumption (kWh)	Total kW ($)	Total kWh ($)	Total ($)	$/kW	$/kWh	Blended Avg. ($/kWh)	Base Year Note 6
Academy of Earth & Space Sciences	LPLS	9205120	4200412608	118.1	1,064.7	288,676	$ 7,673	$ 36,424	$ 44,097	$ 7.21	$ 0.126	$ 0.153	Dec 17 - Nov 18
Bauerlie Field	GLP	728012540	7342448702	182.4	1,129.6	77,680	$ 7,323	$ 19,010	$ 26,333	$ 6.48	$ 0.245	$ 0.339	Jan 18 - Dec 18
Dale Avenue	LPLS	9215027	4246356018	475.0	2,214.3	612,774	$ 15,798	$ 60,495	$ 76,293	$ 7.13	$ 0.099	$ 0.125	Jan 18 - Dec 18
	GLP	9214067	7342851000										
Department of Facilities	GLP	248001166	7342447005	254.2	1,950.3	519,434	$ 9,717	$ 58,014	$ 67,731	$ 4.98	$ 0.112	$ 0.130	Dec 17 - Nov 18
	GLP	1265234	7342852007										
	GLP	648000139	7342449601										
	BPL	Unmetered	7247576200										
District Central Offices	GLP	1790650	7342448605	1140.4	7,507.1	2,018,422	$ 38,666	$ 233,633	$ 272,299	$ 5.15	$ 0.116	$ 0.135	Dec 17 - Nov 18
	LPLS	9217719	4245759208										
Early Learning Center	GLP	16429423	7342449903	127.2	811.3	145,805	$ 4,242	$ 19,466	$ 23,709	$ 5.23	$ 0.134	$ 0.163	Jan 18 - Dec 18
Eastside High School	LPLS	9217758	4245757906	1130.0	8,972.0	2,274,132	$ 39,462	$ 208,478	$ 247,941	$ 4.40	$ 0.092	$ 0.109	Jan 18 - Dec 18
	GLP	678001063	7342852902										
Edward Kilpatrick*	LPLS	9211649	4249751309	221.2	1,518.1	365,668	$ 9,327	$ 32,599	$ 41,927	$ 6.14	$ 0.089	$ 0.115	Jan 18 - Dec 18
John F. Kennedy High School	LPLP	9213772	4245757701	1429.7	8,087.6	2,276,538	$ 32,339	$ 208,671	$ 241,010	$ 4.00	$ 0.092	$ 0.106	Dec 17 - Nov 18
	GLP	728011171	7342850802										
New International High School	LPLS	9214264	4245759402	907.2	7,163.3	1,435,431	$ 34,697	$ 137,527	$ 172,224	$ 4.84	$ 0.096	$ 0.120	Dec 17 - Nov 18
	GLP	9193780	7342852708										
New Roberto Clemente K. Center	GLP	9196678	7342448400	91.2	696.0	218,160	$ 4,889	$ 26,181	$ 31,070	$ 7.02	$ 0.120	$ 0.142	Jan 18 - Dec 18
New Roberto Clemente Elementary School*	LPLS	9217720	4249751600	969.6	5,703.2	2,267,867	$ 36,094	$ 185,206	$ 221,301	$ 6.33	$ 0.082	$ 0.098	Jan 18 - Dec 18
	GLP	9193893	7342447102										
	GLP	638000747	7342853305										
Norman S. Weir	LPLS	9206962	4245758805	374.0	2,805.3	677,411	$ 12,462	$ 60,391	$ 72,853	$ 4.44	$ 0.089	$ 0.108	Dec 17 - Nov 18
Rev. Dr. Martin Luther King Jr.	LPLS	9204952/9217765	4200334208	382.4	3,160.3	904,200	$ 20,820	$ 98,531	$ 119,351	$ 6.59	$ 0.109	$ 0.132	Jan 18 - Dec 18
Roberto Clemente Elementary	LPLS	9211650	4245758600	503.6	2,828.8	546,452	$ 9,988	$ 40,901	$ 50,888	$ 3.53	$ 0.075	$ 0.093	Jan 18 - Dec 18
Rosa L. Parks School of Fine & Performing Arts	LPLS	9205118	4245759003	372.6	2,599.0	753,178	$ 11,769	$ 75,770	$ 87,538	$ 4.53	$ 0.101	$ 0.116	Jan 18 - Dec 18
	BPL	Unmetered	4245759003										
Rutland Early Childhood Learning Center	GLP	728002774	7342449105	115.2	726.4	100,640	$ 4,129	$ 17,150	$ 21,279	$ 5.68	$ 0.170	$ 0.211	Jan 18 - Dec 18
School 12	LPLS	9214613	4234100803	97.7	1,053.9	300,236	$ 6,526	$ 26,016	$ 32,542	$ 6.19	$ 0.087	$ 0.108	Dec 17 - Nov 18
School 13	LPLS	9205117	4201066304	247.6	1,768.0	437,074	$ 11,094	$ 44,654	$ 55,748	$ 6.27	$ 0.102	$ 0.128	Jan 18 - Dec 18
School 17	GLP	5316465	7342851302	73.6	453.6	140,000	$ 3,100	$ 16,049	$ 19,149	$ 6.83	$ 0.115	$ 0.137	Jan 18 - Dec 18
School 18	LPLS	9204967	4245758503	377.8	2,779.6	552,323	$ 11,713	$ 48,420	$ 60,133	$ 4.21	$ 0.088	$ 0.109	Jan 18 - Dec 18
	BPL	Unmetered	4245758503										
	GLP	638000686	7342850705										
School 28	LPLS	9205276	4245757809	344.2	2,479.0	673,684	$ 10,360	$ 53,830	$ 64,190	$ 4.18	$ 0.080	$ 0.095	Dec 17 - Nov 18
School 6	LPLS	9204757	4230050402	146.6	1,503.3	484,361	$ 9,490	$ 41,037	$ 50,527	$ 6.31	$ 0.085	$ 0.104	Jan 18 - Dec 18
School 7	GLP	278000728	7342449709	180.4	1,332.8	236,790	$ 6,559	$ 30,546	$ 37,106	$ 4.92	$ 0.129	$ 0.157	Dec 17 - Nov 18
Silk City 2000 Academy	GLP	678004190	7342852104	219.0	1,504.6	376,350	$ 8,054	$ 44,451	$ 52,505	$ 5.35	$ 0.118	$ 0.140	Jan 18 - Dec 18

Note 1: Electric Commodity supplier of electricity for the baseline period is BGS And the Delivery company is Public Service Electric & Gas (PSE&G)
Note 2: The effective rate does not include fixed charges and is the portion energy costs that can be affected by a change in energy and demand.
Note 3: Total kWh in the buildings with multiple accounts is combined and Blended Avg. $/kWh is the average of multiple accounts in a building
Note 4: The Peak Demand is defined as the highest monthly billed demand that occured during the 12 month baseline period.
Note 5: The Blended Avg. $/kWh is the total 12 month utility costs divided by the total 12 months kWhs. The total summer billed demand rate is the annual demand rate plus the summer demand rate.
Note 6: The baseline dates are different due to the available billing meter read dates on the utility bills
Note 7: *Edward Kilpatrick - April 2018 Bill missing and is an average of months (March and May)/ **New Roberto Clemente - September 2018 Bill missing and is an average of months (August and October)

Natural Gas

Due to the complex nature and variablity of the gas rates which includes demand and balancing charges in the tarriff rates the blened average unit cost is consided the effective rate for savings calculations. In cases where more than one account/meter serves a school the total average of all combined accouts is used unless the accout is not significant, for instance where the account exists but delivers no natual gas on a regual basis or uses a very small ammout relative to the other accounts.

Building Name	Rate	Meter #	Account #	Total (Therms)	Total ($)	Blended Avg. $/Therms	Base Year Note 4
Academy of Earth & Space Sciences	LVG	3165500	4200412608	14,900	$ 11,857	$ 0.796	Dec 17 - Nov 18
Dale Avenue	LVG	2597859	7342446807	34,222	$ 25,025	$ 0.731	Jan 18 - Dec 18
	GSG	3216656	7342446807				
Department of Facilities	LVG	2209285	7342448303	38,669	$ 34,303	$ 0.887	Dec 17 - Nov 18
	GSG	1866426	7342449601				
District Central Offices	LVG	2809003	4245759208	50,503	$ 43,503	$ 0.861	Dec 17 - Nov 18
Early Learning Center	LVG	2413558	7342850500	11,631	$ 9,692	$ 0.833	Jan 18 - Dec 18
Eastside High School (Note 6)	LVG	2209040	4245759100	156,980	$ 138,036	$ 0.879	Jan 18 - Dec 18
	LVG	3274091	4245759100				
	GSG	1806123	7342851701				
	GSG	1906209	7342446505				
Edward Kilpatrick	LVG	2124598	4200017903	29,038	$ 23,996	$ 0.826	Jan 18 - Dec 18
John F. Kennedy High School (Note 7)	LVG	2808720/2808430/2917093	4245758708	238,333	$ 203,664	$ 0.855	Dec 17 - Nov 18
New International High School	LVG	3166085	4245759402	33,447	$ 29,373	$ 0.878	Dec 17 - Nov 18
New Roberto Clemente K. Center	GSG	3568098	7342448400	5,124	$ 4,823	$ 0.941	Jan 18 - Dec 18
New Roberto Clemente Elementary School	LVG	3164198	4249751600	82,102	$ 64,384	$ 0.784	Jan 18 - Dec 18
Norman S. Weir	LVG	2808618	7342446106	37,926	$ 30,668	$ 0.809	Dec 17 - Nov 18
Rev. Dr. Martin Luther King Jr.	LVG	2917458	7406295405	119,860	$ 100,232	$ 0.836	Jan 18 - Dec 18
	LVG	2600314	4200334208				
Roberto Clemente Elementary	NA	NA	NA	NA	NA	NA	NA
Rosa L. Parks School of Fine & Performing Arts	LVG	3163775	7342851205	21,221	$ 17,375	$ 0.819	Jan 18 - Dec 18
Rutland Early Childhood Learning Center	GSG	2123674	7342449105	5,624	$ 5,279	$ 0.939	Jan 18 - Dec 18
School 12	LVG	2124575	7342446408	47,226	$ 40,395	$ 0.855	Dec 17 - Nov 18
School 13	LVG	2523061	4201066304/ 4249751708	52,702	$ 47,295	$ 0.897	Jan 18 - Dec 18
School 17	LVG	2643349	7342448818	15,007	$ 12,871	$ 0.858	Jan 18 - Dec 18
School 18	LVG	2600283	7342448206	46,596	$ 38,618	$ 0.829	Jan 18 - Dec 18
School 28	LVG	2679396	7342447307	58,977	$ 51,289	$ 0.870	Dec 17 - Nov 18
School 6	LVG	2808980	7342447900	52,319	$ 47,209	$ 0.902	Jan 18 - Dec 18
School 7	LVG	2679397	7342447803	31,568	$ 25,835	$ 0.818	Dec 17 - Nov 18
Silk City 2000 Academy	LVG	3861610	7342852104	33,431	$ 29,978	$ 0.897	Jan 18 - Dec 18

Note 1: Natural Gas supplier is BGS and the delivery company is PSE&G
Note 2: Total therms in the buildings with multiple accounts is combined and Blended Avg. $/Therms is the average of multiple accounts in a building
Note 3: The Blended Avg. $/Therms rate does not include fixed charges and is the portion energy costs that can be affected by a change in energy
Note 4: The baseline dates are different due to the available billing meter read dates on the utility bills
Note 5: The Blended Avg. $/therms is the total 12 month utility costs divided by the total 12 months therms.
Note 6: The november bill of account # 4245759100 is missing and it is estimated based on the Heating degree days
Note 7: The JFK bills were missing Supply Charges from (Dec 17 - Mar 18), the supply charge ($/therm) of District Central Offices was used for calculating the supply charges for those months

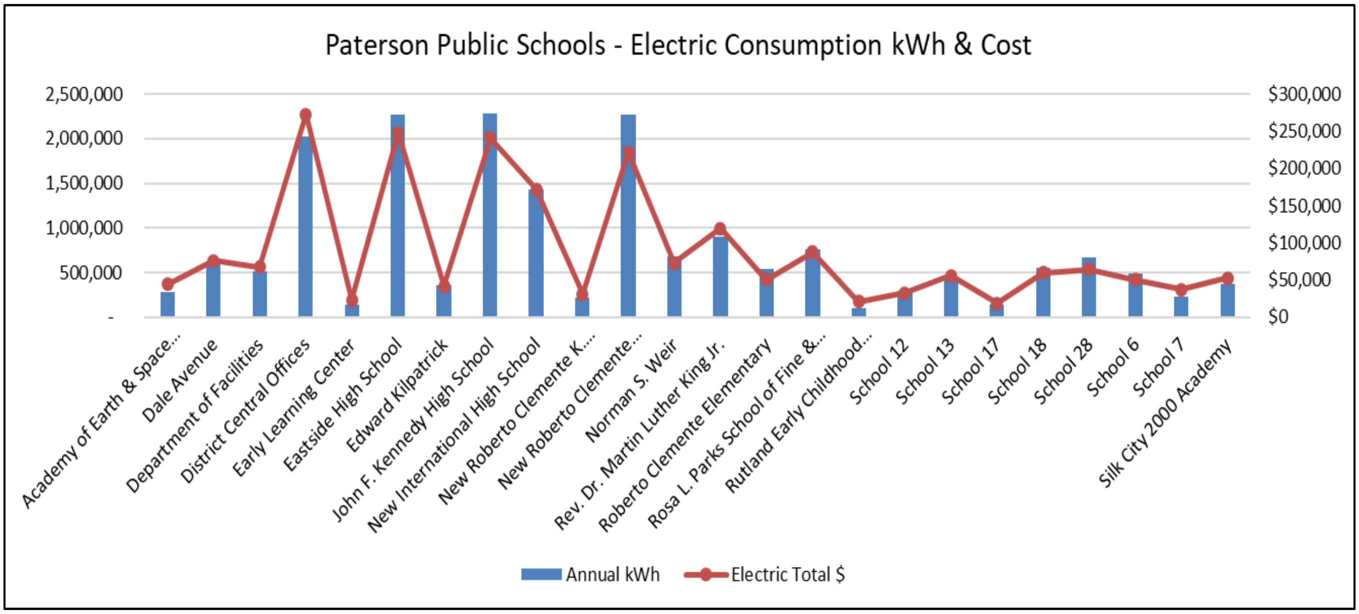
Utility Breakdown by Building

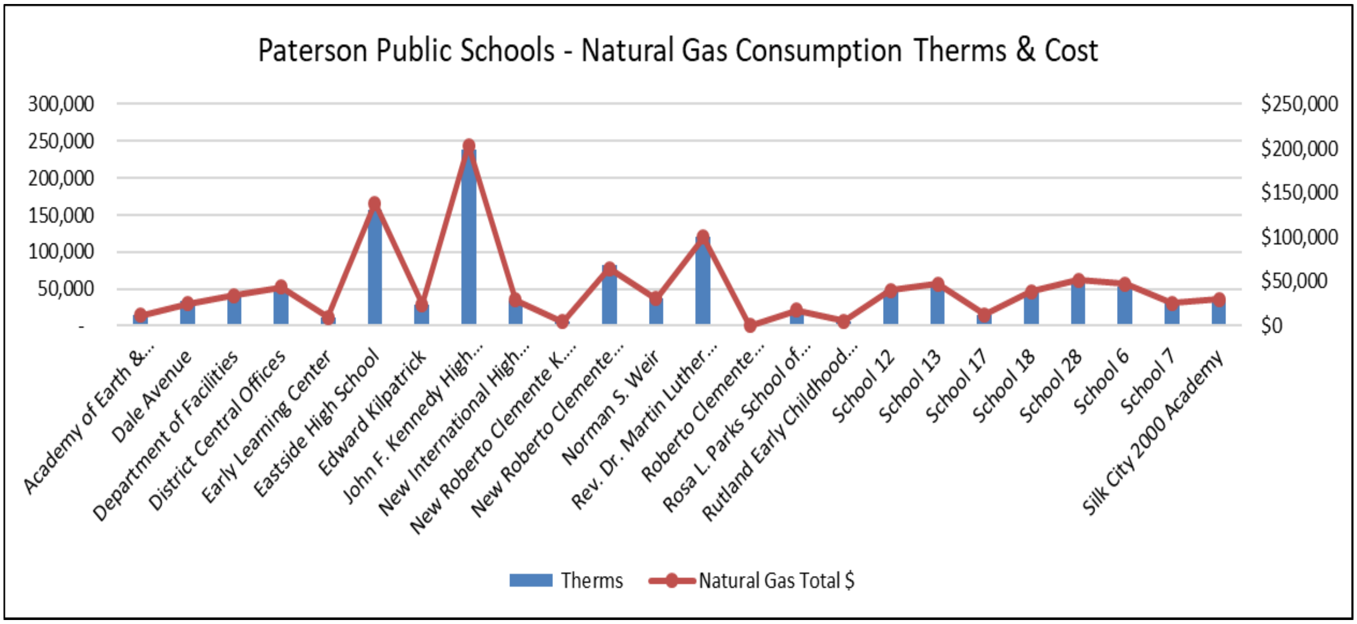
Electric Usage and Demand

A detailed look at the monthly usage (kWh) in a typical year is shown in the Appendix.

Natural Gas Usage

A detailed look at the monthly usage (therms) in a typical year is shown in the Appendix.





Utility Escalation Rates

For purposes of calculating the extended value of the energy savings of this project, the following utility escalation rates have been used.

Name of School	Energy					
	Electric Consumption		Annual Electric Demand		Natural Gas	
	Escalation Rate	Start Year of Escalation	Escalation Rate	Start Year of Escalation	Escalation Rate	Start Year of Escalation
Academy of Earth and Space Sciences (Panther)	2.2%	Year 1	2.2%	Year 1	2.4%	Year 1
Dale Avenue	2.2%	Year 1	2.2%	Year 1	2.4%	Year 1
Department of Facilities	2.2%	Year 1	2.2%	Year 1	2.4%	Year 1
District Central Offices	2.2%	Year 1	2.2%	Year 1	2.4%	Year 1
Early Learning Center	2.2%	Year 1	2.2%	Year 1	2.4%	Year 1
Eastside High School	2.2%	Year 1	2.2%	Year 1	2.4%	Year 1
Edward Kilpatrick	2.2%	Year 1	2.2%	Year 1	2.4%	Year 1
John F. Kennedy HS	2.2%	Year 1	2.2%	Year 1	2.4%	Year 1
New International HS	2.2%	Year 1	2.2%	Year 1	2.4%	Year 1
New R.Clemente School	2.2%	Year 1	2.2%	Year 1	2.4%	Year 1
New Roberto Center	2.2%	Year 1	2.2%	Year 1	2.4%	Year 1
Norman S. Weir	2.2%	Year 1	2.2%	Year 1	2.4%	Year 1
Rev. Dr. MLK Jr.	2.2%	Year 1	2.2%	Year 1	2.4%	Year 1
R.Clemente ES	2.2%	Year 1	2.2%	Year 1	2.4%	Year 1
Rosa L. Parks	2.2%	Year 1	2.2%	Year 1	2.4%	Year 1
Rutland ECLC	2.2%	Year 1	2.2%	Year 1	2.4%	Year 1
School 12	2.2%	Year 1	2.2%	Year 1	2.4%	Year 1
School 13	2.2%	Year 1	2.2%	Year 1	2.4%	Year 1
School 17	2.2%	Year 1	2.2%	Year 1	2.4%	Year 1
School 18	2.2%	Year 1	2.2%	Year 1	2.4%	Year 1
School 28	2.2%	Year 1	2.2%	Year 1	2.4%	Year 1
School 6	2.2%	Year 1	2.2%	Year 1	2.4%	Year 1
School 7	2.2%	Year 1	2.2%	Year 1	2.4%	Year 1
Silk City Academy	2.2%	Year 1	2.2%	Year 1	2.4%	Year 1

SECTION 3. FINANCIAL IMPACT

Energy Savings and Cost Summary

The table below provides a summary of the costs and savings associated with the measures recommended in the Energy Savings Plan. The savings have been calculated based on the savings methodology detailed throughout this report and included in the appendix of this report. Costs for each measure have been estimated based on project implementation experience and industry standards.

ECM ID	ECMs	School	Estimated Installed Hard Costs ($)	Estimated Annual Savings ($)	Estimated Simple Payback (years)	Installation Plan
1	Lighting Upgrades - LED	Dale Avenue	$125,388	$13,665	9.2	Public Bidding
2	Lighting Upgrades - LED	Department of Facilities	$65,237	$7,253	9.0	Public Bidding
3	Lighting Upgrades - LED	District Central Offices	$347,156	$38,886	8.9	Public Bidding
4	Lighting Upgrades - LED	Eastside High School	$657,039	$39,668	16.6	Public Bidding
5	Lighting Upgrades - LED	Edward Kilpatrick	$174,844	$15,958	11.0	Public Bidding
6	Lighting Upgrades - LED	John F. Kennedy High School	$622,504	$47,873	13.0	Public Bidding
7	Lighting Upgrades - LED	New International High School	$297,680	$29,046	10.2	Public Bidding
8	Lighting Upgrades - LED	New Roberto Clemente School	$316,056	$16,221	19.5	Public Bidding
9	Lighting Upgrades - LED	New Roberto K Center	$17,030	$1,865	9.1	Public Bidding
10	Lighting Upgrades - LED	Norman S. Weir	$133,406	$10,341	12.9	Public Bidding
11	Lighting Upgrades - LED	Rev. Dr. Martin Luther King Jr.	$315,215	$42,402	7.4	Public Bidding
12	Lighting Upgrades - LED	Roberto Clemente Elementary	$91,342	$3,343	27.3	Public Bidding
13	Lighting Upgrades - LED	Rosa L. Parks School of Fine and Performing Arts	$131,599	$9,327	14.1	Public Bidding
14	Lighting Upgrades - LED	School 12	$125,805	$8,692	14.5	Public Bidding
15	Lighting Upgrades - LED	School 13	$195,397	$16,798	11.6	Public Bidding
16	Lighting Upgrades - LED	School 18	$181,621	$13,710	13.2	Public Bidding
17	Lighting Upgrades - LED	School 28	$250,936	$16,455	15.3	Public Bidding
18	Lighting Upgrades - LED	School 6	$214,825	$17,366	12.4	Public Bidding
19	Lighting Upgrades - LED	School 7	$101,288	$12,408	8.2	Public Bidding
20	Lighting Upgrades - LED	Silk City 2000 Academy	$92,123	$9,967	9.2	Public Bidding
21	Lighting Upgrades - LED, Direct Install	Academy of Earth and Space Sciences (PANTHER)	$111,121	$13,315	8.3	Direct Install
22	Lighting Upgrades - LED, Direct Install	Early Learning Center	$35,353	$4,617	7.7	Direct Install
23	Lighting Upgrades - LED, Direct Install	Rutland Early childhood Learning Center	$40,444	$5,363	7.5	Direct Install
24	Lighting Upgrades - LED, Direct Install	School 17	$33,835	$2,672	12.7	Direct Install
25	Exhuast Fan Motor Replacement	New International High School	$37,039	$329	112.5	Public Bidding
26	Exhaust Fan Motor Replacement	New Roberto Clemente School	$16,006	$350	45.8	Public Bidding
27	Exhaust Fan Motor Replacement	Norman S. Weir	$4,642	$230	20.2	Public Bidding

ECM ID	ECMs	School	Estimated Installed Hard Costs ($)	Estimated Annual Savings ($)	Estimated Simple Payback (years)	Installation Plan
28	Exhuast Fan Motor Replacement	Rev. Dr. Martin Luther King Jr.	$36,560	$1,034	35.3	Public Bidding
29	Exhuast Fan Motor Replacement	Rosa L. Parks School of Fine and Performing Arts	$11,836	$165	71.8	Public Bidding
30	Exhuast Fan Motor Replacement	Rutland Early childhood Learning Center	$3,353	$148	22.6	Public Bidding
31	Exhuast Fan Motor Replacement	School 18	$11,786	$441	26.7	Public Bidding
32	Exhuast Fan Motor Replacement	School 7	$3,353	$62	53.9	Public Bidding
33	VFDs on HW Pumps	Eastside High School	$34,434	$8,504	4.0	Public Bidding
34	VFDs on HW Pumps	New International High School	$28,975	$4,189	6.9	Public Bidding
35	VFDs on HW Pumps	School 12	$29,100	$4,031	7.2	Public Bidding
36	VFDs on HW Pumps	School 28	$24,210	$2,744	8.8	Public Bidding
37	VFDs on HW Pumps	School 6	$40,114	$5,273	7.6	Public Bidding
38	Destratification Fans	Eastside High School	$21,609	$2,482	8.7	Public Bidding
39	Destratification Fans	John F. Kennedy High School	$32,755	$3,721	8.8	Public Bidding
40	Destratification Fans	New International High School	$21,609	$2,485	8.7	Public Bidding
41	Destratification Fans	New Roberto Clemente School	$16,377	$1,758	9.3	Public Bidding
42	Destratification Fans	Rosa L. Parks School of Fine and Performing Arts	$6,867	$633	10.8	Public Bidding
43	Destratification Fans	School 28	$13,380	$1,180	11.3	Public Bidding
44	Auditorium Air Conditioning (2) 20 Ton	Eastside High School	$210,187	-$5,090		Public Bidding
45	Chiller Refurbishment	Dale Avenue	$7,412	$1,418	5.2	Public Bidding
46	Gymnasium Air Conditioning (2) 20 Ton	Eastside High School	$356,345	-$5,090		Public Bidding
47	Steam Boiler Replacement	Dale Avenue	$530,495	$834	636.3	Public Bidding
48	Boiler Controls / Intellidyne	John F. Kennedy High School	$13,047	$4,438	2.9	Public Bidding
49	Boiler Controls / Intellidyne	New International High School	$13,047	$1,639	8.0	Public Bidding
50	Boiler Controls / Intellidyne	New Roberto Clemente School	$13,047	$5,570	2.3	Public Bidding
51	Boiler Controls / Intellidyne	School 12	$13,047	$1,207	10.8	Public Bidding
52	Boiler Controls / Intellidyne	School 13	$13,047	$1,739	7.5	Public Bidding
53	Boiler Controls / Intellidyne	School 17	$13,047	$618	21.1	Public Bidding
54	Boiler Controls / Intellidyne	School 18	$13,047	$1,481	8.8	Public Bidding
55	Boiler Controls / Intellidyne	School 28	$13,047	$3,559	3.7	Public Bidding
56	Boiler Controls / Intellidyne	School 6	$13,047	$1,432	9.1	Public Bidding
57	Boiler Controls / Intellidyne	Silk City 2000 Academy	$13,047	$1,124	11.6	Public Bidding
58	RTU Replacement	Rosa L. Parks School of Fine and Performing Arts	$132,025	$515	256.3	Public Bidding

ECM ID	ECMs	School	Estimated Installed Hard Costs ($)	Estimated Annual Savings ($)	Estimated Simple Payback (years)	Installation Plan
59	DI HVAC Controls - Direct Install	Academy of Earth and Space Sciences (PANTHER)	$573	$1,592	0.4	Direct Install
60	DI HVAC Controls - Direct Install	Early Learning Center	$3,443	$2,141	1.6	Direct Install
61	DI HVAC Controls - Direct Install	Rutland Early childhood Learning Center	$2,948	$1,103	2.7	Direct Install
62	DI HVAC Controls - Direct Install	School 17	$5,377	$1,138	4.7	Direct Install
63	Building Controls - Central Plant	Academy of Earth and Space Sciences (PANTHER)	$48,615	$1,033	47.1	Public Bidding
64	Building Controls - Central Plant	All Sites	$100,393	$0		Public Bidding
65	Building Controls - Central Plant	Dale Avenue	$66,374	$6,348	10.5	Public Bidding
66	Building Controls - Central Plant	Early Learning Center	$19,105	$1,510	12.7	Public Bidding
67	Building Controls - Central Plant	Eastside High School	$92,057	$18,401	5.0	Public Bidding
68	Building Controls - Central Plant	Edward Kilpatrick	$32,978	$2,180	15.1	Public Bidding
69	Building Controls - Central Plant	John F. Kennedy High School	$82,664	$17,029	4.9	Public Bidding
70	Building Controls - Central Plant	New International High School	$61,993	$4,136	15.0	Public Bidding
71	Building Controls - Central Plant	New Roberto Clemente School	$54,691	$6,841	8.0	Public Bidding
72	Building Controls - Central Plant	New Roberto K Center	$16,611	$1,084	15.3	Public Bidding
73	Building Controls - Central Plant	Norman S. Weir	$38,523	$851	45.3	Public Bidding
74	Building Controls - Central Plant	Rev. Dr. Martin Luther King Jr.	$71,629	$8,997	8.0	Public Bidding
75	Building Controls - Central Plant	Roberto Clemente Elementary	$29,091	$729	39.9	Public Bidding
76	Building Controls - Central Plant	Rosa L. Parks School of Fine and Performing Arts	$23,661	$1,826	13.0	Public Bidding
77	Building Controls - Central Plant	Rutland Early childhood Learning Center	$13,690	$1,010	13.6	Public Bidding
78	Building Controls - Central Plant	School 12	$36,598	$2,065	17.7	Public Bidding
79	Building Controls - Central Plant	School 13	$34,590	$2,741	12.6	Public Bidding
80	Building Controls - Central Plant	School 17	$42,530	$980	43.4	Public Bidding
81	Building Controls - Central Plant	School 18	$54,075	$4,948	10.9	Public Bidding
82	Building Controls - Central Plant	School 28	$38,393	$4,322	8.9	Public Bidding
83	Building Controls - Central Plant	School 6	$33,191	$6,316	5.3	Public Bidding
84	Building Controls - Central Plant	School 7	$27,258	$1,368	19.9	Public Bidding
85	Building Controls - Central Plant	Silk City 2000 Academy	$37,024	$2,045	18.1	Public Bidding
86	Building Controls - Distributions (AHU/RTU)	Academy of Earth and Space Sciences (PANTHER)	$6,389	$0		Public Bidding
87	Building Controls - Distributions (AHU/RTU)	Dale Avenue	$31,956	$982	32.5	Public Bidding

ECM ID	ECMs	School	Estimated Installed Hard Costs ($)	Estimated Annual Savings ($)	Estimated Simple Payback (years)	Installation Plan
88	Building Controls - Distributions (AHU/RTU)	Edward Kilpatrick	$24,034	$0		Public Bidding
89	Building Controls - Distributions (AHU/RTU)	John F. Kennedy High School	$63,418	$3,819	16.6	Public Bidding
90	Building Controls - Distributions (AHU/RTU)	New International High School	$92,532	$1,394	66.4	Public Bidding
91	Building Controls - Distributions (AHU/RTU)	New Roberto Clemente School	$84,501	$1,065	79.4	Public Bidding
92	Building Controls - Distributions (AHU/RTU)	New Roberto K Center	$13,179	$0		Public Bidding
93	Building Controls - Distributions (AHU/RTU)	Norman S. Weir	$32,321	$689	46.9	Public Bidding
94	Building Controls - Distributions (AHU/RTU)	Rev. Dr. Martin Luther King Jr.	$96,134	$2,009	47.9	Public Bidding
95	Building Controls - Distributions (AHU/RTU)	Rosa L. Parks School of Fine and Performing Arts	$87,202	$1,190	73.3	Public Bidding
96	Building Controls - Distributions (AHU/RTU)	Rutland Early childhood Learning Center	$35,229	$0		Public Bidding
97	Building Controls - Distributions (AHU/RTU)	School 12	$20,383	$0		Public Bidding
98	Building Controls - Distributions (AHU/RTU)	School 13	$109,484	$1,262	86.8	Public Bidding
99	Building Controls - Distributions (AHU/RTU)	School 18	$23,705	$1,626	14.6	Public Bidding
100	Building Controls - Distributions (AHU/RTU)	School 28	$55,003	$946	58.2	Public Bidding
101	Building Controls - Distributions (AHU/RTU)	School 6	$43,686	$1,556	28.1	Public Bidding
102	Building Controls - Distributions (AHU/RTU)	School 7	$4,259	$0		Public Bidding
103	Building Controls - Distributions (AHU/RTU)	Silk City 2000 Academy	$33,404	$0		Public Bidding
104	Data Analytics	All Sites	$316,100	$35,108	9.0	Public Bidding
105	Building Envelope Upgrades	Academy of Earth and Space Sciences (PANTHER)	$15,734	$887	17.7	Public Bidding
106	Building Envelope Upgrades	Dale Avenue	$6,524	$443	14.7	Public Bidding
107	Building Envelope Upgrades	Early Learning Center	$12,693	$550	23.1	Public Bidding
108	Building Envelope Upgrades	Eastside High School	$46,722	$3,543	13.2	Public Bidding
109	Building Envelope Upgrades	Edward Kilpatrick	$9,379	$2,030	4.6	Public Bidding
110	Building Envelope Upgrades	John F. Kennedy High School	$37,752	$5,202	7.3	Public Bidding
111	Building Envelope Upgrades	New International High School	$76,389	$3,271	23.4	Public Bidding
112	Building Envelope Upgrades	New Roberto Clemente School	$12,873	$1,244	10.3	Public Bidding
113	Building Envelope Upgrades	New Roberto K Center	$7,006	$531	13.2	Public Bidding
114	Building Envelope Upgrades	Norman S. Weir	$12,613	$866	14.6	Public Bidding
115	Building Envelope Upgrades	Rev. Dr. Martin Luther King Jr.	$44,251	$3,789	11.7	Public Bidding
116	Building Envelope Upgrades	Roberto Clemente Elementary	$11,984	$132	90.7	Public Bidding
117	Building Envelope Upgrades	Rosa L. Parks School of Fine and Performing Arts	$34,886	$2,620	13.3	Public Bidding

ECM ID	ECMs	School	Estimated Installed Hard Costs ($)	Estimated Annual Savings ($)	Estimated Simple Payback (years)	Installation Plan
118	Building Envelope Upgrades	School 12	$21,495	$6,168	3.5	Public Bidding
119	Building Envelope Upgrades	School 13	$24,824	$2,617	9.5	Public Bidding
120	Building Envelope Upgrades	School 17	$32,812	$1,725	19.0	Public Bidding
121	Building Envelope Upgrades	School 18	$150,220	$6,643	22.6	Public Bidding
122	Building Envelope Upgrades	School 28	$23,343	$2,122	11.0	Public Bidding
123	Building Envelope Upgrades	School 6	$5,726	$511	11.2	Public Bidding
124	Building Envelope Upgrades	School 7	$10,035	$1,306	7.7	Public Bidding
125	Building Envelope Upgrades	Silk City 2000 Academy	$5,452	$226	24.1	Public Bidding
126	Domestic Fixtures (Sink Faucets)	Academy of Earth and Space Sciences (PANTHER)	$511	$135	3.8	Public Bidding
127	Domestic Fixtures (Sink Faucets)	Dale Avenue	$2,137	$808	2.6	Public Bidding
128	Domestic Fixtures (Sink Faucets)	Early Learning Center	$511	$58	8.8	Public Bidding
129	Domestic Fixtures (Sink Faucets)	Eastside High School	$2,462	$528	4.7	Public Bidding
130	Domestic Fixtures (Sink Faucets)	Edward Kilpatrick	$2,091	$297	7.0	Public Bidding
131	Domestic Fixtures (Sink Faucets)	John F. Kennedy High School	$4,879	$1,419	3.4	Public Bidding
132	Domestic Fixtures (Sink Faucets)	New International High School	$2,741	$325	8.4	Public Bidding
133	Domestic Fixtures (Sink Faucets)	New Roberto Clemente School	$2,324	$361	6.4	Public Bidding
134	Domestic Fixtures (Sink Faucets)	New Roberto K Center	$186	$38	5.0	Public Bidding
135	Domestic Fixtures (Sink Faucets)	Norman S. Weir	$1,115	$210	5.3	Public Bidding
136	Domestic Fixtures (Sink Faucets)	Rev. Dr. Martin Luther King Jr.	$1,858	$510	3.6	Public Bidding
137	Domestic Fixtures (Sink Faucets)	Roberto Clemente Elementary	$1,255	$501	2.5	Public Bidding
138	Domestic Fixtures (Sink Faucets)	Rosa L. Parks School of Fine and Performing Arts	$697	$205	3.4	Public Bidding
139	Domestic Fixtures (Sink Faucets)	Rutland Early childhood Learning Center	$325	$47	6.9	Public Bidding
140	Domestic Fixtures (Sink Faucets)	School 12	$836	$368	2.3	Public Bidding
141	Domestic Fixtures (Sink Faucets)	School 13	$1,906	$395	4.8	Public Bidding
142	Domestic Fixtures (Sink Faucets)	School 17	$511	$77	6.6	Public Bidding
143	Domestic Fixtures (Sink Faucets)	School 18	$1,487	$729	2.0	Public Bidding
144	Domestic Fixtures (Sink Faucets)	School 28	$2,742	$235	11.7	Public Bidding
145	Domestic Fixtures (Sink Faucets)	School 6	$1,487	$352	4.2	Public Bidding
146	Domestic Fixtures (Sink Faucets)	School 7	$604	$180	3.4	Public Bidding

ECM ID	ECMs	School	Estimated Installed Hard Costs ($)	Estimated Annual Savings ($)	Estimated Simple Payback (years)	Installation Plan
147	Domestic Fixtures (Sink Faucets)	Silk City 2000 Academy	$977	$143	6.8	Public Bidding
148	PPA Rate Savings	Eastside High School	$0	$0	N/A	Solar PPA
149	PPA Rate Savings	John F. Kennedy High School	$0	$0	N/A	Solar PPA
150	PPA Rate Savings	New International High School	$0	$0	N/A	Solar PPA
151	PPA Rate Savings	Rev. Dr. Martin Luther King Jr.	$0	$0	N/A	Solar PPA
152	PPA Rate Savings	Rosa L. Parks School of Fine and Performing Arts	$0	$0	N/A	Solar PPA
153	PPA Rate Savings	School 28	$0	$0	N/A	Solar PPA
154	PPA Rate Savings	School 6	$0	$0	N/A	Solar PPA
155	PPA Rate Savings	School 5	$0	$0	N/A	Solar PPA
156	Liquid Pool Cover	Norman S. Weir	$9,297	$2,046	4.5	Public Bidding
157	Pool System Upgrades	Norman S. Weir	$69,490	$2,871	24.2	Public Bidding
158	Cogeneration 35kw	Eastside High School	$257,890	$15,545	16.6	Public Bidding
159	DHW Heater Replacement	John F. Kennedy High School	$44,752	$0		Public Bidding
160	Steam Trap Replacements	Dale Avenue	$45,723	$3,897	11.7	Public Bidding
161	Steam Trap Replacements	John F. Kennedy High School	$155,851	$16,649	9.4	Public Bidding
162	Steam Trap Replacements	School 12	$12,098	$4,932	2.5	Public Bidding
163	Steam Trap Replacements	School 13	$60,905	$10,875	5.6	Public Bidding
164	Steam Trap Replacements	School 17	$31,624	$313	100.9	Public Bidding
165	Steam Trap Replacements	School 7	$65,644	$833	78.8	Public Bidding
166	Steam Trap Replacements	Silk City 2000 Academy	$15,209	$1,293	11.8	Public Bidding
167	Roof Restoration	Eastside High School	$816,546	$0		Public Bidding
168	Roof Restoration	John F. Kennedy High School	$1,298,190	$0		Public Bidding
169	Roof Restoration	School 28	$376,214	$0		Public Bidding
170	HVAC Piping Insulation	Academy of Earth and Space Sciences (PANTHER)	$5,024	$279	18.0	Public Bidding
171	HVAC Piping Insulation	Dale Avenue	$16,991	$885	19.2	Public Bidding
172	HVAC Piping Insulation	Early Learning Center	$6,044	$350	17.3	Public Bidding
173	HVAC Piping Insulation	Eastside High School	$62,401	$6,551	9.5	Public Bidding
174	HVAC Piping Insulation	Edward Kilpatrick	$7,831	$661	11.8	Public Bidding
175	HVAC Piping Insulation	John F. Kennedy High School	$63,678	$6,606	9.6	Public Bidding
176	HVAC Piping Insulation	New International High School	$7,295	$492	14.8	Public Bidding
177	HVAC Piping Insulation	New Roberto Clemente School	$14,717	$965	15.3	Public Bidding
178	HVAC Piping Insulation	Norman S. Weir	$5,927	$461	12.9	Public Bidding
179	HVAC Piping Insulation	Rev. Dr. Martin Luther King Jr.	$14,475	$1,873	7.7	Public Bidding

ECM ID	ECMs	School	Estimated Installed Hard Costs ($)	Estimated Annual Savings ($)	Estimated Simple Payback (years)	Installation Plan
180	HVAC Piping Insulation	School 12	$64,453	$2,455	26.3	Public Bidding
181	HVAC Piping Insulation	School 13	$35,513	$1,903	18.7	Public Bidding
182	HVAC Piping Insulation	School 17	$7,738	$592	13.1	Public Bidding
183	HVAC Piping Insulation	School 18	$7,288	$696	10.5	Public Bidding
184	HVAC Piping Insulation	School 28	$7,003	$704	9.9	Public Bidding
185	HVAC Piping Insulation	School 6	$9,680	$605	16.0	Public Bidding
186	HVAC Piping Insulation	School 7	$26,582	$1,408	18.9	Public Bidding
187	HVAC Piping Insulation	Silk City 2000 Academy	$4,960	$421	11.8	Public Bidding
188	Educational Program	All Sites	$0	$0		Public Bidding
189	Refrigeration Controls (E-Temp)	Dale Avenue	$9,853	$2,282	4.3	Public Bidding
190	Refrigeration Controls (E-Temp)	Early Learning Center	$2,956	$1,052	2.8	Public Bidding
191	Refrigeration Controls (E-Temp)	Eastside High School	$17,735	$5,556	3.2	Public Bidding
192	Refrigeration Controls (E-Temp)	Edward Kilpatrick	$5,912	$1,261	4.7	Public Bidding
193	Refrigeration Controls (E-Temp)	John F. Kennedy High School	$15,764	$4,153	3.8	Public Bidding
194	Refrigeration Controls (E-Temp)	New International High School	$3,941	$1,487	2.6	Public Bidding
195	Refrigeration Controls (E-Temp)	New Roberto Clemente School	$7,882	$1,878	4.2	Public Bidding
196	Refrigeration Controls (E-Temp)	Norman S. Weir	$3,941	$861	4.6	Public Bidding
197	Refrigeration Controls (E-Temp)	Rev. Dr. Martin Luther King Jr.	$1,971	$1,153	1.7	Public Bidding
198	Refrigeration Controls (E-Temp)	Roberto Clemente Elementary	$3,941	$680	5.8	Public Bidding
199	Refrigeration Controls (E-Temp)	Rosa L. Parks School of Fine and Performing Arts	$2,956	$1,273	2.3	Public Bidding
200	Refrigeration Controls (E-Temp)	School 12	$4,926	$1,002	4.9	Public Bidding
201	Refrigeration Controls (E-Temp)	School 13	$5,912	$1,480	4.0	Public Bidding
202	Refrigeration Controls (E-Temp)	School 17	$3,941	$1,107	3.6	Public Bidding
203	Refrigeration Controls (E-Temp)	School 18	$3,941	$857	4.6	Public Bidding
204	Refrigeration Controls (E-Temp)	School 28	$8,868	$1,718	5.2	Public Bidding
205	Refrigeration Controls (E-Temp)	School 6	$1,971	$896	2.2	Public Bidding
206	Refrigeration Controls (E-Temp)	School 7	$5,912	$1,869	3.2	Public Bidding
207	Refrigeration Controls (E-Temp)	Silk City 2000 Academy	$1,971	$570	3.5	Public Bidding
208	Legend Power	New Roberto Clemente School	$25,070	$9,445	2.7	Test Installation by Manufacturer
			$13,081,933	$788,829	16.6	

Operational Savings Estimates

The lighting retrofits recommended for this project will reduce the number of lamps that need to be replaced each year due to the longer lasting lamps and new technology fixtures. The LED lighting recommended for the exterior fixtures will last much longer than the current high intensity discharge (HID) lighting and will generate material cost savings.

A brief description of the operational savings estimated for this project is included below. Energy Systems Group has worked with the District to quantify the exact sources of savings by going through past invoices and expenses. The operational savings will not be escalated.

Operational Savings for Financial Model	
ECM Description	**Annual Savings**
LED Lighting Upgrades & Occupancy Sensors – District Wide (24 Schools)	$ 215,092
Direct Digital Controls (DDC) Upgrade – District Wide, Boiler Replacement – Steam Boilers – Dale Avenue	$ 387,782
Totals	**$ 602,874**

Potential Revenue Generation Estimates

As part of the Energy Savings Plan for Paterson Public Schools, several avenues for obtaining rebates and incentives have been investigated which include:

- NJ Smart Start Equipment Incentives
- Demand Response Energy Efficiency Credit

The estimated incentive amount for each program is listed below. Upon final selection of project scope and award of subcontractor bids, the incentive applications will be filed.

NJ Smart Start Equipment Incentives

The NJ Smart Start Equipment Incentives provide prescriptive rebates for defined retrofits. Incentives are applied on a unit-by-unit basis for making energy efficiency upgrades. The table below summarizes the equipment incentives, which will be applied for at Paterson Public Schools:

Building	Energy Conservation Measure	Energy Rebate/ Incentives
Academy of Earth and Space Sciences (PANTHER)	Lighting Upgrades - LED, Direct Install	$15,355.08
Dale Avenue	Lighting Upgrades - LED	$6,195.96
Department of Facilities	Lighting Upgrades - LED	$3,954.20
District Central Offices	Lighting Upgrades - LED	$20,890.34
Early Learning Center	Lighting Upgrades - LED, Direct Install	$11,583.72
Eastside High School	Lighting Upgrades - LED	$24,620.98
Edward Kilpatrick	Lighting Upgrades - LED	$7,182.40
John F. Kennedy High School	Lighting Upgrades - LED	$32,648.46
New International High School	Lighting Upgrades - LED	$13,073.36
New Roberto Clemente School	Lighting Upgrades - LED	$13,303.84
New Roberto K Center	Lighting Upgrades - LED	$1,079.40
Norman S. Weir	Lighting Upgrades - LED	$5,476.11
Rev. Dr. Martin Luther King Jr.	Lighting Upgrades - LED	$18,226.81
Roberto Clemente Elementary	Lighting Upgrades - LED	$3,781.34
Rosa L. Parks School of Fine and Performing Arts	Lighting Upgrades - LED	$7,293.03
Rutland Early childhood Learning Center	Lighting Upgrades - LED, Direct Install	$13,556.60
School 12	Lighting Upgrades - LED	$5,628.99
School 13	Lighting Upgrades - LED	$8,897.14
School 17	Lighting Upgrades - LED, Direct Install	$10,308.42
School 18	Lighting Upgrades - LED	$7,897.64
School 28	Lighting Upgrades - LED	$10,968.35
School 6	Lighting Upgrades - LED	$11,822.65
School 7	Lighting Upgrades - LED	$5,202.61
Silk City 2000 Academy	Lighting Upgrades - LED	$4,458.17
Early Learning Center	DI HVAC Controls - Direct Install	$1,941.38
Academy of Earth and Space Sciences (PANTHER)	DI HVAC Controls - Direct Install	$323.43
Rutland Early childhood Learning Center	DI HVAC Controls - Direct Install	$1,662.50
School 17	DI HVAC Controls - Direct Install	$3,031.53

Demand Response Energy Efficiency Credit

The LED Lighting Upgrades recommended for the District will be eligible for the Energy Efficiency Credit available through PJM. The Energy Efficiency Credit pays consumers based on the permanent load reduction through the installation of energy efficiency measures. The following table summarizes the available Demand Response Incentives available due to the lighting upgrades at all buildings at the Paterson Public Schools.

Demand Response Energy – Emergency Capacity Credit		
PJM Payment Year	**Approved Load (kW)**	**Annual Customer Capacity Benefit**
2020/2021	612.2 kW	$16,460
2021/2022	612.2 kW	$11,758
2022/2023	612.2 kW	$11,758
2023/2024	612.2 kW	$11,758
Totals		**$51,734**

Business Case for Recommended Project

FORM VI - ENERGY SAVINGS PLAN

ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP):
ESCO's PRELIMINARY ANNUAL CASH FLOW ANALYSIS FORM
Paterson Phase 2
ENERGY SAVINGS IMPROVEMENT PROGRAM

ESCO Name: ENERGY SYSTEMS GROUP **Project Scenario 3**

Note: Respondents must use the following assumptions in all financial calculations:

(a) The cost of all types of energy should be assumed to inflate at 2.4% gas, 2.2% electric per year; and

1. Term of Agreement: 20 years — **Design/Consultant Fee** $ 1,415,603
2. Construction period² (months): 18 — **Costs of Issuance** $ 200,000
3. Cash Flow Analysis Format:

Total Financed Amount[4] $ 18,909,103
Total ESG Project Cost [1] $ 17,293,500

Interest Rate to be used for Proposal Purposes: 2.35%

	Annual Energy Savings	Annual Operational Savings	Energy Rebates/ Incentives	Solar PPA	Total Annual Savings	Annual Project Costs	Board Costs	Annual Service Costs	Net Cash-Flow to client	Cumulative Cash Flow
Installation[3]	$ 198,605	$ -	$ -	$ 38,671	$ 237,276	$ -	$ -	$ -	$ 237,276	$ 237,276
1	$ 806,641	$ 602,874	$ 286,825	$ 79,043	$ 1,775,383	$ 1,712,314	$ 1,772,983	$ 60,669	$ 2,400	$ 239,676
2	$ 824,855	$ 602,874	$ 11,758	$ 80,782	$ 1,520,269	$ 1,517,869	$ 1,517,869	$ -	$ 2,400	$ 242,076
3	$ 843,482	$ 215,092	$ 11,758	$ 82,559	$ 1,152,891	$ 1,150,491	$ 1,150,491	$ -	$ 2,400	$ 244,476
4	$ 862,529	$ 215,092	$ 11,758	$ 84,375	$ 1,173,754	$ 1,171,354	$ 1,171,354	$ -	$ 2,400	$ 246,876
5	$ 882,007	$ 215,092	$ -	$ 86,231	$ 1,183,331	$ 1,180,931	$ 1,180,931	$ -	$ 2,400	$ 249,276
6	$ 901,926	$ -	$ -	$ 88,129	$ 990,055	$ 987,655	$ 987,655	$ -	$ 2,400	$ 251,676
7	$ 922,296	$ -	$ -	$ 90,067	$ 1,012,363	$ 1,009,963	$ 1,009,963	$ -	$ 2,400	$ 254,076
8	$ 943,126	$ -	$ -	$ 92,049	$ 1,035,175	$ 1,032,775	$ 1,032,775	$ -	$ 2,400	$ 256,476
9	$ 964,427	$ -	$ -	$ 94,074	$ 1,058,501	$ 1,056,101	$ 1,056,101	$ -	$ 2,400	$ 258,876
10	$ 986,211	$ -	$ -	$ 96,144	$ 1,082,354	$ 1,079,954	$ 1,079,954	$ -	$ 2,400	$ 261,276
11	$ 1,008,487	$ -	$ -	$ 98,259	$ 1,106,746	$ 1,104,346	$ 1,104,346	$ -	$ 2,400	$ 263,676
12	$ 1,031,267	$ -	$ -	$ 100,420	$ 1,131,688	$ 1,129,288	$ 1,129,288	$ -	$ 2,400	$ 266,076
13	$ 1,054,563	$ -	$ -	$ 102,630	$ 1,157,192	$ 1,154,792	$ 1,154,792	$ -	$ 2,400	$ 268,476
14	$ 1,078,385	$ -	$ -	$ 104,888	$ 1,183,273	$ 1,180,873	$ 1,180,873	$ -	$ 2,400	$ 270,876
15	$ 1,102,747	$ -	$ -	$ 107,195	$ 1,209,942	$ 1,207,542	$ 1,207,542	$ -	$ 2,400	$ 273,276
16	$ 1,127,660	$ -	$ -	$ -	$ 1,127,660	$ 1,125,260	$ 1,125,260	$ -	$ 2,400	$ 275,676
17	$ 1,153,137	$ -	$ -	$ -	$ 1,153,137	$ 1,150,737	$ 1,150,737	$ -	$ 2,400	$ 278,076
18	$ 1,179,190	$ -	$ -	$ -	$ 1,179,190	$ 1,176,790	$ 1,176,790	$ -	$ 2,400	$ 280,476
19	$ 1,205,833	$ -	$ -	$ -	$ 1,205,833	$ 1,203,433	$ 1,203,433	$ -	$ 2,400	$ 282,876
20	$ 1,233,078	$ -	$ -	$ -	$ 1,233,078	$ 1,096,397	$ 1,096,397	$ -	$ 136,681	$ 419,557
Totals	**$ 20,310,452**	**$ 1,851,024**	**$ 322,099**	**$ 1,425,515**	**$ 23,909,090**	**$ 23,428,864**	**$ 23,489,533**	**$ 60,669**	**$ 419,557**	**$ -**

NOTES:

1 **Includes: Hard costs and project service fees defined in ESCO's PROPOSED 'FORM V"**
2 **No payments are made by the Board during the construction period.**
3 **Installation period savings for Energy Savings and Operational Savings are guarenteed. These savings will be used in addition to the first loan payment.**
4 **Total Financed Cost includes all Fees and project costs.**

Incentive Breakout for Recommended Project

Year	DR EE Credit	NJ Clean Energy Rebates	Total
1	$16,460	$270,364	$ 286,824
2	$11,758	$0	$ 11,758
3	$11,758	$0	$ 11,758
4	$11,758	$0	$ 11,758
TOTAL	**$51,734**	**$270,364**	**$ 322,099**

Greenhouse Gas Reductions

The project's reduced emissions would be equivalent to:

CO_2 sequestered by	**199,549**	**tree seedlings grown for 10 years in an urban scenario**
CO_2 sequestered by	**1,659**	**acres of pine or fir forests**
CO_2 emissions from	**1,488**	**passenger vehicles**
CO_2 emissions from	**18,099**	**barrels of oil consumed**
CO_2 emissions from the *energy* use of	**662**	**homes for one year**
CO_2 emissions from burning	**41**	**coal railcars**

Source:
All carbon equivalencies extracted directly from the EPA website.
"Greenhouse Gas Equivalencies Calculator." Clean Energy. U.S. Environmental Protection Agency. <www.epa.gov/cleanenergy/energy-resources/refs.html> (Jan. 24,2011).

AVOIDED EMISSIONS	Total Electric Savings & Onsite Solar Power Generation	Total Natural Gas Savings	Total Annual Avoided Emissions
Annual Unit Savings	8,334,625 kWh	269,775 Therms	
NO_X	7,918 lbs	2,482 lbs	10,400 lbs
SO_2	18,420 lbs	0 lbs	18,420 lbs
CO_2	9,266,353 lbs	3,156,368 lbs	12,422,723 lbs

Factors Used in Calculations:

CO_2 Electric Emissions:	1,111.79	lbs.	per	MWh	saved
CO_2 Gas Emissions:	11.7	lbs.	per	therm	saved
NO_X Electric Emissions:	0.95	lbs.	per	MWh	saved
NO_X Gas Emissions:	0.0092	lbs.	per	therm	saved
SO_2 Electric Emissions:	2.21	lbs.	per	MWh	saved

SECTION 4. ENERGY CONSERVATION MEASURES

01-01 Comprehensive LED Lighting Upgrades

ECM Summary

Light Fixtures at School 28

Lighting Retrofit and Replacement: Most of the lighting fixtures throughout the Paterson Public Schools, utilize older technologies that can be upgraded. Improvements to lighting will reduce electrical consumption and improve lighting levels. The costs of material to maintain the current systems will also be reduced since these renovations replace items (i.e., lamps and ballasts) that are near the end of their life cycle and/or considered environmentally hazardous.

Where appropriate, lighting levels will be adjusted to meet Illumination Engineering Society (IES) standards.

Lighting Levels: Our proposed lighting system improvements will maximize savings while maintaining or improving existing light levels in each area. All installations will comply with IES standards. Post-retrofit light levels are typically increased because of the improved design and installation of newer equipment, but areas that are currently over lit will be adjusted to maintain IES recommended light level. Before and after sample light level reading will be performed to confirm expected results.

Typical LED lighting system exhibit the following characteristics:

- Extremely Long Life – up to 50,000+ hours
- Highly efficient with very low wattage consumption
- Solid state lighting technology ensures that the fixtures are highly durable

Lighting Controls: Lighting controls are effective in areas where lighting is left on unnecessarily, mainly because it is a common area or due to the inconvenience to manually switch lights off when a room is left or on when a room is first occupied. This is common in rooms that are occupied for only short periods and only a few times per day. Lighting controls come in many forms. Sometimes an additional switch is adequate to provide reduced lighting levels when full light output is not needed.

Occupancy sensors detect motion and will switch the lights on when the room is occupied. Occupancy sensors can either be mounted in place of a current wall switch, or on the ceiling to cover large areas. Lighting controls will be installed in various offices, break rooms, restrooms, and other locations where appropriate. In the next phase, ESG will perform detailed sample measurements to determine coincident lighting room occupancy and overall lighting level information to accurately determine and identify spaces suitable for lighting controls throughout each facility.

Facilities Recommended for this Measure

- Dale Avenue
- Silk City 2000 Academy
- Department of Facilities
- District Central Offices
- Eastside High School
- Edward Kilpatrick
- John F. Kennedy High School
- New International High School
- New Roberto Clemente School
- New Roberto K Center
- Norman S. Weir
- Rev. Dr. Martin Luther King Jr.
- Roberto Clemente Elementary
- Rosa L. Parks School of Arts
- School 12
- School 13
- School 18
- School 28
- School 6
- School 7

Scope of Work

- Verify availability of ambient light through detailed light level readings in the spaces
- Safely disconnect the existing lighting fixture from live circuit
- Remove existing Fluorescent Lamps
- Where necessary remove existing receptacles in the fixtures
- Install the retrofit kit and install 10.5 watt LED line voltage tubes
- Reconnect all the wiring
- Test for operation
- Clean-up work area
- Properly dispose of removed material
- Provide training to staff on operation of new lighting system
- Refer to Line by Line inventory included in Appendix 6.

Savings Methodology

In general, savings calculations for lighting retrofits are calculated using the following methodology:

Savings Calculation Method		
Baseline Energy Usage (kWh / yr)	=	Existing Fixture Watts x Operating Hours / yr x 1 kW / 1000 Watts
Estimated Energy Usage (kWh / yr)	=	Proposed Fixture Watts x Op. Hours/yr x 1 kW / 1000 Watts
Energy Savings (kWh / yr)	=	Baseline Energy Usage – Estimated Energy Usage
Baseline Demand (kW)	=	Existing Fixture Watts / 1000 Watts
Retrofit Demand (kW)	=	Proposed Fixture Watts / 1000 Watts
Energy Savings (kW)	=	(Existing Fixture Watts – Proposed Fixture Watts) x 1 kW / 1000 Watts

Maintenance

Lighting will need to be replaced in order to provide consistent light quality throughout the exterior space. It is recommended to conduct group re-lamping on regularly scheduled intervals in order to minimize maintenance requirements.

Benefits

- Electrical energy savings
- Improved exterior light quality
- Reduction in maintenance of exterior lighting system
- Improved safety around school perimeter
- Reduced lamp replacement for 5 to 10 years for LEDs

01-02 Comprehensive LED Lighting Upgrades - NJDI

ECM Summary

Existing small to mid-sized commercial and industrial facilities with a peak electric demand that did not exceed 200 kW in any of the preceding 12 months are eligible to participate in Direct Install. Applicants will submit the last 12 months of electric utility bills indicating that they are below the demand threshold and have occupied the building during that time. Buildings must be located in New Jersey and served by one of the state's public, regulated electric or natural gas utility companies. Created specifically for existing small to medium-sized facilities, Direct Install is a turnkey solution that makes it easy and affordable to upgrade to high efficiency equipment. The program pays up to 70% of retrofit costs, dramatically improving your payback on the project.

Facilities Available for Direct Install

Academy of Earth and Space Sciences
Early Learning Center
School 17
Rutland Early Childhood Learning Center

Scope of Work

- ESG will work closely with one of the program partners to evaluate the Direct Install Program
- The systems and equipment addressed by the program are
    - Lighting

Savings Methodology

In general, savings calculations for lighting retrofits are calculated using the following methodology:

Savings Calculation Method		
Baseline Energy Usage (kWh / yr)	=	Existing Fixture Watts x Operating Hours / yr x 1 kW / 1000 Watts
Estimated Energy Usage (kWh / yr)	=	Proposed Fixture Watts x Op. Hours/yr x 1 kW / 1000 Watts
Energy Savings (kWh / yr)	=	Baseline Energy Usage – Estimated Energy Usage
Baseline Demand (kW)	=	Existing Fixture Watts / 1000 Watts
Retrofit Demand (kW)	=	Proposed Fixture Watts / 1000 Watts
Energy Savings (kW)	=	(Existing Fixture Watts – Proposed Fixture Watts) x 1 kW / 1000 Watts

Maintenance

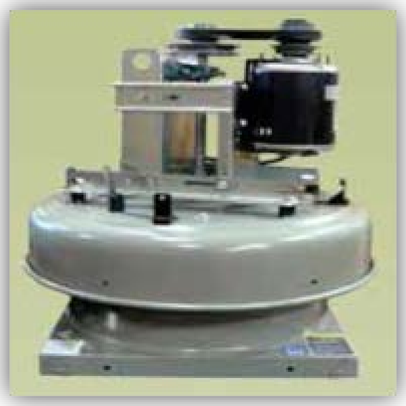
Lighting will need to be replaced in order to provide consistent light quality throughout the exterior space. It is recommended to conduct group re-lamping on regularly scheduled intervals in order to minimize maintenance requirements.

Benefits

- Reduced installation cost utilizing Direct Install Incentive Program.
- Electrical energy savings

02-02 Exhaust Fan Motor Replacement

ECM Summary



Low Efficiency Motor - GREENHECK Vari-Green Motor

The District has several exhaust fans that have older low-efficiency motors and have exceeded their useful life. Although this measure results in a poor payback period, it is recommended based on the potential for energy savings, improved occupant comfort and safety concerns.

On small motor applications, Electronically Commutated (EC) Motors have the proven potential to generate significant savings. These motors are typically in sizes up to 1 horsepower, and their efficiencies are high compared to the older fractional horsepower motors. Since these motors are without mechanical brushes and the commuter reduces friction losses, they work much like Direct Current (DC) motors. They are programmable and can be used for a wide range of applications.

Facilities Recommended for this Measure

New Roberto Clemente School	Rutland Early Childhood Learning Center
Norman S Weir School	School 18
Rev. Dr. Martin Luther King	School 7
Rosa L Parks School of Fine and Preforming Arts	New International High School

Scope of Work by School

New International HS / Qty. (9)
Removal & New Installation Work

- Disconnect Qty. (2) .25HP, (5) .5HP, (1) .75HP & (1) 3HP fan motors and replace with new premium efficiency fan motors. On all belt driven fans, replace fan belts, motor pulley and fan sheave.
- Clean fan wheels as required.

New Roberto Clemente / Qty. (10)
Removal & New Installation Work

- Disconnect Qty. (2) .25HP, (2) 1HP & (5) 2HP & (1) 3HP fan motors and replace with new premium efficiency fan motors. On all belt driven fans, replace fan belts, motor pulley and fan sheave.
- Clean fan wheels as required.

Norman S. / Qty. (3)
Removal & New Installation Work

- Disconnect Qty. (2) .5HP & (1) 1HP fan motors and replace with new premium efficiency fan motors. On all belt driven fans, replace fan belts, motor pulley and fan sheave.
- Clean fan wheels as required.

Rev. Martin L. King ES / Qty. (23)
Removal & New Installation Work

- Disconnect Qty. (8) .33HP, (11) 1HP, (2) 2HP & (2) .75HP fan motors and replace with new premium efficiency fan motors. On all belt driven fans, replace fan belts, motor pulley and fan sheave.
- Clean fan wheels as required.

Rosa L. Parks School of Fine & Performing Arts / Qty. (6)
Removal & New Installation Work

- Disconnect Qty. (2) .33HP, (2) 5HP & (2) .75HP fan motors and replace with new premium efficiency fan motors. On all belt driven fans, replace fan belts, motor pulley and fan sheave.
- Clean fan wheels as required.

Rutland Early Learning Center / Qty. (2)
Removal & New Installation Work

- Disconnect Qty. (2) .33HP fan motors and replace with new premium efficiency fan motors. On all belt driven fans, replace fan belts, motor pulley and fan sheave.
- Clean fan wheels as required.

School #7 / Qty. (2)
Removal & New Installation Work

- Disconnect Qty. (2) .5HP fan motors and replace with new premium efficiency fan motors. On all belt driven fans, replace fan belts, motor pulley and fan sheave.
- Clean fan wheels as required.

School #18 / Qty. (13)
Removal & New Installation Work

- Disconnect Qty. (4) .33HP, (4) .5HP, (2) .75HP, (1) 1HP, (1) 2HP & (1) 3HP fan motors and replace with new premium efficiency fan motors. On all belt driven fans, replace fan belts, motor pulley and fan sheave.
- Clean fan wheels as required.

Savings Methodology

Savings Calculation Method		
Motor (kW)	=	(Motor Horsepower x 0.746 (kW/HP) x Load Factor) = or = (Motor Amperage x Volts x 1.732 x Power Factor) / 1000
Speed Ratio Correction Factor	=	((New RPM)/(Existing RPM)) ^ 3
Existing Energy Use (kWh)	=	(Existing kW /Existing Efficiency) x Hours of Use
Existing Demand Use (kW)	=	(Existing kW /Existing Efficiency) x Peak Load Months x Utilization factor
New Energy Use (kWh)	=	(New kW /New Efficiency) x Hours of Use x Speed Ratio Correction Factor
New Demand Use (kW)	=	(New kW /New Efficiency) x Peak Load Months x Utilization factor x Speed Ratio Correction Factor
Total Savings (kWh, kW)	=	(kWh existing - kWh new) x $/kWh + (kW existing - kW new) x $/kW

Maintenance

Periodically the equipment should be checked to ensure proper operation.

Benefits

- Minimizes fan coil unit energy efficiency
- Lower operating cost
- Drastically reduced humidity
- Improved indoor air quality

02-03 Variable Frequency Drives (VDFs) On Hot Water Pumps

ECM Summary

Pumps with Variable Frequency Drives

ABB Variable Frequency Drives

This measure will replace constant volume pumping systems with a variable flow system through the installation of Variable Frequency Drive(s) (VFD) on electric motor(s) for hot water pumps, where prudent. Constant volume systems are equipped with a differential pressure sensor and bypass valve that diverts water not being used at the terminal units back to the pump inlet. While this enables the system to properly control flow at the units, the central pumps continually operate at full speed/flow. Varying the speed of a motor to match the actual load at the terminal units reduces the pumps electrical motor power (kW), which results in significant electrical energy savings.

Any single speed or two speed inverter-duty pump motor (typically greater than 5 to 10 HP) that has fluctuating loads is a good candidate for a variable speed drive. Heating hot water pumps are ideal candidates for VFD control due to the varying loads on building heating demand and motors which are typically larger than 10 HP.

It is our recommendation that new Variable Frequency Drive(s) be installed on the hot water pumps in the schools indicated below. The VFDs will include a bypass to allow the motor to operate at full speed in HAND in the event of VFD failure. The VFD will be supplied complete with an open protocol communications card for integration with existing Energy Management System (EMS) or newly installed EMS. The VFD will be controlled by the EMS to maintain hot water heating loop differential pressure set point. If necessary, 3-way valves at terminal units will be converted to 2-way valves in order to ensure proper operation of the system.

Facilities Recommended for this Measure

Eastside High School
School 28
School 12
New International High School
School 6

Scope of Work by School

The scope of work is as follows:

Eastside HS (Old Boiler Room)

Removal & New Installation Work

- Disconnect Qty. (2) 30HP heating hot water system pumps and replace with Qty. (2) new 30HP premium efficiency motors and new variable frequency drives (VFD's).
- Include new motor couplings to connect new motors to existing pumps.
- Install new VFD's on wall and connect line voltage from new VFD's to new motors.
- Tap will need to be installed by MC in heating hot water main pipe with location determined by engineer for pressure differential switch with controls and wiring to be by controls contractor.

New International HS

Removal & New Installation Work

- Disconnect Qty. (2) 15HP heating hot water system base mounted pumps and motors.
- F&I Qty. (2) new 15HP premium efficiency motors with pumps and new variable frequency drives (VFD's).
- Include new suction diffusers, valves, strainers, and flex connectors for each new base mounted pump.
- Include vibration isolation for (2) new base mounted pumps.
- Install new VFD's on wall and connect line voltage from new VFD's to new motors.
- Tap will need to be installed by MC in heating hot water main pipe with location determined by engineer for pressure differential switch with controls and wiring to be by controls contractor.

School #6

Removal & New Installation Work

- Disconnect Qty. (2) 15HP & (1) 10HP heating hot water system pump motors and replace with premium efficiency / inverter duty motors and new variable frequency drives (VFD's) to match.
- Include new motor couplings to connect new motors to existing pumps.
- Install new VFD's on wall and connect line voltage from new VFD's to new motors.
- Mechanical Contractor (MC) is responsible for all line voltage wiring of motors and VFD's.
- Controls Contractor (CC) is only responsible for DDC and low voltage controls and wiring.
- Tap will need to be installed by MC in heating hot water main pipe with location determined by engineer for pressure differential switch with controls and wiring to be by CC.

School #12

Removal & New Installation Work

- Disconnect Qty. (2) 15HP heating hot water system pump motors and replace with premium efficiency / inverter duty motors and new variable frequency drives (VFD's) to match.
- Include new motor couplings to connect new motors to existing pumps.
- Install new VFD's on wall and connect line voltage from new VFD's to new motors.
- Mechanical Contractor (MC) is responsible for all line voltage wiring of motors and VFD's.
- Controls Contractor (CC) is only responsible for DDC and low voltage controls and wiring.
- Tap will need to be installed by MC in heating hot water main pipe with location determined by engineer for pressure differential switch with controls and wiring to be by CC.

School #28

Removal & New Installation Work

- Disconnect Qty. (2) 10HP heating hot water system pump motors and replace with premium efficiency / inverter duty motors and new variable frequency drives (VFD's) to match.
- Include new motor couplings to connect new motors to existing pumps.
- Install new VFD's on wall and connect line voltage from new VFD's to new motors.
- Mechanical Contractor (MC) is responsible for all line voltage wiring of motors and VFD's.
- Controls Contractor (CC) is only responsible for DDC and low voltage controls and wiring.
- Tap will need to be installed by MC in heating hot water main pipe with location determined by engineer for pressure differential switch with controls and wiring to be by CC.

Savings Methodology

Savings Calculation Method		
Pump kWh Used	=	(HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (Annual Op Hours x % of Time at % Flow)
Pump kW Dem'd	=	(HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (% of Time at % Flow x DUF x Months/year)
Pump kWh Used After Conversion	=	(HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (Annual Op Hours x % of Time at % Flow)
Pump kW Dem'd After Conversion	=	(HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (% of Time at % Flow x DUF x Months/year)
Heating Savings	=	Existing Heating Cost x Assumed Valve Leakage

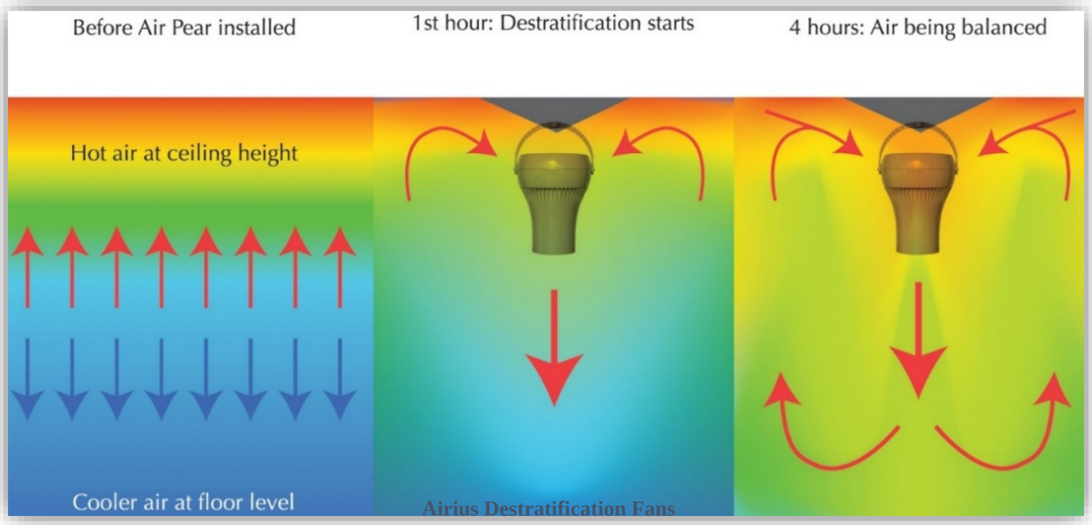
Maintenance

Periodically the equipment should be checked to ensure proper operation.

Benefits

- Electric and Natural Gas savings

02-04 Destratification Fans



ECM Summary

In rooms with high ceilings typically stratification of heated air occurs, resulting in air at ceiling level being warmer than the floor level. Since temperature at the floor level dictates the comfort of occupants and is typically the location of the thermostat controlling the system, this results in additional operating hours to satisfy space conditions. A de-stratification fan continuously mixes the air, balancing temperatures from ceiling to floor and wall to wall which helps the HVAC system maintain the desired temperature.

Facilities Recommended for this Measure

Eastside High School	New Roberto Clemente School
New International High School	Rosa L. Parks School of Fine and Preforming Arts
John F. Kennedy High School	School 28

Scope of Work

- Furnish and install Airius Model 25 de-stratification fans.
- Furnish and install the required new power wiring to connect the fans
- Furnish the required new circuit breaker, electrical metallic tubing (EMT) conduit and miscellaneous wiring devices to complete the installation
- Start and test the new fan
- Clean up area
- Provide required warranty
- Provide training required for operating personnel

Savings Methodology

(1) Total Roof/wall Thermal Resistance (RRT) = $R_{Air\ Outside}$ + $R_{Roof/wall}$ + $R_{Air\ Inside}$
(2) Total Roof/wall Heat Transfer Coefficient (U) = 1/($R_{Air\ Outside}$ + $R_{Roof/wall}$ + $R_{Air\ Inside)}$
(3) Existing upper wall and Roof Deck Underside Temperature = Space Temperature + 20^{O}F
(4) Proposed Roof Deck Underside Temperature
= (Proposed Space Temperature + Existing Roof Deck Underside Temperature) / 2
(5) ∆TH Existing = Existing Roof Deck Underside Temperature - Ambient Temperature
(6) ∆TH Proposed = Proposed Roof Deck Underside Temperature - Ambient Temperature
(7) Existing Heating Energy Input = URT × A_{Roof} × {∑(Heating Bin Hours ×∆TH Existing)} / (HV × η)
Where ∑ - Summation overall heating bin hours, Occupied and Unoccupied Hrs
(8) Proposed Heating Energy Input = URT × A_{Roof} × {∑(Heating Bin Hours ×∆TH Proposed)} / (HV × η)
Where ∑ - Summation overall heating bin hours, Occupied and Unoccupied Hrs
(9) Annual Heating Energy Saved = Existing Heating Energy Input - Proposed Heating Energy Input
(10) Annual Destrat Fan Electric Usage (kWh) = Fan Operating (hrs)/ yr × kW/fan × # fans

Maintenance

Check the proper operation of destrat fans on a periodic basis.

Benefits

- Energy Savings
- Improved Air Distribution

03-01 Auditorium Air Conditioning (2) 20 Ton

ECM Summary

Some of the schools in the district have areas that are either not fully air conditioned or have systems that are in need of an upgrade/replacement. We have proposed addition of cooling at these schools, predominantly in areas of high occupancy – auditoriums, cafeterias, gymnasiums, etc. - in an efficient manner so that the space can be comfortably occupied throughout the year. This ECM entails the addition a high efficiency DX cooling system. The proposed system will reduce cooling costs compared to a standard DX equipment and will include DDC controls that can be easily integrated into the proposed Building Management System. The new systems will also ensure that all equipment operates with a common, environmentally low-impact refrigerant minimizing the plants ozone depletion potential.

East HS Auditorium

Facilities Recommended for this Measure

Eastside High School Auditorium

Scope of Work

Eastside HS Auditorium Air Conditioning

Demolition and Removal Work:

- Concept is to replace Qty. (2) existing and abandoned chilled water coils in fan units suspended behind auditorium above stage on mezzanine level. Both fan units will be refurbished with new fan motors, cleaned and serviced and new 20-ton DX evaporator coils installed in place of CHW coils that will be removed. New 20-ton DX evaporator coils will connect to (2) new 20-ton air cooled condensers on roof.
- Disconnect electrical, controls, CHW piping and sheet metal ducting.
- Using hoists, cut loose and lower CHW cooling coil and fan motor at each HV unit.

New Installation Work:

- F&I Qty. (2) York / JCI (or equal) 20-ton cooling only air-cooled condensers.
- F&I Qty. (2) York / JCI (or equal) 20-ton DX cooling coils in existing fan sections reusing main supply duct air distribution systems.
- F&I Qty. (2) new fan blower motors, belts, pulleys and sheaves to deliver designed minimum of 8000CFM.
- Thoroughly clean each entire fan section, blower wheels, hot water coils and inside of units. Make any repairs to interior liner insulation of fan coil units as needed.

- F&I Qty. (2) new roof mounted steel beam supports for each new rooftop unit that will span across main support beams below to set. Design and sizing of new steel will be responsibility of engineer for project.
- Include roofing contractor to properly seal any roof penetrations and steel support posts for new condensers.
- F&I all new line voltage wiring and conduit from nearest main electrical panel that can support the added electrical load for cooling condenser units. Connect new line voltage power to new unit disconnects.
- F&I new return air smoke detectors.
- F&I new room thermostat controllers.
- Provide crane for setting of new steel beam supports on roof and new condensers.
- F&I new PVC condensate line and trap at each indoor unit.
- Mechanical Contractor is to hire as part of his contract an independent certified air test and balance company to perform a 'Pre-Test' of airflow CFM's on both HV units prior to disconnecting and removing of both HV's. Upon completion and start-up of new fan motors and cooling coils, independent test and balance contractor will return to perform a 'Post-Test' of air flow CFM's on both existing HV units.

Savings Methodology

Savings Calculation Method		
Cooling Savings (kWh)	=	Unit-Size (Tons) x Cooling gradient (%) x (Existing Unit kW/Ton – New Unit kW/Ton) x Bin Hours

Maintenance

Periodically the equipment should be checked to ensure proper operation.

Benefits

- Electric savings
- Improved occupant comfort

03-02 Gymnasium Air Conditioning (2) 20 Ton

ECM Summary

Some of the schools in the district have areas that are either not fully air conditioned or have systems that are in need of an upgrade/replacement. We have proposed addition of cooling at these schools, predominantly in areas of high occupancy – auditoriums, cafeterias, gymnasiums, etc. - in an efficient manner so that the space can be comfortably occupied throughout the year. This ECM entails the addition a high efficiency DX cooling system. The proposed system will reduce cooling costs compared to a standard DX equipment and will include DDC controls that can be easily integrated into the proposed Building Management System. The new systems will also ensure that all equipment operates with a common, environmentally low-impact refrigerant minimizing the plants ozone depletion potential.

East Side HS Gymnasium

Facilities Recommended for this Measure

Eastside High School Gymnasium

Scope of Work

<u>Eastside HS Gymnasium Air Conditioning</u>

Demolition and Removal Work:

- Concept is to replace Qty. (2) existing suspended hot water heating and venting units and replace with Qty. (2) new 20 Ton packaged cooling only units with new duct mounted hot water heating coils and reuse main supply duct air distribution systems.
- Disconnect electrical, controls, hot water piping and sheet metal ducting.
- Using platform lifts and hoists, cut loose and lower sections cut apart of steel service platform at each HV unit.
- Disassemble HV unit and lower to ground in sections using platform lifts and hoists.

New Installation Work:

- F&I Qty. (2) York / JCI (or equal) 20 ton packaged cooling only rooftop units.
- F&I Qty. (2) new roof mounted steel beam supports for each new rooftop unit that will span 30 across to set on main steel girders. Design and sizing of new steel will be responsibility of engineer for project.
- Include roofing contractor to properly seal around modified fresh air intake on roof that will now be used for return air and for sealing of steel beam supports down to main steel below roof.
- Units to include economizer with single enthalpy control and smoke detector.

- F&I Qty. (2) new duct mounted hot water heating coils located in existing supply duct systems. Reconnect existing hot water piping to each new hot water heating coil with new insulated piping and control valves with shut off valves,
- F&I all new line voltage wiring and conduit from nearest main electrical panel that can support the added electrical load for cooling units. Connect new line voltage power to new unit disconnects.
- F&I new custom fabricated insulated ducting to connect existing duct to new hot water duct coils and new RTU's on roof.
- F&I new return air smoke detectors.
- F&I new room thermostat controllers.
- Provide crane for setting of new steel beam supports on roof and new RTU's.
- F&I new PVC condensate trap at each unit.
- Mechanical Contractor is to hire as part of his contract an independent certified air test and balance company to perform a 'Pre-Test' of airflow CFM's on both HV units prior to disconnecting and removing of both HV's. Upon completion and start-up of new RTU's, independent test and balance contractor will return to perform a 'Post-Test' of air flow CFM's on both new RTU's.

Savings Methodology

Savings Calculation Method		
Cooling Savings (kWh)	=	Unit-Size (Tons) x Cooling gradient (%) x (Existing Unit kW/Ton – New Unit kW/Ton) x Bin Hours

Maintenance

Periodically the equipment should be checked to ensure proper operation.

Benefits

- Electric savings
- Improved occupant comfort

03-03 Air Cooled Chiller Refurbishment

ECM Summary

Energy Systems Group proposes to refurbish the existing chiller at Dale Avenue. The presence of dirt and other debris in a chiller system can affect the components within the system. Dirty or fouled components are the most common complication in commercial refrigeration today. Strainers used to collect foreign material within the system should be cleaned periodically. Condensing tubes require inspection and cleaning in the presence of buildup. Refrigerant should be checked periodically to ensure sufficient volume.

Air Cooled Chiller - Dale Avenue

Facilities Recommended for this Measure

Dale Avenue

Scope of Work

Energy Systems Group proposes to refurbish the existing chiller at Dale Avenue School as follows:

- Existing McQuay Model AGS250B27-FR10 air cooled chiller will have routine maintenance following guidelines of McQuay Chiller Manual including but not limited to the following;

- Electrical System – Maintenance of the electrical system involves the general requirement of keeping connections clean and tight. Pump interlocks and flow switches should be checked to be sure they interrupt the control circuit when tripped.
- Cleaning and Preserving;
  1) Strainers – Remove and clean strainers in the chilled water system and condenser water system.
  2) Condenser Tubes – Inspect the condenser tubes annually for fouling and clean if required. The standard waterboxes should be removed with care due to their weight. A hoist will be required for this process; refer to McQuay maintenance manual for guidelines.
  3) Refrigerant - check compressors for proper refrigerant charge, adding of refrigerant as required.

Savings Methodology

Energy savings will result from reducing the amount of energy the compressor will consume. In general, ESG uses the following approach to determine savings for this specific measure:

Savings Calculation Method		
Energy Use (Kwh)	=	Capacity (Tons)*(Hours of Operation/Year)*(Scheduled Usage)*(Efficiency)
Energy Savings (Kwh)	=	Existing Energy Use(Kwh)-New Energy Use (Kwh)
Energy Demand (Kw)	=	(Peak Capacity (Tons)*(Efficiency)

Energy Demand Cost ($)	=	(Energy Demand (Kw)*(Demand Cost ($/Kw))
Energy Cost Savings ($)	=	(Energy Savings(Kwh)*($/Kwh))+(Existing Demand Cost ($)-New Demand Cost ($))

Maintenance

Periodically the equipment should be checked to ensure proper operation.

Benefits

Electrical energy savings.

04-02 Steam Boiler Replacement

ECM Summary

Steam boilers are used to provide heating to the classrooms and office areas throughout a building. In schools where the boilers are very old and in a poor shape, the replacement of existing boilers with a similar number of new greater efficiency units will provide efficiency gains that will generate operating and fuel cost savings. The radiant and convective heat losses will also be reduced with the installation of new boilers which makes the entire steam system more efficient. Where applicable, the steam boilers that are recommended for replacement will be replaced by boilers with increased efficiencies (including thermal and combustion losses).

In some cases, a single boiler may provide all the heating for a building with no source of heating back-up. The replacement of the single boiler in these boiler plants with multiple new, high-efficiency units will generate significant energy savings as well as provide redundancy to the heating system. Each new boiler will be slightly smaller than the existing single boiler but as a whole central plant will meet or exceed the heating capacity of the current boiler. The installation of the smaller boilers will increase the efficiency of the entire plant by operating more efficiently at low loads than the single boiler.

Existing Steam Boilers – Dale Avenue

Facilities Recommended for this Measure

Dale Avenue

Scope of Work

Demolition and Removal Work

Replace Qty. (2) existing Smith Model 28A-13 sectional cast iron steel boilers with two new Smith high efficiency sectional CI steam boilers and Power Flame gas gun burners.

- Demolition of Qty. (2) existing Smith Model 28A-13 CI sectional steam boilers.
- Disconnect and remove existing feedwater tank and pumps for replacement.
- Disconnect, remove and properly dispose of steam and condensate piping for boilers to nearest isolation valves or as required for new installation.
- Disconnect, remove and properly dispose of gas flue for boilers inside mechanical room and entire steel stack run up the outside of the building, including brick and concrete base.

- Disconnect all electric, controls, gas piping, water lines, pressure reliefs and drains.

New Installation Work

- F&I Qty. (2) new Smith Model G28HE-13, CI sectional steam boilers with new Power Flame gas gun burners or equal set on existing concrete pads.

Details of installation to include the following:

- F&I Qty. (2) new Smith Model G28HE-14 sectional CI steam boilers.
- F&I Qty. (2) new Power Flame Model C3-G-25 modulating gas burners and gas trains.
- F&I Qty. (1) new Skidmore Model VNSSM-153.5-500 Floor triplex Boiler Feed Water Unit complete with 500 Gallon Floor Mounted Cylindrical 304 Stainless Steel Receiver (42" Dia. X 84" Long), with 3 pumps, electrical controls, etc.
- F&I new steam and condensate piping from new boilers to existing main steam and condensate lines.
- F&I new boiler drains, equalizer / condensate return lines, pressure reliefs piped to floor drains, water supply, blow down drains piped over to existing floor drains.
- F&I new 2" fiberglass insulation on all new and existing steam piping 'that has no insulation', drain lines, condensate piping in boiler room.
- F&I new gas line piping from existing gas line to new burners with new shut off valves.
- F&I new 16-inch diameter AL29-4C single wall stainless steel flue pipe to connect from each new boiler to new main common flue in boiler room.
- F&I all new single wall chimney with new concrete foundation to be installed in place of existing steel chimney that is to be removed.
- F&I proper pipe suspensions for all piping.
- F&I pipe identification and tags for all pipe, valves, etc.
- Reconnect existing line voltage electrical circuits to new boilers.
- All boiler devices shipped with or added to boiler that are line voltage and part of the installation shall be wired in by mechanical contractor.
- All low voltage controls and wiring is to be performed by controls contractor for the project.
- Provide factory startup of new boilers and equipment including feedwater tanks and pumps.
- Mechanical Contractor is responsible as part of his contract to hire an independent balancing contractor to provide 'Pre-Testing' and documenting of all flow rates for system; system pumps, boiler pumps and feedwater tank pumps prior to demolishing and removing old equipment. Once all new equipment is installed, the independent balancing contractor will be brought back to do a 'Post-Testing' of all newly installed equipment, pumps, etc.

Savings Methodology

In general, savings calculations for boiler replacement are calculated using the following methodology:

Boiler Replacement

$E_E \quad = \sum_{i=1}^{8760} (Q_i \div \eta_E)$

$E_P \quad = \sum_{i=1}^{8760} (Q_i \div \eta_P)$

$E_S \quad = E_E - E_P$

$C_S \quad = E_S \times FUR$

Where,

E_E = Annual energy (fuel) use of existing system

E_P = Annual energy use of proposed system

E_S = Annual energy savings

C_S = Annual cost savings

Q_i = Hourly heating demand, modeled as a linear fit of OA DBT (dry-bulb temperature), with a cut-off temperature above which there is no heating

η = Combustion efficiency of heating system based on field data, manufacturer's rating or snap-shot measurements

Maintenance

Follow manufacturers' recommendations for preventative maintenance.

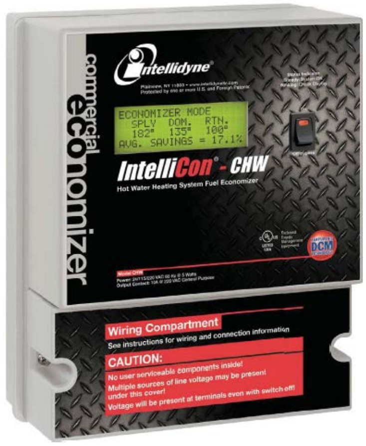
Benefits

- Natural Gas savings
- Operational savings through new equipment and preventative maintenance plan

04-03 Boiler Controls - Intellidyne

ECM Summary

A heating system must be able to provide acceptable comfort at the lowest anticipated outdoor temperature. Most residential boilers have a heat capacity 1.5 to 2 times larger than needed to maintain space temperature on extreme days. Due to this oversizing of the boiler, the burner will cycle on and off to prevent overheating of the system water during any call for heat.



Intellidyne Heating Economizer

Intellidyne Heating System Economizers increase system efficiency. Thus, the heating system uses less fuel to generate the same amount of heat. This is done by dynamically changing the aquastat's effective dead-band based on the measured heating load. This causes the average water temperature to be varied (depending on the measured load) and is accomplished by extending the burner's off-time. Extending the off-time also results in longer, more efficient burns and a reduction in burner cycling. Just as computer control has increased the gas mileage of automobiles, Intellidyne Heating System Economizers improve the fuel utilization of heating systems by supplementing the antiquated on/off control action of the aquastat with the analysis and control capabilities of a computer.

Intellidyne Heating System Economizers reduce fuel consumption 10% to 20% and decrease burner cycling by 30% or more.

Facilities Recommended for this Measure

John F. Kennedy HS	New International HS
New Roberto Clemente	School 6
School 12	School 13
School 17	School 18
School 28	Silk City Academy

Scope of Work

<u>John F. Kennedy HS</u>

- F&I Qty. (2) Intelligent Control Systems (ICS) Model i-con 1110 & 1112 microprocessor-based, fuel saving controls on existing boiler burners.

<u>New International HS</u>

- F&I Qty. (2) Intelligent Control Systems (ICS) Model i-con 1210 & 1211 microprocessor-based, fuel saving controls on existing boiler burners.

New Roberto Clemente MS

- F&I Qty. (2) Intelligent Control Systems (ICS) Model i-con 1210 & 1211 microprocessor-based, fuel saving controls on existing boiler burners.

Silk City 2000 Academy

- F&I Qty. (1) Intelligent Control Systems (ICS) Model i-con 1110 & 1112 microprocessor-based, fuel saving controls on existing boiler burners.

School #6

- F&I Qty. (2) Intelligent Control Systems (ICS) Model i-con 1210 & 1211 microprocessor-based, fuel saving controls on existing boiler burners.

School #12

- F&I Qty. (2) Intelligent Control Systems (ICS) Model i-con 1110 & 1112 microprocessor-based, fuel saving controls on existing boiler burners.

School #13

- F&I Qty. (2) Intelligent Control Systems (ICS) Model i-con 1210 & 1211 microprocessor-based, fuel saving controls on existing boiler burners.

School #17

- F&I Qty. (2) Intelligent Control Systems (ICS) Model i-con 1110 & 1112 microprocessor-based, fuel saving controls on existing boiler burners.

School #18

- F&I Qty. (2) Intelligent Control Systems (ICS) Model i-con 1210 & 1211 microprocessor-based, fuel saving controls on existing boiler burners.

School #28

- F&I Qty. (2) Intelligent Control Systems (ICS) Model i-con 1210 & 1211 microprocessor-based, fuel saving controls on existing boiler burners.

Savings Methodology

Energy savings will result from reducing the compressor cycling. In general, ESG uses the following approach to determine savings for this specific measure:

Savings Calculation Method		
Total Existing Boiler Natural Gas Usage (Therms)	=	Therms
Savings (% of Total)	=	13%*
Factor of Safety	=	50%
Total Natural Gas Savings (Therms)	=	(Existing Usage)*(Savings %)*(Factor of Safety)

The savings estimate (%) matches the value stipulated by the New Jersey Board of Public Utilities New Jersey Clean Energy Program Protocols to Measure Resource Savings. ESG has also applied a 50% factor of safety to lower the estimated savings.

Maintenance

Periodically the equipment should be checked to ensure proper operation.

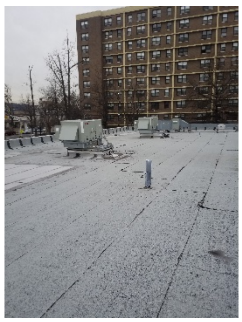
Benefits

- Natural Gas saving

05-01 RTU Replacement

ECM Summary

Rooftop units in the Paterson Public Schools vary based on age and condition. Replacing aged rooftop HVAC units will reduce the operating and maintenance costs of these systems. Both heating and cooling efficiencies of packaged rooftop equipment have significantly increased in the past 10 years. ESG has identified several older units that still utilize R22 refrigerant as the prime candidates for replacement.



Rosa L. Parks

Facilities Recommended for this Measure

Rosa L. Parks School of Fine and Performing Arts

Scope of Work (By School)

Rosa L. Parks School of Fine & Performing Arts

Demolition and Removal Work:

Concept is to replace Qty. (7) existing packaged gas / electric RTU's and install all new high efficiency replacement units to set on existing roof curbs with new custom manufacturers curb adapters.

- Disconnect electrical, controls and gas piping.
- Reclaim refrigerant.
- Crane units off onto flatbed trailer for disposal.

New Installation Work:

- F&I Qty. (7) Total York/JCI RTU's (or equal); Qty. (1) 2 ton, (2) 3 ton, (1) 4 ton and (3) 5 ton packaged high efficiency gas heating and electric cooling rooftop units with custom curb adapters.
- Units to include economizer with single enthalpy control.
- Reconnect line voltage power to new unit disconnects.
- Reconnect existing gas lines to new units.
- F&I new return air smoke detector in each unit.
- F&I new room thermostat controller.
- F&I new convenience outlet for each unit with overhead lighting as per code.

- Provide crane for setting of (7) new units.
- F&I new PVC condensate trap at each unit.
- Provide crane for the setting of new units.
- Mechanical Contractor is to hire as part of his contract an independent certified air test and balance company to perform a 'Pre-Test' of airflow CFM's on all RTU equipment prior to disconnecting and removing of all RTU's. Upon completion and start-up of new RTU's, independent test and balance contractor will return to perform a 'Post-Test' of air flow CFM's on all new RTU's.

Savings Methodology

Savings Calculation Method		
Cooling Savings (kWh)	=	RTU-Size (Tons) x Cooling gradient (%) x (Existing RTU kW/Ton – New RTU kW/Ton) x Bin Hours
Heating Savings (Therm)	=	((RTU-Size (Btu/h)/Existing RTU Eff.) – (RTU-Size (Btu/h)/ New RTU Eff.)) x Heating gradient (%) x Bin Hours/100000

Maintenance

Periodically the equipment should be checked to ensure proper operation.

Benefits

- Electric and Natural Gas savings

06-01 HVAC Controls - NJDI

ECM Summary

Existing small to mid-sized commercial and industrial facilities with a peak electric demand that did not exceed 200 kW in any of the preceding 12 months are eligible to participate in Direct Install. Applicants will submit the last 12 months of electric utility bills indicating that they are below the demand threshold and have occupied the building during that time. Buildings must be located in New Jersey and served by one of the state's public, regulated electric or natural gas utility companies. Created specifically for existing small to medium-sized facilities, Direct Install is a turnkey solution that makes it easy and affordable to upgrade to high efficiency equipment. The program pays up to 70% of retrofit costs, dramatically improving your payback on the project.

Facilities Available for Direct Install

Academy of Earth and Space Sciences	School 17
Early Learning Center	Rutland Early Childhood Learning Center

Scope of Work

- ESG will work closely with one of the program partners to evaluate the Direct Install Program
- The systems and equipment addressed by the program are
    - HVAC Controls

Savings Methodology

See savings calculations provided in Appendix.

Maintenance

Periodically the equipment should be checked to ensure proper operation.

Benefits

- Reduced installation cost utilizing Direct Install Incentive Program.
- Electrical energy and Natural gas savings

06-02, 03 Building Controls – Central Plant, Distributions (AHU/RTU)

ECM Summary

This ECM includes modernization of the District's DDC control system for the HVAC equipment. With the communication between the control devices and the new updated digital interface/software, the facility manager will be able to take advantage of scheduling for occupied and unoccupied periods based on the actual occupancy of each space in the facility. The DDC system will also aid in the response time to service / maintenance issues when the facility is not under normal maintenance supervision, i.e. after-hours.

Originally, the Building Management System (BMS) system in most of the schools were utilizing a pneumatic control system, over the intervening years, the BMS was converted to various iterations of a hybrid between a previously installed pneumatic system with a legacy Direct Digital Control (DDC) system overlaid. Additional renovations subsequently converted most of the building eventually to stand-alone proprietary DDC controls. The existing direct digital control systems installed are utilizing proprietary based programming that is severely limited in its capabilities to provide the functionality required by the facility's operational personnel. Due to the incapability of the various manufacturers to interact with one another, a Unified open protocol system utilizing the Niagara platform communicating with a BACnet protocol is an ideal solution for the existing situation. The new web-based workstations can be located to any net-accessible location for connection to the BMS with the correct credentials.

The central plant of each building consists of all heating and/or cooling equipment and associated pumps and typically represents the largest energy consumption used in the course of conditioning the building. Therefore, the central plant has the greatest potential for energy savings through upgraded building automation controls.

The primary air handlers represent the second largest energy consumer of a buildings' heating and cooling equipment. Older DDC controls on the primary air handler units do not easily allow for some of the advanced energy conservation strategies that are possible with new DDC controls like Demand control ventilation and centralized synchronizing scheduling. Significant energy savings at the air handlers and tighter control over supply air temperature will result in increased occupant comfort.

Existing unit ventilators and other terminal units typically have sensors and controls that allow for limited setback and control capabilities. In each space, a new DDC sensor/thermostat as required, will be installed and tied to the facility Building Automation System (BAS) in order to provide control to the individual terminal unit. With the new controls, each space can be controlled individually which will allow for very detailed scheduling and control. The level of control available at each terminal unit will eliminate the energy wasted to condition outdoor air and reduce the energy needed to maintain the indoor temperature during unoccupied hours.

Facilities Recommended for this Measure

All Facilities

Scope of Work

Below is the scope for each building on a point-by-point basis,

Where N=New Point, E=Existing Point, SAT = Supply Air Temperature, MAT = Make-up Air Temperature, RAT = Return Air Temperature, SS = Start/Stop, OA = Outside Air, RA = Return Air, LPS = Low-Pressure Steam, HW = Hot water, DP = Differential Pressure, HWS/HWR = Hot Water Supply/Return, ATC = Automatic Temperature Control, EMT = Electrical metallic tubing, MER = Mechanical Equipment Room, RTU = Roof-top Units, AHU = Air-Handling Unit.

Common items (otherwise noted in specific scopes)

- Performance functionality and sequencing testing of devices which are to remain, including enclosures, control valves, transformers, relays, sensors wiring, etc…
- Provide detailed report of any non-operable device to ESG for remediation consideration.
- Web-Based Open Source/Open System Building Network Communication bus (BACnet) to each DDC controller, plenum rated.
- The School District to provide TCP/IP drop at each System Network Controller to their WAN system.
- (1) Operator Workstation with Web-based Graphics
- (1) Central Dashboard Display of Buildings Historical and Current Utility Demands.
- Hallway and Stairwell Fintube Radiation Coils to be Self-Contained Valves (SCV), with locking bezels in public areas.
- Utility meters provided by others, or existing.
- Installation of control valves, as required, for new Unit Ventilator and Fintube radiation
- Repair/ replacement of relays, current switches, low limit switches, valves, duct air sensors, damper actuators and thermostat guards as required
- Exhaust Fans - Start/Stop Control & Status monitoring
- Institute Energy Reduction Strategies, including but not limited to:
    - Demand Control Ventilation (DCV)
    - Centralized Synchronized Scheduling
- Equipment not within DDC control:
- Cabinet Unit Heaters (Local control)
- Kitchen Makeup Air Units (Local Control)
- TCU Buildings (Local Control)
- Domestic Hot Water (Local Control)

- Emergency Generators, including fuel oil systems (Local Control)
- Building Sumps (Local Control)
- Lighting Controls (FBO)
- Window AC Unit Controls (FBO)

District-wide Building Management System

- Provide modification of the existing BMS Archival Data Server
- Expansion of the District's Centralized Alarming
- Expansion of the District's Centralized Trending
- Expansion of the District's Scheduling
- Expansion of the District Wide BMS Analytics Software
- Expansion of Energy Usage Collection and archiving from the district's schools,

Academy of Earth and Space Sciences (Panther)

A. Supervisory Network Controller:

- Provide a new (1) Honeywell Niagara 4 (WEBs) JACE w/enclosure. Migrate existing network communication wiring to the new Honeywell Niagara 4 (WEBs) JACE controller.
- Provide LON driver, if required for integration of 3rd party devices.

B. Hot Water Boiler control:

- Provide a new Honeywell Niagara 4 (WEBs) DDC controller.
- Existing Tekmar controller to remain.
- Migrate the existing device wiring which are capable of reuse (i.e. relays, current switches, actuators, transducers) to the new Honeywell Niagara 4 (WEBs) DDC controller.
- Retro-commission the existing devices which are capable of reuse (i.e. relays, current switches, actuators, transducers).
- Provide new system compatible temperature sensors, if required.

C. Hot Water Pump control:

- Migrate the existing control device wiring to the new Honeywell Niagara 4 (WEBs) DDC controller.
- Retro-commission the existing devices which are capable of reuse (i.e. relays, current switches, actuators, transducers).

D. Hot Water System Pressure control:

- Migrate the existing pressure bypass control valve and pressure transducer wiring to the new Honeywell Niagara 4 (WEBs) DDC controller.
- Retro-commission the existing devices which are capable of reuse (i.e. relays, current switches, actuators, transducers).

E. Domestic Hot Water Heater:

- No Control work involved in scope.

F. Building Utility Meter monitoring:

- Provide monitoring of the (2) utility meters through the BMS by a simple pulse or standard signal connection.
  a. LPLS 9205120
  b. LVG 3165500
- Utility meters provided by others.

G. (3) AC Unit Controls (AC-1, AC-2, AC-3):

- Provide (3) new Honeywell Niagara 4 (WEBs) DDC controllers.
- Migrate existing device wiring to the new Honeywell Niagara 4 (WEBs) DDC controller.
- Retro-commission the existing devices which are capable of reuse (i.e. relays, current switches, actuators, transducers).
- Provide new system compatible temperature sensors.
- Provide new communications network wiring, if required.

H. (3) Variable Air Volume Box control (1st Floor, 2nd Floor, and 3rd Floor):

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC VAV controllers.
- Migrate existing device wiring to the new Honeywell Niagara 4 (WEBs) DDC controller.
- Retro-commission the existing devices which are capable of reuse (i.e. relays, current switches, actuators, transducers).
- Provide new system compatible temperature sensors.

I. 1st Floor, 2nd Floor, and 3rd Floor Duct Bypass Damper control:

- Provide (3) new Honeywell Niagara 4 (WEBs) DDC controllers.
- Migrate existing device wiring to the new Honeywell Niagara 4 (WEBs) DDC controller.
- Retro-commission the existing devices which are capable of reuse (i.e. relays, current switches, actuators, transducers).
- Provide new communications network wiring, if required.

Dale Avenue School

A. (1) Supervisory Network Controller:

- Provide (1) new Honeywell Niagara 4 (WEBs) JACE.
- Migrate existing communication wiring to the new Honeywell Niagara 4 (WEBs) JACE controller.

B. (1) Low Pressure Steam Boiler control:

- Provide a (1) new Honeywell Niagara 4 (WEBs) DDC controller.

- Provide enabling control of the (2) new LPS boilers, including a steam pressure sensor. Boiler staging, flue gas, condensate and feed tank controls provided by mechanical contractor.
- Retro-commission the existing devices which are capable of reuse (i.e. relays, current switches, actuators, transducers).
- Provide new system compatible temperature sensors, if required.
- Existing Boiler-Matic 2000 controller to remain.

C. (1) Chilled Water System control:

- Provide a (1) new Honeywell Niagara 4 (WEBs) DDC controller.
- Migrate existing device wiring to the new Honeywell Niagara 4 (WEBs) DDC controller.
- Retro-commission the existing devices which are capable of reuse (i.e. relays, current switches, actuators, transducers).
- Provide new system compatible temperature sensors, if required.

D. (3) Chilled Water Pump control (Primary, Secondary and Standby):

- Migrate the existing control device wiring to the new Honeywell Niagara 4 (WEBs) DDC controller.
- Retro-commission the existing devices which are capable of reuse (i.e. relays, current switches, actuators, transducers).

E. (1) Chilled Water System Pressure control:

- Migrate the existing pressure bypass control valve and pressure transducer wiring to the new Honeywell Niagara 4 (WEBs) DDC controller.
- Retro-commission the existing devices which are capable of reuse (i.e. relays, current switches, actuators, transducers).

F. (1) Glycol Management System monitoring:

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC controller with new monitoring points for Calmac panel warnings and alarms into the BMS.

G. (1) Air Handling Unit - 1 / Exhaust Fan – 2 control (1st/2nd Floor Halls and Rooms)

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC controller.
- 2. Migrate existing device wiring to the new Honeywell Niagara 4 (WEBs) DDC controller.
- 3. Retro-commission the existing devices which are capable of reuse (i.e. relays, current switches, actuators, transducers).
- 4. Provide new control valves and actuators for Heating Control valve and Cooling control valves.
- 5. Provide new actuators for control dampers.
- 6. Provide new system compatible temperature sensors, if required.

H. (1) Air Handling Unit - 2 / Exhaust Fan – 1 control (Gymnasium):

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC controller.
- Migrate existing device wiring to the new Honeywell Niagara 4 (WEBs) DDC controller.
- Retro-commission the existing devices which are capable of reuse (i.e. relays, current switches, actuators, transducers).
- Provide new control valves and actuators for Heating Control valve and Cooling control valves.
- Provide new actuators for control dampers.
- Provide Demand Control Ventilation sequences and devices.
- Provide new system compatible temperature sensors, if required.

I. (2) AC-1/ACCU-1 and AC-2/ACCU-2 (Cafeteria):

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC Thermostat controller.
- Migrate existing device wiring.
- Retro-commission the existing devices which are capable of reuse (i.e. relays, current switches, actuators, transducers).
- Provide new communications network wiring.

J. (4) Building Utility Meter monitoring:

- Provide monitoring of the utility meters through the BMS by a simple pulse or standard signal connection.
  a. LPLS 9215027
  b. GLP 9214067
  c. LVG 2597859
  d. GSG 3216656
- Utility meters provided by others.

Early Learning Center

A. (1) Supervisory Network Controller:

- Provide (1) new Honeywell Niagara 4 (WEBs) JACE w/enclosure.
- Migrate existing network communication wiring to the new Honeywell Niagara 4 (WEBs) JACE controller.

B. (1) Hot Water Boiler control:

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC controller w/enclosure
- The existing Hydrotherm controller is to remain.
- Migrate the existing device wiring which are capable of reuse (i.e. relays, current switches, actuators, transducers) to the new Honeywell Niagara 4 (WEBs) DDC controller.
- Provide new system compatible space temperature sensors, if required.
- Provide new communications network wiring.

C. (3) Hot Water Pump control:

- Migrate the existing control device wiring to the new Honeywell Niagara 4 (WEBs) DDC controller.
- Retro-commission the existing devices which are capable of reuse (i.e. relays, current switches, actuators, transducers).

D. Domestic Hot Water Heater:

- No Control work involved in Scope.

E. (2) Building Utility Meter monitoring:

- Provide monitoring of the utility meters through the BMS by a simple pulse or standard signal connection.
  a. GLP 678001063
  b. LVG 2413558
- Utility meters provided by others.

Eastside High School

A. (1) Supervisory Network Controller:

- Provide (3) new Honeywell Niagara 4 (WEBs) JACE(s) w/enclosure.
- Migrate existing network communication wiring.
- Provide new communications network wiring, if required.

B. (1) Hot Water Boilers (MER # 1 New Wing)

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC controller.
- The existing Aerco controller to remain.
- Migrate the existing device wiring which are capable of reuse (i.e. relays, current switches, actuators, transducers) to the new Honeywell Niagara 4 (WEBs) DDC controller.
- Retro-commission the existing devices which are capable of reuse (i.e. relays, current switches, actuators, transducers).
- Provide new system compatible temperature sensors, if required.

C. (2) Hot Water Pump Control (MER # 1 VFD):

- Migrate the existing device wiring which are capable of reuse (i.e. relays, current switches, actuators, transducers) to the new Honeywell Niagara 4 (WEBs) DDC controller.
- Retro-commission the existing devices which are capable of reuse (i.e. relays, current switches, actuators, transducers).

D. (1) Hot Water Boiler control (MER # 2 Old Boiler Room)

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC controller.
- The existing Aerco boiler controller to remain.
- Migrate the existing control device wiring to the new Honeywell Niagara 4 (WEBs) DDC controller.

- Retro-commission the existing devices which are capable of reuse (i.e. relays, current switches, actuators, transducers).
- Provide new system compatible space temperature sensors, if required.

E. (2) Hot Water Pump control (MER # 2 MS to VFD):

- Provide new start/stop control and status for the Hot Water Pump VFD
- Provide speed control of (2) new Hot Water Pump VFD(s)
- Provide (2) new differential pressure sensor (mechanical installation by others)
- Provide new integration of the Hot Water Pump VFD via communications.

F. (1) Chilled Water System control (MER #3 Old Chiller Room) (N.I.S.):

- The Chilled Water and Condenser Water systems are defunct:
- Controls are not within this Scope of Work.

G. (5) Hot Water Pump control (MER – Roof Penthouse):

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC controllers.
- Migrate existing device wiring to the new Honeywell Niagara 4 (WEBs) DDC controller.
- Retro-commission the existing control devices on the unit (i.e. relays, current switches, actuators, transducers).
- Provide new control valve actuator.
- Provide new system compatible space temperature sensors, if required.
- Provide new communications network wiring.

H. (4) Building Utility Meter Monitoring:

- Provide monitoring of the utility meters through the BMS by a simple pulse or standard signal connection.
    a. LPLS 9217758
    b. GLP 678001063
    c. LVG 2209040
    d. LVG 3274091
- Utility meters provided by others.

Edward Kilpatrick

A. (1) Supervisory Network Controller:

- Provide a new Honeywell Niagara 4 (WEBs) JACE w/enclosure.
- Migrate existing network communication wiring to the new Honeywell Niagara 4 (WEBs) JACE controller.

B. (2) New Hot Water Boiler control:

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC controller w/enclosure

- Provide control of (2) new Hot Water boilers, wiring of BCP panel and associated devices.
- Provide new system compatible space temperature sensors, if required.
- Provide new communications network wiring.

C. (2) Hot Water Pump control:

- Migrate the existing control device wiring to the new Honeywell Niagara 4 (WEBs) DDC controller.
- Retro-commission the existing devices which are capable of reuse (i.e. relays, current switches, actuators, transducers).

D. (1) Roof Top Unit control (Main Office):

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC thermostat controller.
- Migrate existing device wiring to the new Honeywell Niagara 4 (WEBs) DDC controller.
- Retro-commission the existing control devices on the unit (i.e. relays, current switches, actuators, transducers).
- Provide new system compatible space temperature sensors, if required.
- Provide new communications network wiring, if required.

E. (2) Building Utility Meter Monitoring:

- Provide monitoring of the utility meters through the BMS by a simple pulse or standard signal connection.
    a. LPLS 9211649
    b. LVG 2124598
- Utility meters provided by others.

John F. Kennedy High School

A. (1) Supervisory Network Controller:

- Provide (1) new Honeywell Niagara 4 (WEBs) JACE w/enclosure.
- Migrate existing network communication wiring to the new Honeywell Niagara 4 (WEBs) JACE controller.

B. (1) Low Pressure Steam Boiler control MER # 1

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC controller.
- Migrate the existing device wiring which are capable of reuse (i.e. relays, current switches, actuators, transducers) to the new Honeywell Niagara 4 (WEBs) DDC controller.
- Retro-commission the existing devices which are capable of reuse (i.e. relays, current switches, actuators, transducers).
- Provide new control valve actuators, as required. Control valves to remain.
- Integrate new boiler via communications, as applicable

C. Domestic Hot Water Heater:

- No Control work involved in Scope.

D. (4) Air Handling Unit control (Gymnasium)

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC Thermostat controller.
- Migrate existing device wiring to the new Honeywell Niagara 4 (WEBs) DDC controller.
- Retro-commission the existing devices which are capable of reuse (i.e. relays, current switches, actuators, transducers).
- Provide new system compatible space temperature sensors.
- Provide a new communications network bus, if required.

E. (2) Air Handling Unit control (Boys/Girls Locker Rooms)

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC Thermostat controller.
- Migrate existing device wiring to the new Honeywell Niagara 4 (WEBs) DDC controller.
- Retro-commission the existing devices which are capable of reuse (i.e. relays, current switches, actuators, transducers).
- Provide new system compatible space temperature sensors.
- Provide a new communications network bus, if required.

F. (2) Air Handling Unit control (Print Shop/Band Room)

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC Thermostat controller.
- Migrate existing device wiring to the new Honeywell Niagara 4 (WEBs) DDC controller.
- Retro-commission the existing devices which are capable of reuse (i.e. relays, current switches, actuators, transducers).
- Provide new system compatible space temperature sensors.
- Provide a new communications network bus, if required.

G. (3) Roof Top Unit control ((2) TV Studio/ (1) Auditorium)

- Provide integration of (3) new Split AC Units
- Provide a new communications network bus, if required.

H. (5) Building Utility Meter Monitoring:

- Provide monitoring of the utility meters through the BMS by a simple pulse or standard signal connection.
    a. LPLP 9213772
    b. GLP 728011171
    c. LVG 2908720
    d. LVG 2808430
    e. LVG 2917093
- Utility meters provided by others.

New International High School

A. (1) Supervisory Network Controller:

- Provide a new Honeywell Niagara 4 (WEBs) JACE w/enclosure.
- Migrate existing network communication wiring to the new Honeywell Niagara 4 (WEBs) JACE controller.

B. (1) Hot Water System

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC controller.
- The existing Aerco controller to remain.
- Migrate the existing device wiring which are capable of reuse (i.e. relays, current switches, actuators, transducers) to the new Honeywell Niagara 4 (WEBs) DDC controller.
- Retro-commission the existing devices which are capable of reuse (i.e. relays, current switches, actuators, transducers).
- Provide new system compatible temperature sensors, if required.
- Hot Water Boiler Isolation Valves (Installation by others)

C. (2) Hot Water Pump Control (MS - VFD):

- Provide new start/stop control and status for the Hot Water Pump VFD
- Provide speed control of (2) new Hot Water Pump VFD(s)
- Provide (2) new differential pressure sensor (mechanical installation by others)
- Provide new integration of the Hot Water Pump VFD via communications.

D. (2) Chilled Water Pump Control (MS - VFD):

- Provide new start/stop control and status for the Chilled Water Pump VFD
- Provide speed control of (2) new Chilled Water Pump VFD(s)
- Provide (2) new differential pressure sensor (mechanical installation by others)
- Provide new integration of the Chilled Water Pump VFD via communications.

E. (2) Building Utility Meter Monitoring:

- Provide monitoring of the utility meters through the BMS by a simple pulse or standard signal connection.
    a. LPLS 9214264
    b. LVG 3166085
- Utility meters provided by others.

F. (5) Energy Recovery Unit control:

- Migrate the existing control device wiring to new Honeywell Niagara 4 (WEBs) DDC controllers.
- Retro-commission the existing devices which are capable of reuse (i.e. relays, current switches, actuators, transducers).

G. (4) Roof Top Unit control:

- Migrate the existing control device wiring to new Honeywell Niagara 4 (WEBs) DDC controllers.
- Provide Demand Control Ventilation sequences and devices.
- Retro-commission the existing devices which are capable of reuse (i.e. relays, current switches, actuators, transducers).

H. (1) Makeup Air Unit control:

- Migrate the existing control device wiring to new Honeywell Niagara 4 (WEBs) DDC controllers.
- Retro-commission the existing devices which are capable of reuse (i.e. relays, current switches, actuators, transducers).

<u>New Roberto Clemente School</u>

A. (1) Supervisory Network Controller:

- Provide a new Honeywell Niagara 4 (WEBs) JACE w/enclosure.
- Migrate existing network communication wiring to the new Honeywell Niagara 4
- (WEBs) JACE controller.

B. (1) Hot Water System

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC controller.
- Migrate the existing device wiring which are capable of reuse (i.e. relays, current switches, actuators, transducers) to the new Honeywell Niagara 4 (WEBs) DDC controller.
- Retro-commission the existing devices which are capable of reuse (i.e. relays, current switches, actuators, transducers). Existing control valves to remain.
- Provide new system compatible temperature sensors, if required.

C. (2) Hot Water Pump Control (MS):

- Migrate the existing device wiring which are capable of reuse (i.e. relays, current switches, actuators, transducers) to the new Honeywell Niagara 4 (WEBs) DDC controller.
- Retro-commission the existing devices which are capable of reuse (i.e. relays, current switches, actuators, transducers). Existing control valves to remain.

D. (1) Chilled and Condenser Water Systems

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC controller.
- Migrate the existing device wiring which are capable of reuse (i.e. relays, current switches, actuators, transducers) to the new Honeywell Niagara 4 (WEBs) DDC controller.
- Retro-commission the existing devices which are capable of reuse (i.e. relays, current switches, actuators, transducers). Existing control valves to remain.
- Provide new system compatible temperature sensors, if required.

E. (4) Chilled and Condenser Water Pump Control (MS - VFD):

- Migrate the existing device wiring which are capable of reuse (i.e. relays, current switches, actuators, transducers) to the new Honeywell Niagara 4 (WEBs) DDC controller.

- Retro-commission the existing devices which are capable of reuse (i.e. relays, current switches, actuators, transducers). Existing control valves to remain.

F. (2) Building Utility Meter Monitoring:

- Provide monitoring of the utility meters through the BMS by a simple pulse or standard signal connection.
  a. LPLS 9217720
  b. LVG 3164198
- Utility meters provided by others.

G. (5) Roof Top Unit control

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC controller.
- Migrate existing device wiring to the new Honeywell Niagara 4 (WEBs) DDC controller.
- Retro-commission the existing control devices on the unit (i.e. relays, current switches, actuators, transducers). Existing valves to remain.
- Provide Demand Control Ventilation sequences and devices (Gym/Café Only)
- Provide new system compatible space temperature sensors, if required.
- Provide new communications network wiring, if required.

New Robert Clemente K-Center

A. (1) Supervisory Network Controller:

- Provide a new Honeywell Niagara 4 (WEBs) JACE w/enclosure.
- Migrate existing network communication wiring to the new Honeywell Niagara 4 (WEBs) JACE controller.

B. (2) Building Utility Meter Monitoring:

- Provide monitoring of the utility meters through the BMS by a simple pulse or standard signal connection.
  a. GLP 9196678
  b. GSG 3568098
- Utility meters provided by others.

C. (5) Roof Top Unit control

- Provide (1) new Honeywell Niagara 4 (WEBs) Thermostat DDC controller.
- Migrate existing device wiring.
- Retro-commission the existing control devices on the unit (i.e. relays, current switches, actuators, transducers).
- Provide Demand Control Ventilation sequences and devices (Gym/Café Only)
- Provide new system compatible space temperature sensors, if required.
- Provide new communications network wiring, if required.

Norman S. Weir School

A. Supervisory Network Controller:

- Provide a new Honeywell Niagara 4 (WEBs) JACE w/enclosure.
- Provide new network communication wiring to the new Honeywell Niagara 4 (WEBs) JACE controller.

B. (2) Building Utility Meter Monitoring:

- Provide monitoring of the utility meters through the BMS by a simple pulse or standard signal connection.
  a. LPLS 9206962
  b. LVG 2808618
- Utility meters provided by others.

C. (1) Pool Heating Hot Water System

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC controller.
- New device wiring and device (i.e. relays, current switches, actuators, transducers) and temperature sensors to the new Honeywell Niagara 4 (WEBs) DDC controller.
- All existing control valves to remain.

D. (2) Building Heating and Ventilating Unit control (Hallways)

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC controller.
- Provide new device wiring to the new Honeywell Niagara 4 (WEBs) DDC controller (i.e. relays, current switches, actuators, transducers).
- Provide Demand Control Ventilation sequences and devices (Gym/Café Only)
- Provide new system compatible space temperature sensors.

E. (1) Pool Filter System

- No Control work in this Scope.

F. (1) Pool Heating and Ventilating Unit control

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC controller.
- Provide new device wiring to the new Honeywell Niagara 4 (WEBs) DDC controller (i.e. relays, current switches, actuators, transducers).
- Provide new system compatible space temperature sensors.

Martin Luther King School

A. Supervisory Network Controller:

- Provide a new Honeywell Niagara 4 (WEBs) JACE w/enclosure.
- Migrate existing network communication wiring to the new Honeywell Niagara 4 (WEBs) JACE controller.

B. (1) Hot Water System

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC controller.
- Provide BACnet integration to the (4) new Hot Water Boilers.
- Retro-commission and Migrate the existing device wiring which are capable of reuse to the new Honeywell Niagara 4 (WEBs) DDC controller.
- Provide new system compatible temperature sensors, if required.

C. (2) Hot Water Pump Control (MS - VFD):

- Provide new start/stop control and status for the Hot Water Pump VFD
- Provide speed control of (2) new Hot Water Pump VFD(s)
- Provide (2) new differential pressure sensor (mechanical installation by others)

D. (3) Building Utility Meter Monitoring:

- Provide monitoring of the utility meters through the BMS by a simple pulse or standard signal connection.
  a. LPLS 9204952/9217765
  b. LVG 2917458
  c. LVG 2600314
- Utility meters provided by others.

E. (11) Classroom Roof Top Unit control

- Provide (1) new Honeywell Niagara 4 (WEBs) Thermostat DDC controller.
- Provide new system compatible space temperature sensors, if required.
- Provide new communications network wiring, if required.

F. (2) Gymnasium Roof Top Unit control

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC controller.
- Migrate existing device wiring.
- Retro-commission the existing control devices on the unit (i.e. relays, current switches, actuators, transducers).
- Provide new DDC Hot Water control valves and actuators.
- Provide Demand Control Ventilation sequences and devices.
- Provide new system compatible space temperature sensors, if required.
- Provide new communications network wiring, if required.

G. (2) HVAC Unit control

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC controller.
- Migrate existing device wiring.
- Retro-commission the existing control devices on the unit (i.e. relays, current switches, actuators, transducers).Existing control valves to remain.
- Provide Demand Control Ventilation sequences and devices.
- Provide new system compatible space temperature sensors, if required.

- Provide new communications network wiring, if required.

Old Roberto Clemente Elementary School

A. Supervisory Network Controller:

- Provide a new Honeywell Niagara 4 (WEBs) JACE w/enclosure.
- Migrate existing network communication wiring to the new Honeywell Niagara 4
- (WEBs) JACE controller.

B. (1) Building Utility Meter Monitoring:

- Provide monitoring of the utility meters through the BMS by a simple pulse or standard signal connection.
  a. LPLS 9211650
- Utility meters provided by others.

C. (1) Chiller/Air Cooled Condenser Systems

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC controller.
- Migrate the existing device wiring which are capable of reuse (i.e. relays, current switches, actuators, transducers) to the new Honeywell Niagara 4 (WEBs) DDC controller.
- Retro-commission the existing devices which are capable of reuse (i.e. relays, current switches, actuators, transducers). Existing control valves to remain.
- Provide new system compatible temperature sensors, if required.

D. (2) Pump Control (MS - VFD):

- Provide new start/stop control and status for the Pump VFD

E. (1) Air Handling Unit control

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC controller.
- Migrate existing device wiring.
- Retro-commission the existing control devices on the unit (i.e. relays, current switches, actuators, transducers).Existing control valves to remain.
- Provide new damper actuators
- Provide Demand Control Ventilation sequences and devices.
- Provide new system compatible space temperature sensors, if required.
- Provide new communications network wiring, if required.

Rosa Parks Elementary School

A. (1) Supervisory Network Controller:

- Provide a new Honeywell Niagara 4 (WEBs) JACE w/enclosure.
- Migrate existing network communication wiring to the new Honeywell Niagara 4
- (WEBs) JACE controller.

B. (2) Building Utility Meter Monitoring:

- Provide monitoring of the utility meters through the BMS though a simple pulse or standard signal connection. Utility meters provided by others.
  a. LPLS 9205118
  b. LVG 3163775

C. (1) Domestic Hot Water Heater:

- No Control work involved in Scope.

D. (6) Classroom Roof Top Unit control

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC controller.
- Migrate existing device wiring.
- Retro-commission the existing control devices on the unit (i.e. relays, current switches, actuators, transducers).
- Provide Demand Control Ventilation sequences and devices.
- Provide new system compatible space temperature sensors, if required.
- Provide new communications network wiring, if required.

E. (5) Cafeteria/Auditorium Roof Top Unit control

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC controller.
- Migrate existing device wiring.
- Retro-commission the existing control devices on the unit (i.e. relays, current switches, actuators, transducers).
- Provide Demand Control Ventilation sequences and devices.
- Provide new system compatible space temperature sensors, if required.
- Provide new communications network wiring, if required.

F. (1) Makeup Air Unit control

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC thermostat controller.
- Migrate existing device wiring.
- Retro-commission the existing control devices on the unit (i.e. relays, current switches, actuators, transducers).
- Provide new system compatible space temperature sensors.

<u>Rutland Early Childhood Learning Center</u>

A. (1) Supervisory Network Controller:

- Provide a new Honeywell Niagara 4 (WEBs) JACE w/enclosure.
- Migrate existing network communication wiring to the new Honeywell Niagara 4
- (WEBs) JACE controller.

B. (2) Building Utility Meter Monitoring:

- Provide monitoring of the utility meters through the BMS by a simple pulse or standard signal connection. Utility meters provided by others.
  a. GPL 728002774
  b. GSG 2123674

C. (5) Roof Top Unit control

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC controller.
- Provide new device wiring to the new Honeywell Niagara 4 (WEBs) DDC controller (i.e. relays, current switches, actuators, transducers).
- Provide new system compatible space temperature sensors.
- Provide new communications network wiring, if required.

<u>School #12</u>

A. (1) Supervisory Network Controller:

- Provide a new Honeywell Niagara 4 (WEBs) JACE w/enclosure.
- Migrate existing network communication wiring to the new Honeywell Niagara 4
- (WEBs) JACE controller.

B. (1) Heating Plant Boiler control

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC controller.
- Provide control of (2) new Steam boilers, wiring of associated low voltage devices.
- Provide new system compatible space temperature sensors, if required.
- Provide new communications network wiring.

C. (1) Heat Exchanger control

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC controller.
- Migrate the existing device wiring which are capable of reuse (i.e. relays, current switches, actuators, transducers) to the new Honeywell Niagara 4 (WEBs) DDC controller.
- Retro-commission the existing devices which are capable of reuse (i.e. relays, current switches, actuators, transducers).
- Provide new control valve actuators, as required. Control valves to remain.
- Provide new system compatible space temperature sensors, if required.

D. (2) Hot Water Pump Control (MS - VFD):

- Provide new start/stop control and status for the Hot Water Pump VFD
- Provide speed control of (2) new Hot Water Pump VFD(s)
- Provide (2) new differential pressure sensor (mechanical installation by others)

D. (2) Building Utility Meter Monitoring:

- Provide monitoring of the utility meters through the BMS by a simple pulse or standard signal connection. Utility meters provided by others.
  a. LPLS 9214613
  b. LVG 2124575

School #13

A. (1) Supervisory Network Controller:

- Provide a new Honeywell Niagara 4 (WEBs) JACE w/enclosure.
- Migrate existing network communication wiring to the new Honeywell Niagara 4 (WEBs) JACE controller.

B. (1) Heating Plant Boiler control

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC controller.
- Provide control of (2) new Steam boilers, wiring of associated low voltage devices.
- Provide new system compatible space temperature sensors, if required.
- Provide new communications network wiring.

C. (2) Building Utility Meter Monitoring:

- Provide monitoring of the utility meters through the BMS by a simple pulse or standard signal connection. Utility meters provided by others.
  a. LPLS 8205117
  b. LVG 2523061

D. (2) Gymnasium/Auditorium Air Handling Unit control

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC controller.
- Provide new device wiring to the new Honeywell Niagara 4 (WEBs) DDC controller (i.e. relays, current switches, actuators, transducers).
- Provide Demand Control Ventilation sequences and devices.
- Provide new system compatible space temperature sensors.
- Provide new communications network wiring, if required.

E. (11) Classroom Roof Top Unit control

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC controller.
- Provide new device wiring to the new Honeywell Niagara 4 (WEBs) DDC controller (i.e. relays, current switches, actuators, transducers).
- Provide new system compatible space temperature sensors.
- Provide new communications network wiring, if required.

School #17

A. (1) Supervisory Network Controller:

- Provide a new Honeywell Niagara 4 (WEBs) JACE w/enclosure.

- Migrate existing network communication wiring to the new Honeywell Niagara 4
- (WEBs) JACE controller.

B. (1) Heating Plant Boiler control

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC controller.
- Provide control of (2) new Steam boilers, wiring of associated low voltage devices.
- Provide new system compatible space temperature sensors, if required.
- Provide new communications network wiring.

C. (2) Building Utility Meter Monitoring:

- Provide monitoring of the utility meters through the BMS by a simple pulse or standard signal connection. Utility meters provided by others.
  a. GLP 5316465
  b. LVG 2643349

D. Domestic Hot Water Heater:

- No Control work involved in Scope.

School #18

A. (1) Supervisory Network Controller:

- Provide a new Honeywell Niagara 4 (WEBs) JACE w/enclosure.
- Migrate existing network communication wiring to the new Honeywell Niagara 4
- (WEBs) JACE controller.

B. (1) Hot Water System

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC controller.
- Provide control of (2) new Hot Water boilers, wiring of associated low voltage devices.
- Provide new system compatible space temperature sensors, if required.
- Provide new communications network wiring.

C. (10) Hot Water Pump Control (MS):

- Provide new start/stop control and status for the Hot Water Pump

D. (3) Building Utility Meter Monitoring:

- Provide monitoring of the utility meters through the BMS by a simple pulse or standard signal connection. Utility meters provided by others.
  a. LPLS 9204967
  b. GLP 638000686
  c. LVG 2600283

E. (2) Gymnasium/Auditorium Roof Top Unit control

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC controller.
- Provide new device wiring to the new Honeywell Niagara 4 (WEBs) DDC controller (i.e. relays, current switches, actuators, transducers).
- Provide Demand Control Ventilation sequences and devices.
- Provide new system compatible space temperature sensors.
- Provide new communications network wiring, if required.

School #28

A. Supervisory Network Controller:

- Provide a new Honeywell Niagara 4 (WEBs) JACE w/enclosure.
- Migrate existing network communication wiring to the new Honeywell Niagara 4 (WEBs) JACE controller.

B. (1) New Hot Water Boiler control:

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC controller w/enclosure
- Provide control of (2) new Hot Water boilers, wiring of associated low voltage devices.
- Provide new system compatible space temperature sensors, if required.
- Provide new communications network wiring.

C. (2) Hot Water Pump Control (MS - VFD):

- Provide new start/stop control and status for the Hot Water Pump VFD
- Provide speed control of (2) new Hot Water Pump VFD(s)
- Provide new differential pressure sensor (mechanical installation by others)

D. (2) Building Utility Meter Monitoring:

- Provide monitoring of the utility meters through the BMS by a simple pulse or standard signal connection. Utility meters provided by others.
  a. LPLS 9205276
  b. LVG 2809396

E. Domestic Hot Water Heater:

- No Control work involved in Scope.

F. (1) Gymnasium Air Handling Unit control:

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC thermostat controller.
- Migrate existing device wiring to the new Honeywell Niagara 4 (WEBs) DDC controller.
- Provide new control devices on the unit (i.e. relays, current switches, actuators, transducers).
- Provide new control damper actuators.
- Provide new control valve and actuators.
- Provide Demand Control Ventilation sequences and devices.
- Provide new system compatible space temperature sensors, if required.

- Provide new communications network wiring, if required.

G. (1) Auditorium Air Handling Unit control:

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC thermostat controller.
- Migrate existing device wiring to the new Honeywell Niagara 4 (WEBs) DDC controller.
- Provide new control devices on the unit (i.e. relays, current switches, actuators, transducers).
- Provide new control damper actuators.
- Provide new control valve and actuators.
- Provide Demand Control Ventilation sequences and devices.
- Provide new system compatible space temperature sensors, if required.
- Provide new communications network wiring, if required.

H. (2) Cafeteria Air Handling Unit control:

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC controller.
- Migrate existing device wiring to the new Honeywell Niagara 4 (WEBs) DDC controller.
- Provide new control devices on the unit (i.e. relays, current switches, actuators, transducers).
- Provide new control valve and actuators.
- Provide new control damper actuators.
- Provide Demand Control Ventilation sequences and devices.
- Provide new system compatible space temperature sensors, if required.
- Provide new communications network wiring, if required.

School #6

A. Supervisory Network Controller:

- Provide a new Honeywell Niagara 4 (WEBs) JACE w/enclosure.
- Migrate existing network communication wiring to the new Honeywell Niagara 4 WEBs) JACE controller.

B. (1) Hot Water Boiler control:

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC controller w/enclosure
- Provide control of (2) Hot Water boilers, wiring of associated low voltage devices.
- Provide new system compatible space temperature sensors, if required.
- Provide new communications network wiring.

C. (2) Hot Water Pump Control (MS - VFD):

- Provide new start/stop control and status for the Hot Water Pump VFD
- Provide speed control of (2) new Hot Water Pump VFD(s)
- Provide new differential pressure sensor (mechanical installation by others)

D. (2) Building Utility Meter Monitoring:

- Provide monitoring of the utility meters through the BMS by a simple pulse or standard signal connection. Utility meters provided by others.
  a. LPLS 9204757
  b. LVG 2808980

E. (5) Heating & Ventilating Unit control:

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC controller.
- Migrate existing device wiring to the new Honeywell Niagara 4 (WEBs) DDC controller.
- Provide new control devices on the unit (i.e. relays, current switches, actuators, transducers).
- Provide new control valve and actuators.
- Provide new control damper actuators.
- Provide Demand Control Ventilation sequences and devices.
- Provide new system compatible space temperature sensors, if required.
- Provide new communications network wiring, if required.

F. Domestic Hot Water Heater:

- No Control work involved in Scope.

School #7

A. (1) Supervisory Network Controller:

- Provide a new Honeywell Niagara 4 (WEBs) JACE w/enclosure.
- Migrate existing network communication wiring to the new Honeywell Niagara 4 (WEBs) JACE controller.

B. (1) Steam Heating System

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC controller.
- Migrate the existing device wiring which are capable of reuse (i.e. relays, current switches, actuators, transducers) to the new Honeywell Niagara 4 (WEBs) DDC controller.
- Retro-commission the existing devices which are capable of reuse (i.e. relays, current switches, actuators, transducers). Existing control valves to remain.
- Provide new system compatible temperature sensors, if required.

C. (2) Building Utility Meter Monitoring:

- Provide monitoring of the utility meters through the BMS by a simple pulse or standard signal connection. Utility meters provided by others.
  a. GLP 278000728
  b. LVG 2679397

Silk City 2000 Academy

A. (1) Supervisory Network Controller:

- Provide a new Honeywell Niagara 4 (WEBs) JACE w/enclosure.

- Migrate existing network communication wiring to the new Honeywell Niagara 4 (WEBs) JACE controller.

B. (1) New Boiler control:

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC controller w/enclosure
- Provide control of boiler, wiring of associated low voltage devices.
- Provide new system compatible space temperature sensors, if required.
- Provide new communications network wiring.

C. (2) Building Utility Meter Monitoring:

- Provide monitoring of the utility meters through the BMS by a simple pulse or standard signal connection. Utility meters provided by others.
  a. GLP 678004190
  b. LVG 3861610

D. (1) Domestic Hot Water Heater:

- No Control work involved in Scope.

E. (3) Roof Top Unit control

- Provide (1) new Honeywell Niagara 4 (WEBs) Thermostat DDC controller.
- Migrate existing device wiring.
- Retro-commission the existing control devices on the unit (i.e. relays, current switches, actuators, transducers).
- Provide new system compatible space temperature sensors, if required.
- Provide new communications network wiring, if required.

F. (3) Air Handling Unit Ventilator control

- Provide (1) new Honeywell Niagara 4 (WEBs) DDC controller.
- Provide new device wiring to the new Honeywell Niagara 4 (WEBs) DDC controller (i.e. relays, current switches, actuators, transducers). Existing control valves to remain.
- Provide new DDC damper actuator
- Provide new system compatible space temperature sensors.

Savings Methodology

See savings calculations provided in Appendix.

Maintenance

Update software as needed.

Benefits

- Electrical energy savings
- Natural gas savings

- Continuous monitoring and HVAC scheduling
- Maintaining occupancy comfort levels
- Reduce operational cost

06-05 Data Analytics

ECM Summary

1.0 The purpose of the analytic software application is to analyze data produced by energy and equipment systems in order to identify faults, trends, anomalies and opportunities for improved performance and reduced energy use in the operation of building equipment systems.

2.0 The analytics software application shall provide the following features and capabilities as a minimum:

2.1.1 **Operating Systems:** The analytic software application shall operate on current versions of Microsoft Windows, Linux and Apple OSX operating systems.

2.1.2 **Time series database:** The analytic software application shall utilize a database technology designed for the efficient storage and analysis of large volumes of time series data. Time stamps shall support millisecond resolution. The software shall not employ a relational database structure but shall instead use tagging to model and describe data and shall support the use of the open source data modeling/tagging standards developed by Project-Haystack: http://project-haystack.org/. In addition to supporting all Project-Haystack tags, it shall be possible to create custom tags as needed.

2.1.3 **Data Access Connectors:** The analytic software application shall have the ability to accept and normalize data from a variety of sources via connectors for Bacnet IP, oBix Modbus TCP, Sedona, OPC, MQTT and the web services protocol defined by Project-Haystack.org. It shall also support data access via SQL compatible databases, CSV format files, XML format files, web services, JSON, and other EDI techniques. Once data has been imported, the software shall provide a unified data format to enable analytics algorithms to identify patterns across the different data sets independent of original format.

2.1.4 **Open interfaces for Application Integration:** The analytic software application shall provide open, REST-based API's to enable integration with third party software applications. The open APIs shall enable data to be entered/imported into the database, exported from the database, posting of analytic queries from external applications and output of analytic results to external applications, and integration with third party software applications such as maintenance management and work order processing. APIs shall be fully documented and available as part of the standard product. All data and analytic results shall be available via the REST API.

2.1.5 **Hosted or On-premise Deployment:** The analytic software application shall be able to be deployed locally in the facility (on-premise) or provided as a hosted service. Deployment shall not be limited to a SaaS (Software as a Service) deployment model. Cloud-based operation shall be supported on Microsoft Azure and Amazon Web Services as a minimum.

2.1.6 **Weather Data Service:** The analytic software application shall include a built in subscription to a worldwide weather service providing weather data for all major metropolitan areas. The weather service shall include a three-day forecast and provide historical weather data extending back at least 1 year. It shall be possible to integrate other weather services and locally connected sensors to the software via a documented weather data API. Weather service shall provide an update frequency of at least every 3 hours. Weather data shall include:

- Current temperature
- High temperature for the day

- Low temperature for the day
- Sunrise and sunset times
- Relative Humidity
- Degree days (heating and cooling with adjustable balance point value)

3.0 Email notification: The analytic software application shall provide automatic notification of detected issues via email as well as automated emailing of reports. Email notification services shall as a minimum provide:

- Immediate notification of detected issues
- Daily digest or summary of detected issues
- The ability to delineate which issue notifications are sent to which recipients down to the level of specifying that specific issues or categories of issues are sent to individual recipients
- Email notifications shall include hyperlinks which when selected will take the user directly to the visualization of the issue in the software application. Users shall be required to authenticate for access to the visualizations.
- Email of reports formatted as PDF, HTML, PNG, or Excel documents.

4.0 Analytic Rules:

4.1 Support for Custom Rule Development - User Programmability: The analytic software application shall provide the ability to develop customized rules and algorithms tailored to the operational needs and characteristics of individual facilities; the needs of the monitoring and verification project; and the fault detection requirements of the project without dependence on the manufacturer for rule development. Tools for user development of customized rules shall be provided as a standard part of the product and fully documented.

4.2 Standard Analytic Functions: The analytic software application shall provide an extensive library of standard analytic functions. It shall be possible to use these standard analytic functions as elements to build custom analytic rules for the specific needs of individual facilities. Source code for the standard analytic functions shall be provided as part of the standard product.

5.0 Reporting:

5.1 Browser-based User Interface: The system shall present all views and data visualizations in a standard web browser using HTML5 technology. The use of plug-ins or Java in the browser shall not be required. The system shall support the use of the current version of industry leading browsers as a minimum.

5.2 Standard Views of Analytic Results: The analytic software application shall include standard views to present analytic results, which shall be automatically generated when issues are found by analytic rules. No programming or development shall be required to create these views. These views shall include as a minimum:

- All rule violations across a portfolio of sites, all rule violations per site, and rule violations per equipment system, including time, date and duration of all violations.
- The ability to assign cost relationships to rules to provide cost calculations. Cost calculations shall be selectable on a minimum of 3 factors including: duration of violation, occurrence of violation, per day that a violation is detected. In addition, the system shall support development of custom formula-based cost calculations.
- Standard filters to enable the user to easily look at rule violations by site, data, exception type for any selected date or date range.

- Automatic calculation and presentation of Key Performance Indicators. It shall be possible to define custom KPIs as needed. It shall be possible to filter KPI results based on: Sites, KPI type, and date range as a minimum.
- The system shall allow for any standard view to be saved as a report for easy access by operators and shall allow all reports to be emailed as PDF, HTML, PNG, or Excel documents. Any standard system view shall be able to be saved as a custom report including its configuration criteria, e.g., time range, targets (sites or equipment), rule violations or other configuration options as applicable to the standard system view.

5.3 Custom Views of Analytic Results. The analytic software application shall allow for the creation of custom reports and data views. Custom reports shall be able to be created by making queries against the database and saving the query as a saved report. Saved reports shall be able to be executed by typical system users with a single mouse click.

5.4 Chart Types: Custom reports shall allow for inclusion of time-based charts of analytic results and data values. It shall be possible to create custom reports that combine the above chart types into compound reports.The following chart types shall be supported as a minimum:

- DateTime Line Chart
- DateTime Area Chart
- DateTime Bar Chart
- DateTime Runtime Chart
- DateTime Two Y-Axes Chart
- Time Line Chart
- X-Y Line Chart
- X-Y Area Chart
- X-Y Scatter Chart
- Category Bar Chart
- Category Stacked Bar Chart
- Bubble Chart
- Tabular Data Display

5.5 Export of all report views: The system shall allow for the export of any and all report views and shall support export in CSV, Excel, XML, HTML PNG, SVG and text format. Export of report views shall be a feature available to the typical operator and be able to be accomplished with 2-3 mouse clicks and include the ability for operators to send the report as an email when selecting the export format.

5.6 Automatic charting of data: The analytic software shall automatically create 2-axis charts for all time series data once it has been entered into the database. Examples of data that will be presented in auto-generated charts include: sensor values, control point status, setpoints and other numeric, time stamped data values. An application to enable navigation of the data charts shall be provided and shall organize data into groups related to equipment systems.

6.0 Mobile and Handheld User Interface Support

6.1 Mobile Devices: The analytic software application shall support the presentation of analytic results on mobile and handheld devices providing the following capabilities as a minimum:

6.2 Presentation: Analytic information shall be in a text-based format with drill down hierarchy including: site level summary, equipment level summary, and detailed listing of detected issues on individual equipment. The ability to view graphic representations data and analytic visualizations in a standard PDF file format. Handheld user interface shall not require the download or installation of an application. Rather the handheld user interface shall utilize HTML5 web pages for presentation of information to the user.

7.0 Energy Specific Reporting and Information Presentation Tools

7.1 Energy Baseline: The analytic software application shall provide the ability to quantify and define energy consumption and demand baselines (including weather normalization) and compare actual energy demand and consumption against those baselines. It shall also allow for definition of other normalization metrics based on customer data without dependence on the software manufacturer for custom development.

7.2 Benchmarking: The analytic software application shall support multi-site benchmarking, allowing the user to compare energy consumption and demand profiles and baselines across all buildings within the users enterprise.

7.3 Financial Analysis/Cost Factors: The analytic software application shall be able to calculate costs for the use of energy resources. It shall also be able to calculate costs associated with faults, issues and other findings identified by any analytic function. The software shall include the ability to define cost factors based on the following as a minimum:

- Duration of event
- Per occurrence of event
- Per day of occurrence
- Custom math formulas
- Energy costs calculated from actual energy tariffs. Tariff calculations shall support the following tariff charge components as a minimum:
- Consumption
- Demand
- Service and equipment charges (both fixed rate and percentage-based)
- Minimum contract charges
- Distribution and Generation charges
- Ratchets
- Time of Use including both time of day and monthly use factors
- Ranges (or blocks)
- Currency
- Custom charges which can be expressed as math functions
- Definition of billing periods (including support for variable billing periods)
- Variable fees based on data retrieved from external systems

7.4 Tracking of Key Performance Indicators: The analytic software shall allow for the definition and tracking of user defined key performance indicators/operational metrics. Examples include: energy demand and consumption normalized for area and weather, peak demand and consumption shown with minimum and maximum ranges across any user selectable period of time. Standard views of all defined KPI’s shall be available without requiring the development of custom visualizations.

7.5 Correlation of Energy Use with Equipment Operation: As a standard function, the analytic software shall provide the ability to automatically present views that show the correlation between energy demand and consumption and the operation of the loads associated with that usage. This capability will extend to all meters including sub-meters and virtual meters. Correlation views shall be able to include weather data and schedule data as selectable items.

7.6 Greenhouse Gas Analysis: The analytic software application shall provide, at a minimum, the ability to calculate and present common energy/carbon dioxide relationships. These relationships must be able to be changed and new relationships added without dependence on the software manufacturer.

7.7 Integration with Energy Star Portfolio Manager: The analytics application shall support integration with Energy Star Portfolio Manager™ and shall provide for the following integration functions as a minimum:

- Ability to manage Energy Star properties and map them to sites within the analytic application
- Ability to manage Energy Star meters and map them to meter points within the analytic application
- Ability to manage Energy Star meter usage data
- Push history data from the analytic application to Energy Star

8.0 User Access Controls

8.1 Level of Access Privilege: The analytic software application shall provide the ability to define users and their associated privileges including the following privilege options:

- Administrator or Operator level access
- Selection of Applications available to each individual user

8.2 Support for Centralized User Credential Management: The system shall support integration with centralized user credential databases via LDAP (Lightweight Directory Access Protocol) to allow authentication against an LDAP user directory.

9.0 Localization for Multi-Language Support

9.1 Multi-Language Support: The analytic software shall support localization for presentation of the text in the user interface in different languages. The localization shall support the Locale feature in standard web browsers to allow the system to detect the user's desired language.

Facilities Recommended for this Measure

Only Buildings with Central Plant Controls

Scope of Work

- To be installed along with the DDC upgrade measure

Savings Methodology

Stipulated Savings = (% of total energy usage)

Total Annual Natural Gas Savings (Th) = Total Annual Natural Gas Usage * Stipulated Savings

Total Annual Electric Savings (kWh) = Total Annual Energy Usage * Stipulated Savings

Maintenance

Periodically the equipment should be checked to ensure proper operation.

Benefits

- Electric and natural gas savings

07-01 Building Envelope Upgrades

ECM Summary

Infiltration drives energy costs higher by allowing unconditioned outside air to enter the building, thus adding to the building load and causing additional unnecessary heating and cooling loads. All Paterson Public School buildings were surveyed in order to identify potential improvements for outside air infiltration reduction. The main observations are listed below:

- Most entrance doors need weather stripping, sweeps or the closure or strike plate adjusted;
- Sealant is recommended around the perimeter of several windows;
- Numerous penetrations were observed that need to be sealed.

These deficiencies mostly reflect the skin of the buildings, which either have existed since original construction of the building, were added during some retrofit periods, or were caused by deterioration.

Door Weather Stripping – daylight showing through the sides of the door is a clear indicator that there is not a tight weather stripping seal (Silk City 2000 Academy).

Overhang Air Sealing – there is no barrier separating the exterior overhang (area beyond metal framing) from the conditioned interior space (Rosa L. Parks HS).

Facilities Recommended for this Measure

All Buildings (excluding Department of Facilities and District Central Offices)

Scope of Work

A building envelope audit was performed for the entire district. The results of the audit were the identification of several areas of envelope deficiency. The deficient areas were tabulated and their savings potential calculated. Building Envelope Scope drawings are listed in the Appendix 3.

<u>Findings</u>

- A/C Unit Weatherization – window air conditioning units are often installed without consideration given to the air leakage pathways around the unit. Since the air conditioners at the Early Learning Center are left in the window for the entirety of the year, the gaps present at the intersection of the sash cover and the units are contributing to year round energy losses. As a result, cooling the respective space in the warmer months, and heating the conditioned space in the winter, requires an increased energy load.

The units are located directly in student classrooms, which contributes to decreased occupancy comfort in the present condition.

- Attic Bypass Sealing – access hatches at Dale Avenue and School 7 entering the roof and attic respectively are not properly sealed, allowing conditioned air to escape into the vented attic space. Since warm air rises, sealing the attic from the conditioned space is crucial to maintaining an efficient building. The air movement reduces the effectiveness of the existing insulation.

- Buck Frame Air Sealing – the buck frame is the area above the window frame, where framing members attach the frame to the wall of the building. Gaps are often left between these areas, and also above and below them. The window systems at Edward Kilpatrick Elementary School, John F. Kennedy High School, School 7, School 12, and School 28 have unsealed buck frames above their respective drop ceiling tiles.

- Caulking – there are cracks and holes found at the window systems and/or door systems in the following buildings: New Roberto Clemente Elementary School, Norman S. Weir Elementary School, Roberto Clemente Elementary School, School 7, School 12, and School 13. Caulking, especially on the exterior of the window system, is subject to conditions here in the Northeast that can lead to a quicker than normal breakdown in the seal. Subsequently, this creates an abundance of pathways for unwanted air to enter or exit a building. Some of the factors that contribute to this breakdown are changes in temperature that cause joints to expand and contract creating a higher demand on the system, as well as UV light from the sun in the warmer months.

- Door Weather Stripping – deteriorated weather-stripping materials, ineffective weather stripping installation and daylight showing at the perimeter of door systems create direct pathways for unwanted infiltration/ exfiltration.

- Overhang Air Sealing – overhangs are roofs, floor systems or areas above entryways that extend beyond the plane of the exterior wall system. These areas of construction are often misunderstood by builders and the cavity that extends beyond the plane of the exterior wall system is often incorrectly "connected" to the interior heated spaces of the building. Overhangs that are not properly sealed at the plane of the surface that should separate the conditioned space from the outdoors lead to excessive air leakage and heat loss at these vulnerable areas in the building envelope. These vulnerabilities are amplified in Paterson, as the surface area of the overhangs in the respective schools (Academy of Earth and Space Sciences (PANTHER), and Rosa L. Parks Preforming Arts School) is large. There is an unsealed overhang at Rosa L. Parks Preforming Arts School that is more than four feet high. This translates to an excessive amount of air leakage.

- Overhead Door/Roll-Up Door Weather Stripping - remove existing weather stripping and replace with new commercial grade weather stripping to create a full air seal around the door. With low grade, none, or deteriorating materials in place overhead and roll-up doors are a major air leakage source in any building with one these systems.

- Penthouse Air Sealing – there are two penthouse level areas in the area of refuge at Norman S. Weir Elementary School that are contributing to energy losses in this building. There are gaps at the roof-wall intersection that are allowing unwanted air to freely flow into the conditioned space.

- Roof Insulation – the attic in School 18 does not have any existing insulation. The only insulation value currently is derived from the wooden roof deck, which does not meet the recommended insulation code for the New Jersey climate. Because the air handling units (and some heating hot water pipes) are located in this space, they are presently required to use more energy to heat and cool the conditioned spaces below. Proper roof insulation will result in a reduced energy load for School 18.

- Roof-Wall Intersection Air Sealing – the roof-wall intersection is regularly an area that allows unwanted air leakage through the building shell. This makes up one of the greatest weaknesses in the assessed building envelopes in Paterson. Exterior flashing and finish details at this area are not constructed to stop air leakage (exterior flashings are for water control, not air control); unsealed exterior flashing details combine with interior gaps in the framing between the roof and wall assembly to allow infiltration/ exfiltration. This condition is present at: Academy of Earth and Sciences (PANTHER), Dale Avenue, Eastside High School, Edward Kilpatrick Elementary School, John F. Kennedy High School, New International High School, New Roberto K Center, Norman S. Weir Elementary School, Rev. Dr. Martin Luther King Jr. Elementary School, Roberto Clemente Elementary School, Rosa L. Parks School of Fine and Preforming Arts, School 12, School 13, School 17, School 28, Silk City 2000 Academy

- Unit Ventilator Air Sealing – there are new unit vents in school 17 that have gaps where the vent was installed into the window frame. Some of these vents have duct tape around their perimeter to prevent unwanted air infiltration; this is not an effective air sealing measure. Since these unit vents are located directly in student classrooms, not only is energy being wasted, but it is also contributing to reduced occupancy comfort in the present condition.

Task	Academy of Earth and Space Sciences (PANTHER)	Dale Avenue	Early Learning Center	Eastside High School	Edward Kilpatrick	John F. Kennedy High School	New International High School	New Roberto Clemente School	New Roberto K Center	Norman S. Weir	Rev. Dr. Martin Luther King Jr.
AC Unit Weatherization (Units)			8								
Buck Frame Air Sealing (LF)					150	2,481					
Caulking (LF)			224					1,440		752	
Door - Install Jamb Spacer (Units)			8			3			1		
Door Weather Striping - Doubles (Units)			2	16	2	41	18	13	1	5	16
Door Weather Stripping - Singles (Units)	3	12	8	27	5	9	11	7	1	5	23
Overhang Air Sealing (SF)	30										
Overhead Door Weather Stripping (Units)				2							
Penetration Air Sealing (SF)											
Penetration Air Sealing (Units)											
Penthouse Air Sealing (LF)										156	
Retrofit Attic Hatch (Units)		1									
Roll-Up Door Weather Stripping (Units)				1		2					
Roof Insulation (SF)											
Roof-Wall Intersection Air Sealing (LF)	462	94		1,183	278	10			354	54	1,514
Roof-Wall Intersection Air Sealing (SF)					66		2,456				
Roof-Wall Intersection Air Sealing (Units)								1			
Unit Ventilator Air Sealing (Units)											

Task	Roberto Clemente Elementary	Rosa L. Parks school of Fine and Performing Arts	School 6	School 7	School 12	School 13	School 17	School 18	School 28	Silk City 2000 Academy	Total Quantity
AC Unit Weatherization (Units)											8
Buck Frame Air Sealing (LF)				412	666				100		3,809
Caulking (LF)	235			1,228	2,909	3,402					10,190
Door - Install Jamb Spacer (Units)	12				12						36
Door Weather Striping - Doubles (Units)	2	5	7	5	1	6	3		18	1	162
Door Weather Stripping - Singles (Units)	6	20	8	1	20	10	2	25	21	2	226
Overhang Air Sealing (SF)		59									89
Overhead Door Weather Stripping (Units)											2
Penetration Air Sealing (SF)									25		25
Penetration Air Sealing (Units)									5		5
Penthouse Air Sealing (LF)											156
Retrofit Attic Hatch (Units)				2							3
Roll-Up Door Weather Stripping (Units)		2							1		6
Roof Insulation (SF)								17,208			17,208
Roof-Wall Intersection Air Sealing (LF)	275	1,043			5	517			186	87	6,062
Roof-Wall Intersection Air Sealing (SF)							540		5		3,067
Roof-Wall Intersection Air Sealing (Units)											1
Unit Ventilator Air Sealing (Units)							8				8

<u>Recommendations</u>

Installation Factsheets, included in the Report for the measures below at the bold round bullets, provide the rationale for a measure and the installation specifications and materials.

For specifications that differ from the Installation Factsheets or where measures do not have Installation Factsheets notes are included at the square bullets below.

- A/C Unit Weatherization
    - Reference the Installation Factsheet; site-specific recommendations are included below.
        - A/C Unit Covers (Early Learning Center) – construct an insulating cover out of rigid insulation and install over the existing air conditioning paneling (cut out required around unit). Seal with sheeting tape around the perimeter of the new cover and at the cover/unit intersection to create a tight seal.

- Attic Bypass Air Sealing
    - Reference the Installation Factsheet; site-specific recommendations are included below.
        - Retrofit Attic Hatch (Dale Avenue) – install rigid insulation on the back-side of the roof hatch; install a gasket at the perimeter of the hatch for a tight seal.
        - Retrofit Attic Hatch (School 7) – install rigid insulation on the back-side of the attic hatch; install a gasket at the perimeter of the hatch for a tight seal.
- Buck Frame Air Sealing
- Caulking
- Door Weather Stripping
- Overhang Air Sealing
- Overhead Door/Roll-Up Door Weather Stripping
    - There is no Installation Factsheet for this measure.

        - Weather Strip – install heavy-duty aluminum carrier with oversized vinyl insert gasket at the sides: install heavy-duty aluminum carrier with an oversized bottom U-style gasket at bottom.
- Penthouse Air Sealing
    - There is no installation factsheet for this measure.
        - Roof-Wall Intersection Air Sealing (Norman S. Weir ES) – use polyurethane spray foam to seal the gap at the roof-wall intersection.
- Roof Insulation
    - Reference the Installation Factsheet; site-specific recommendations are included below.
        - Roof Insulation (School 18) – Install R30 open cell spray polyurethane foam on the underside of the roof deck, in between the rafters; seal with thermal barrier paint.
- Roof-Wall Intersection Air Sealing
- Unit Ventilator Air Sealing

Savings Methodology

The physics of air leakage guide the requirements for the design of an effective air leakage control retrofit project.

- Big Holes = Area
  Sealing big holes and/or a lot of small holes generates savings.
- Big Pressure Differentials = ΔP
  Sealing surfaces that have the highest pressures acting on them generates savings: at the top and bottom of the building (stack pressure), spaces that are pressurized or depressurized (mechanical pressure) and surfaces that are most exposed to the elements (wind pressure).
- Big Temperature Differentials = ΔT or HDD
  Sealing interior-to-exterior air leakage pathways generates savings. Isolating interior spaces (or compartmentalizing) is effective only across interior spaces with very different interior environment needs.

Thermal Upgrade
ESG uses standard heat loss calculations (U, A, ΔT) to estimate savings from thermal barrier improvements.

As with air leakage, the physics of thermal heat loss guide the requirements for the design of an effective energy saving insulation upgrade project.

- Weak Existing Insulation Values: U-Value
  Insulating surfaces with the weakest existing insulation values generates savings.
- Big Surface Areas: Area
  Insulating large surface areas generates savings.
- Big Temperature Differentials: ΔT or Degree Days
  Insulating interior-to-exterior surfaces (attic surfaces are included in this category) generates savings. Isolating interior surfaces (or compartmentalizing) is effective only across interior spaces with very different interior environment needs.

INFILTRATION/ EXFILTRATION SAVINGS CALCULATION METHODOLOGY

Heating Savings

		Flow Factor		$(\Delta P)^{n}$		A		CFM Reduction
1) Q	=	Flow Factor	x	Wind Pressure	x	Aggregate Air Leakage Pathway Hole	=	Cubic Feet / Minute (CFM)
		Q		HDD		Fuel $/MMBTU		
2) Savings	=	CFM	x	HDD for Location	x	Fuel Cost in $	=	Savings in Dollars
				Fuel / Mechanical Efficiency Factor				
				Efficiency Factor				

3) Savings from Air Leakage Control .... = Savings in Dollars

4) Project Investment .... = Investment in Dollars

5) Simple Payback .... = Investment / Savings

INFILTRATION/ EXFILTRATION SAVINGS CALCULATION METHODOLOGY

Cooling Savings

			Flow Factor		$(\Delta P)^{\wedge n}$		A		CFM Reduction
1)	Q	=	Flow Factor	x	Wind Pressure	x	Aggregate Air Leakage Pathway Hole	=	Cubic Feet / Minute (CFM)
			Total Heat Constant		CFM Reduction		Enthalpy		Tons
2)	Tons	=	4.5	x	CFM Reduction	x	Enthalpy Value	=	Tons
					12,000				
					BTU Hour per Ton				
3)	kWh Savings	=	Tons		kW per Ton		Cooling Hours		kWh
			Tons	x	1.2	x	Cooling Hours for Location	=	kWh
4)	Savings	=	kWh		Fuel Cost/kWh				
			kWh Savings	x	Fuel Cost in $	=	Savings in Dollars		

5) Savings from Air Leakage Control .... = Savings in Dollars

6) Project Investment .... = Investment in Dollars

7) Simple Payback .... = Investment / Savings

THERMAL INSULATION SAVINGS CALCULATION METHODOLOGY

Heating and Cooling Savings

1) Pre-retrofit Heat Loss

		U-Value		ΔT		A		
Heat Loss	=	Existing U	x	HDD (or CDD) *24 hrs/day * 0.75	x	Surface Area	=	Pre-retrofit Heat Loss in MMBtu
				1,000,000				
				Convert MMBtu				

		MMBtu		$ / Unit		Efficiency		
Heat Loss	=	Pre-Retrofit Heat Loss in MMBtu	x	Cost / MMBtu	x	Heating Efficiency Factor	=	Pre-retrofit Heat Loss in $

2) Post-retrofit Heat Loss - Same Calculations as Above = Post-retrofit Heat Loss in $

		#1 Result		#2 Result		
3) Savings	=	Pre-retrofit Loss	-	Post-retrofit Loss	=	Savings in Dollars

4) Project Investment .... = Investment in Dollars

5) Simple Payback .... = Investment / Savings

Maintenance

After the building envelopes have been improved, operations and maintenance should be reduced, due to improved space conditions and lower humidity during the cooling season. The maintenance staff should maintain the newly installed equipment per manufacturers' recommendations. The manufacturer specification sheets will be provided for exact maintenance requirements.

Benefits

- Electrical energy savings
- Fuel energy savings
- Increased thermal comfort

08-01 Domestic Fixtures (Sink Faucets)

ECM Summary

Bathroom fixtures offer good water saving opportunities because many of these fixtures can be retrofit to reduce the amount of water consumed per flush (toilets and urinals) or per minute of use (sinks and showers). Reducing sink water usage also saves the thermal energy used to make hot water.

Facilities Recommended for this Measure

All Buildings listed in the table below

Scope of Work

Sink Faucets – 774 Units

- Existing high flow faucets on 774 lavatory sinks will be retrofit to 1.0 gpm:
- For those faucets from which existing aerators cannot be removed without damaging the faucet, a replacement aerator will not be installed. The replacement aerator will be turned over to Owner with the project's shelf stock.
    - *Note: Energy Savings will only be claimed for actual number of aerators installed*
- Where possible, tamper resistant aerator will be installed. For faucets that cannot accept a tamper resistant aerator, a regular aerator will be installed.

Aerator Replacements by School	#
Academy of Earth and Space Sciences (Panther)	11
Dale Avenue	46
Early Learning Center	11
Eastside High School	53
Edward Kilpatrick	45
John F. Kennedy High School	105
New International High School	59
New Roberto Clemente School	50
New Roberto Clemente K Center	4
Norman S. Weir	24
Rev. Dr. Martin Luther King Jr.	40
Roberto Clemente Elementary	27

Aerator Replacements by School	#
Rosa L Parks School of Fine and Preforming Arts	15
Rutland Early Childhood Learning Center	7
School 12	18
School 13	41
School 17	11
School 18	32
School 28	59
School 6	32
School 7	13
Silk City 2000 Academy	21

Savings Methodology

Thermal energy savings for sink usage is based on the following assumptions: the ratio of hot-to-cold water use, average hot and cold water temperatures, and the domestic hot water heater efficiency.

Savings Calculation Method		
Frequency of Use	=	Number of users x % year-round occupancy x fixture uses/day/person
Water Savings (gal/yr)	=	Frequency of Use x (Baseline – Estimated Flow Rate) (gpm or gpf per fixture) x days/year x % high-flow fixtures
Sink/Shower Energy Savings (MMBtu/yr)	=	Water Savings (gal/yr) x (Tmixed -Tcold) (°F) x (1 Btu/lb °F X 8.34 (lb/gal) x 1 MMBtu/1,000,000 Btu
Sink/Shower Energy Savings (kWh/yr)	=	= Energy Savings (MMBtu/yr) x 293.1 kWh/1 MMBtu
Cost Savings ($/yr)	=	[Water Savings] (kgal/yr) x [water rate + sewer rate] ($/kgal) + [(Sink/Shower Energy Savings (MMbtu/yr)] x 1/boiler efficiency (%) x Thermal Rate ($/MMbtu)] + [(Sink/Shower Energy Savings (kWh/yr)] x 1/boiler efficiency (%) x Electric Rate ($/kWh)]

Maintenance

Periodically the equipment should be checked to ensure proper operation.

Benefits

Electrical energy savings.

10-01 PPA Rate Savings

ECM Summary

Grid-tied solar electric systems convert sunlight into electricity. Solar electric panels can be either roof or ground-mounted and connect to your existing electric service. As long as your solar electric system is connected to the utility grid, its clean electricity can be used in your business, or "banked" into the utility grid for later use. Through a process known as net metering, your utility will accept your excess solar power when you are producing more than you are using and will supply you with reliable grid power when the sun is not shining. Your utility company will base your bill on the difference between your solar production and electric use.

During the preliminary investigations it was found that many of the schools have flat sections of roof that could benefit from the generation of clean free electricity from the sun. Note that in all cases, the existing roofing membrane will need to be modified / replaced to extend the roof life to match the useful life of the proposed solar system.

Facilities Considered for this Measure

Refer to Appendix 4 for Sites And System Layouts

Scope of Work

The scope of work is as follows:

Furnish and install up to roof-mounted photovoltaic systems on the school's property.

Ballasted roof mount installations are preferred and will be discussed further in the IGA.

Furnish and install appropriate support system for the PV modules. Roof penetrations are not expected; however, if penetrations are required, approved roofing contractors will preserve existing roof warranty.

Furnish and install inverters for the above systems. The inverters are to be located in the building.

Included in the scope is an energy revenue grade metering system that tracks the generated energy.

For internet access, a network link will be required near each inverter, where a data gateway will communicate the recorded information over the internet. Once setup, the webpage will display actual system output, historical electricity production data, and an estimated amount of CO2 off-set.

Perform a structural strength analysis of the existing school structure to support the proposed PV system.

Provide roofing placement plan for all components.

Provide registered professional engineering review to ensure that the proposed system meets applicable electrical and structural codes.

Estimate of all available utility rebates.

Provide PV system start-up and commissioning.

Provide an O&M Manual, which includes a detailed summary; inverter operation, trouble shooting and maintenance; system documentation to include as-built drawings, site plan, 3-line electrical diagram, conduit route diagram, inverter diagram, string diagram; component data sheets to include module data sheet, inverter data sheet, and racking data sheet; and warranty documentation.

Maintenance

The system will require routine maintenance and testing.

Savings Methodology

Savings Calculation Methodology		
Energy Savings (kWh) =	=	[cost of kWh (utility) – cost of kWh (solar)] x solar production (kWh)

Benefits

- Electric cost savings
- Reduce emissions

12-01 Liquid Pool Cover

ECM Summary

Swimming pools lose energy in a variety of ways, but evaporation is by far the largest source of energy loss. It takes only 1 Btu to raise 1 pound of water 1ºF, however, each pound of 80ºF water that evaporates removes 1,048 Btu of heat from the pool. The evaporation rate for indoor pools is significant, albeit slower than that for outdoor pools. Indoor pools require ventilation to control indoor humidity caused by the large amount of evaporation. The ventilated air must be heated in the winter, which adds to the energy costs. Covering a pool when it is not in use is the single most effective means of reducing pool heating costs: for indoor applications, the use of pool covers minimizes evaporation and reduces the need for seasonally heated, ventilated air.

Swimming Pool - Norman S. Weir

Facilities Recommended for this Measure

Norman S. Weir

Scope of Work

- Install chemical metering pump on existing pool water return line.
- 120V duplex power outlet existing or supplied by Owner.
- Install chemical injection point in existing chemical injection piping
- 2 pails (5 gal per pail, 1 year supply) of Heatsaver Liquid Pool Cover
- Startup, commissioning, and training
- Operations and Maintenance Manual

Savings Methodology

Pool Evaporation (lbm/hr) Unoccupied=	*K (Constant) x Pool Surface Area (sqft) x Density of Air – Pool Surface (lbm/ft3) x (Density of Air- Room ~ Density of Air – Pool Surface)^0.333 (lbm/ft3) x (Humidity Ratio W (Pool Surface) - Humidity Ratio W (Room))*
Pool Evaporation (lbm/hr) Low Use =	*Pool Evaporation (lbm/hr) Unoccupied x (160 x (1/ A/N Ratio (Surface Area/Occupancy)+1)*

Pool Evaporation (lbm/yr) Unoccupied =	*Pool Evaporation (lbm/hr) Unoccupied x Unoccupied Hrs with Cover Off and Heat On*
Pool Evaporation (lbm/yr) Low Use =	*Pool Evaporation (lbm/hr) Low Use x Active Hours*
Total Water Evaporated (kgal/yr) =	*((Pool Evaporation (lbm/yr) Unoccupied + Pool Evaporation (lbm/yr) Low Use))/8.34/1000*
Pool Heat Loss (Unoccupied) (MMBTU/hr) =	*Pool Evaporation (lbm/hr) x Enthalpy at Pool Surface Temp. (Btu/lbmv) x ((1-Fraction of Heat Recovered by the Heat Pump Dehumidifier) x (1-Fraction of Heat Lost to Infiltration (or Other Losses)+ (Fraction of Heat Lost to Infiltration (or Other Losses)/ Efficiency of Water Heater*
Pool Heat Loss (Medium Use) (MMBTU/hr) =	*Pool Heat Required (Unoccupied Hrs) x (62.9 x (1/ A/N Ratio (Surface Area/Occupancy))+1.2*
Pool Heat Loss (Unoccupied) (MMBtu/yr) =	*Unoccupied Hrs with Cover Off and Heat On x Pool Heat Required (Unoccupied)/ 1,000,000*
Pool Heat Loss (Medium Use) (MMBtu/yr) =	*Active Hours x Pool Heat Required (Medium Use) (MMBTU/hr)/ 1,000,000*
Total Pool Heat Loss (MMBtu/yr) =	*Pool Heat Required (Unoccupied) (MMBtu/yr) + Pool Heat Required (Medium Use) (MMBtu/yr)*
Savings (MMBtu/yr) =	*Current Total Pool Heat Loss (MMBtu/yr) – Proposed Total Pool Heat Loss (MMBtu/yr)*

Maintenance

Liquid pool cover needs to be added monthly to remain effective.

Benefits

- Liquid pool covers are made of safe, non-toxic, and biodegradable materials that are undetectable to pool users.
- Natural Gas savings

12-02 Pool System Upgrades

ECM Summary

Filtration and circulation systems for indoor swimming pools consume nearly 40% of the total energy used by an indoor pool facility. Updating existing pool filtration equipment to energy efficient equipment will reduce energy consumption, resulting in energy cost savings. Commercial swimming pool pumps ran with Variable Frequency Drives (VFDs) fulfill flow and pressure requirements while achieving energy savings. VFDs on filtration and circulation pumps speed up or slow down when necessary to match the actual demand.

The existing pool pump and pool filters at the Norman S. Weir Schools' pool facility are outdated and should be upgraded, Upgrading the existing to a higher efficiency pool pump and filter system will improve the overall pool efficiency. The use of a variable speed pump and motor set will optimize pool flow and filtration.

Existing Pool Filters - Norman S. Weir

Existing Pool Pump - Norman S. Weir

Facilities Recommended for this Measure

Norman S. Weir

Scope of Work

Demolition and Removal Work

- Replace (1) each 5-HP single-speed AC motor on pool pump with (1) each premium-efficiency, 5-HP variable speed pump/motor set (Hayward HCP30503 or approved equal).
- Replace (2) sand filtration units set with (2) large filtration area cartridge filter systems – SwimClear Multi-Element with 525 square foot element or approved equal.

New Installation Work:

Proposed are the following:

- Furnish & install (F&I) (1) each premium-efficiency, 5-HP variable speed pump/motor set (Hayward HCP30501 or approved equal). Motors are to be specified to match process, electrical and controls requirements.
- F&I (2) new SwimClear Multi-Element Filter System with 525 square foot elements, or approved equals.

- Inspect the mounting area and install the pump/motor set.
- F&I all motor mounting adapters required for new motors.
- F&I all power transmission components required.
- F&I all piping, fittings, mounting bases, controls, electrical, etc. required to implement the pump/filtration systems per manufacturers recommended standards.
- Reuse existing concrete pad, electrical and other infrastructure.
- Reconnect line voltage and any disconnected controls to the new systems.
- Inspect operation, proper rotation, and perform necessary electrical tests.
- Provide startup of each system.

Savings Methodology

Pool Motor Energy Savings Calculation	
Motor (kW) =	(Motor Horsepower x 0.746 (kW/HP) x Load Factor) = or = (Motor Amperage x Volts x 1.732 x Power Factor) / 1000
Speed Ratio Correction Factor =	((New RPM)/(Existing RPM)) ^ 3
Existing Energy Use (kWh) =	(Existing kW /Existing Efficiency) x Hours of Use
Existing Demand Use (kW) =	(Existing kW /Existing Efficiency) x Peak Load Months x Utilization factor
New Energy Use (kWh) =	(New kW /New Efficiency) x Hours of Use x Speed Ratio Correction Factor
New Demand Use (kW) =	(New kW /New Efficiency) x Peak Load Months x Utilization factor x Speed Ratio Correction Factor
Total Savings (kWh, kW) =	(kWh existing - kWh new) x $/kWh + (kW existing - kW new) x $/kW

Pump Energy Savings Calculation	
Pump kWh Used After Conversion =	(HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (Annual Op Hours x % of Time at % Flow)
*Pump kW Dem'd After Conversion =	(HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (% of Time at % Flow x DUF x Months/year)
Heating and Cooling Savings =	(Existing Heating or Cooling Cost) x (Assumed valve leakage)

Maintenance

Periodically the equipment should be checked to ensure proper operation.

Benefits

- Electric savings

13-01 Cogeneration (35 kW)

ECM Summary

Energy Systems Group proposes to install one (1) 35 kW cogeneration machine at Eastside High School to supply electricity and heat to the building, which will offset a portion of the boiler load. The recovered heat will be rejected into the boiler hot water heating system.

Location: The location for the cogeneration machine at Eastside High School will be in the basement and set on a new concrete housekeeping pad. New exhaust piping shall of through the exterior wall.

Facilities Recommended for this Measure

Eastside High School

Scope of Work

Eastside High School

New Installation Work:

- F&I Qty. (1) Tecogen Micro T35 Model TGE V3800 (35kW) natural gas fired CHP unit with heat rejection system located near exterior wall of old boiler room. Combustion air will be ducted out through wall of basement to outside with new intake louver. New CHP location will be in basement of old boiler room and set on new concrete housekeeping pad.
- F&I new gas piping to CHP unit from main gas meter bank.
- F&I new insulated hot water piping overhead from Tecogen CHP pump module to heating hot water system piping and heat rejection system.
- F&I new electrical power from Tecogen CHP unit to building electrical main switchgear.
- F&I new steel exhaust pipe out through mechanical room wall and up to roof.

Savings Methodology

In general, savings calculations for lighting retrofits are calculated using the following methodology:

Savings Calculation Method	
Energy:	35 kW/module x 1 module(s) x 1 net after "parasitic losses"
	= 35 net kW output x $/kWh avg. displaced energy x run hours
Demand :	35 kW/module x 1 module(s) available x 1 net after "parasitic losses"

When Heat Used to Displace Boiler Gas Use:	$\frac{\left(\frac{Th}{hr\ module}\right)\ x}{boiler\ efficiency}\ x\ 1\ modules\ x\ \$/\mathrm{Th\ boiler\ gas\ rate}$

Maintenance

Follow manufacturers' recommendations for preventative maintenance. In order to be eligible for New Jersey Clean Energy incentives, Paterson Public Schools must demonstrate that they have contracted for an extended maintenance agreement to service the cogeneration units. This maintenance agreement will be conducted outside of the Energy Savings Improvement Program, as required by law.

Benefits

- The installation of a cogeneration unit will result in significant economic benefits to the overall ESIP program. These benefits include:
  - Up to 20-year financing term.
  - Substantial NJ Clean Energy incentives.
  - Potential demand response revenue generation.
  - Additional funding from FEMA grants and other local, state, and national incentives.

15-01 Domestic Hot Water Heater Replacement

ECM Summary

The existing domestic water heaters at some Paterson School District facilities are nearing the end of their useful life. As existing DHW boiler(s) age, they typically experience a loss in efficiency due to fouling and scaling on the internal heat exchange components, as well as an increase in maintenance costs. This measure will include replacing these units with new high-efficiency domestic water heating systems.

The existing domestic hot water heaters are standard efficiency models that operate at a nameplate value of around 80% thermal efficiency. This measure will include the installation of new hot water heaters to replace these aging, lower efficiency ones. New condensing water heaters are available that operate at efficiencies up to 97%.

Domestic Hot Water Heater – JFK

Facilities Recommended for this Measure

John F Kennedy High School

Scope of Work

<u>John F. Kennedy High School</u>

Demolition and Removal Work

- Shut down, drain and disconnect flue venting, HW & CW piping, gas piping and electrical to existing Lochinvar CWN0985PM water heater and RGA0432 storage tank and properly dispose of.

New Installation Work

- F&I Qty. (1) Lochinvar Model CWN0987PM (or equal) (985MBH Input, 81% Thermal Efficiency) gas fired domestic hot water heater.
- F&I Qty. (1) Lochinvar Model RGA0432 (or equal) (432 Gallon) insulated glass lined domestic hot water storage tank.
- F&I new copper pipe, fittings, valves and insulation to reconnect existing hot and cold-water piping to new water heater and storage tank.
- F&I Qty. (1) TACO Model PAX130-150P (34 Gallon) expansion tank.
- F&I new 10" B vent piping to connect into existing chimney.
- Reconnect existing gas piping to new water heater.
- Reconnect existing electric to new water heater.
- Provide factory authorized start-up with written combustion report.
- All existing piping, supply pumps and check valve to remain.

Savings Methodology

Savings Calculation Methodology		
Existing DHWH Efficiency	=	Existing Heat Production/ Existing Fuel Input
Proposed DHWH Efficiency	=	Proposed Heat Production/ Proposed Fuel Input
Energy Savings	=	Heating Production (Proposed Efficiency – Existing Efficiency)

Maintenance

Periodically the equipment should be checked to ensure proper operation.

Benefits

- Natural gas savings

17-01 Steam Trap Replacements

ECM Summary

Mechanical traps are prone to failure as they age, resulting in large steam losses and requiring substantial maintenance. Steam traps separate the steam system from the condensate system. Traditional steam traps can fail in the open or closed position. When a steam trap fails in the open or leaking-by position, some or all of the energy that was added at the boiler is lost into the condensate return system. The energy contained in steam is only utilized when it condenses in a heat exchanger (radiator, convector, hot water heater, AHU coil, etc.) and releases its latent heat to the process. It is at this point the steam trap should allow this condensate into the condensate return system to return to the boiler. As mentioned above, a leaking trap still allows steam to flow through the heat exchange device it serves and will typically not affect its heating capacity. For this reason, leaking traps are rarely discovered without performing specific tests on the trap. Conversely, a steam trap that fails in the closed position does not allow the condensate to enter the condensate return system. As a result, condensate backs up into the heat exchange device it serves, thereby first reducing, then eliminating, its heating capacity. Plugged traps are often identified through "cold calls" and repaired. Replacing or repairing failed traps will improve the efficiency of the steam distribution system and save energy.

School 17

School 7

Facilities Considered for this Measure

Dale Avenue	School 12	School 7
Silk City 2000 Academy	School 13	
John F. Kennedy High School	School 17	

Scope of Work

All operating mechanical traps were tested with an ultrasonic listening device. A sample of thermostatic traps were also tested in the classrooms and offices to identify a projected performance for those systems. Overall, approximately 23% of the total traps were tested at the subject sites, or 190 of the 832 traps. The tested traps had the following failure rates: 5% plugged, 10% blowing, and 19% leaking. Testing results are shown

Paterson School District Phase 2: Steam Trap Quantities

Building	Steam Traps[1]				Total
	F&T	IB	TS	No Trap[2]	
Dale Avenue	42	-	23	-	**65**
JFK High School	54	2	369	-	**425**
School 12	12	1	-	-	**13**
School 13	41	-	114	1	**156**
School 17	20	2	24	-	**46**
School 7	56	-	11	-	**67**
Silk City 2000 Academy	9	-	33		**42**
Total	**234**	**5**	**574**	**1**	**814**

[1] Several schools contained traps that were inaccessible during the audit, quantities/size/type are estimated for these locations.
[2] School 13: Stairwell 2, Landing 2.5 has a radiator with no apparent existing trap.
[3] District Central Offices were audited but are not included in the scope of work.

Summary Results		#	% (of tested)
A	Abandoned in Place	2	n/a
VB	Vacuum Breaker or Misc. Trap Use	-	n/a
NT	Not Tested	640	n/a
P	Plugged (Failed Closed)	9	5%
B	Blowing (Failed Open)	19	10%
L	Leaking	37	19%
OK	Working Properly	125	66%

All mechanical traps (239 total) identified during the audit will be replaced with new traps. Mechanical traps for which replacement is not feasible (due to location, size, or configuration) will be retrofit with a new insert and gasket; the existing cover will be reused (in some instances a new cover will be provided). All thermostatic traps (573 total) identified during the audit will be retrofitted with new insert and cap. Thermostatic traps 1" and greater reuse the existing cap. One unit heater that currently has no trap will be fitted with a new thermostatic trap.

- 239 mechanical traps will be replaced with a new trap manufactured by Tunstall; mechanical traps for which replacement is not feasible (due to size or existing configuration) will be retrofit with a new insert and gasket; the existing cover will be reused
- 573 thermostatic traps will be rebuilt with a new insert, gasket, and cap manufactured by Tunstall. In the event the existing trap will not accept a retrofit kit and new cap, the trap will be replaced with a new steam trap as manufactured by Tunstall.
- One unit heater at School 13 that currently has no trap will be fitted with a new thermostatic trap manufactured by Tunstall
- 2 traps that have been abandoned in place are excluded from the replacement scope
- Sections of the Dale Avenue and JFK High School crawlspaces were treated as confined space at the time of the site audit: the trap quantities listed above include estimated counts for these areas.

Savings Methodology

Savings are calculated using the following methodology:

Steam trap losses depend on the steam pressure and temperature, the type of trap, orifice size, and the level of leakage through the failed trap. Steam losses are calculated based on the amount of steam lost through the trap. Failed closed or “plugged” traps are unique in that there is no steam lost through the trap itself. Steam traps are important in the steam system to remove the condensate from the system. If the condensate is not removed from the steam system, the system loses efficiency. In some cases, a steam trap that is failed closed will cause an excessive buildup of condensate and could cause a blockage of steam flow.

Steam trap losses for leaking traps are calculated using the following modified Napier formula:

Savings Calculation Methodology		
q, heat loss (lb/hr)	=	24.24 * D^2 * (P+14.7) * orifice factor * app factor *loss factor
Where, D	=	orifice diameter (inches)
P	=	Gauge Pressure (psig)
orifice factor	=	0.66 (orifice reduction due to presence of condensate)
app factor	=	application factor (1 if drip leg, 0.92 if coil or other valved application)
loss factor	=	1.0 for blowing by, 0.3 for leaking

Maintenance

Periodically the equipment should be checked to ensure proper operation.

Benefits

- Natural gas savings

19-01 Roof Restoration

Deficiencies in roofing systems were found at many schools throughout the Paterson School District. Energy Systems Group proposes to restore the roofs at some schools in the district. Designated roof sections should be corrected to improve roof performance.

Facilities Recommended for this Measure

Eastside High School	John F. Kennedy	School 28

Scope of Work

Eastside High School

- BUR with Gravel 94,420 sf
- BUR vac gravel and prime with Primetek 7500 primer
- Infrared moisture survey
- Unit price per sf of wet replacement:
- Make necessary repairs per manufacturer's direction
- Apply 1.5" 3lb density polyurethane foam
- Apply 2 coats, 30 mils minimum total of seamless seal low solids silicone/granules
- 4900 lf of new SPF base flashing
- 202 lf of expansion joint cover
- 100 new pipe supports
- 13 new drain baskets

John F. Kennedy High School

- BUR with Gravel 154,000 sf
- BUR vac gravel and prime with Primetek 7500 primer
- Infrared moisture survey
- Unit price per sf of wet replacement:
- Make necessary repairs per manufacturer's direction
- Apply 1.5" 3lb density polyurethane foam
- Apply 2 coats, 30 mils minimum total of seamless seal low solids silicone/granules
- 6890 lf of new SPF base flashing
- 426 lf of expansion joint cover

School 28

- BUR with Gravel 7,470 sf
- BUR vac gravel and prime with Primetek 7500 primer
- Apply 1.5" 3lb density polyurethane foam
- Apply 2 coats, 30 mils minimum total of seamless seal low solids silicone/granules
- BUR with granulated cap sheet 52,580 sf
- Power wash roof and prime with Bleed block primer (10 mils min)
- Apply 20 mils silicone on all seams
- Apply 35 mils minimum in one coat of seamless seal high solids silicone/granulate
- Coat walls with silicone coating up to coping, 2,875 lf at 12" height

- No granules on walls
- 100 lf of new SPF base flashing
- 24 new drain baskets

Common Elements in All Schools:

- 15 year materials and labor
- Granules embedded in all horizontal topcoats
- All concrete coping joints caulked and roll coated with 30 mils of silicone coating
- All roofs to be power washed and primed
- All seams to be treated with an additional 20 mils of silicone coating
- Roof fields for coating restoration 35 mils minimum in one coat of high solids silicone
- Roof fields utilizing polyurethane foam is specified 1.5" minimum of 3lb density foam and 2 coats (30mil minimum) of low solids silicone
- Prevailing wages apply
- All drains to get new baskets

Savings Methodology

N/A

Maintenance

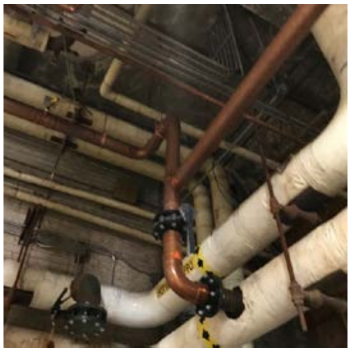
- The roof should be inspected routinely
- 15-year materials and labor Carlisle warranty

Benefits

- Source of revenue throughout the first several years of project development and implementation.
- Public acknowledgement of District's efforts toward energy responsibility.

20-01 HVAC Piping Insulation

ECM Summary



Un-insulated Hot Water Piping – Eastside High School

Non-insulated pipelines and associated valves and fittings carrying thermal fluids because heat loss where not intended and result in excess fuel consumption, as well as discomfort in occupied areas. Valves and fittings without insulation were observed throughout the buildings and installation of new insulation is recommended. Installation of the proper amount of insulation will not only conserve energy but will also improve safety by reducing the chance for burns on hot piping or slipping due to condensate on a pipe. This ECM would insulate bare and poorly insulated heating hot water piping and failed heating hot water piping insulation in the boiler room.

Facilities Recommended for this Measure

All Buildings (excluding Department of Facilities and District Central Offices)

Scope of Work

Findings

- Pipe Insulation –un-insulated pipes in the heating systems are leading to unnecessary distribution losses and wasted energy. This makes up over thirteen hundred feet across the respective locations in Paterson. The large diameter of the pipes at many locations, especially at John F. Kennedy High School, School 12, and School 13, are amplifying the energy losses.
- Valve & Fitting Insulation –valves and fittings are difficult components of a mechanical system to insulate and as a result are frequently left un-insulated. The following components are un-insulated in the respective boiler rooms: Air Scoops, Bonnets (Gate valve), Butterfly valves, Centrifugal Pumps. Check valves, Control valves, Flanges, Flex fittings, Gate valves, In-line Pumps, Pressure Relief valves, Steam Traps, Strainers, Suction Diffusors, and 3-Way valves. There are also many un-insulated 90 degree elbows, 45 degree elbows, and T-intersections throughout the connecting straight pipes. These un-insulated or poorly insulated components have the same temperature fluids passing through them as the pipes that are more likely to be insulated; un-insulated components of the distribution system lead to unnecessary distribution losses and wasted energy.
- Tank Insulation –there are two types of tanks that were found to be un-insulated in Paterson; Air Separator tanks in the heating hot water systems, and Condensate tanks in the steam systems. Some of these un-insulated tanks are larger than the tanks traditionally seen at buildings with a similar size; this is the case at School 12 where there is a condensate tank that is nine feet long, and at Eastside High School where the air separator tank is almost seven feet high. The surface area of these large run-insulated tanks is amplifying the amount of heat (energy) loss as fluids pass through them. Tanks are difficult components of a mechanical system to insulate and as a result are frequently left un-insulated.
- Refer to Appendix 4 for site specific quantities.

***Note**: All insulation thickness shall be confirmed to be in accordance with the New Jersey Energy Conservation Code, ASHRAE 90.1 2013. Contract shall be responsible for verification of these thicknesses.*

Savings Methodology

Mechanical Insulation Savings Calculations

This section describes our methodology for calculating energy savings. We use standard heat transfer methods to compute heat loss from bare and insulated mechanical systems (piping, valves, fittings, tanks and ductwork). The difference in heat loss is the energy savings, as follows:

Energy Savings = [Existing Heat Loss] – [Insulated Heat Loss]

Methodology

We use standard heat transfer methods to compute radiation, convection, and conduction heat loss from

(Alternatively, gain to, for cold systems) bare and insulated systems. Key parameters that affect the heat transfer rate include: temperature of fluid (e.g. steam, hot water, chilled water, etc.); surface temperature of the component (e.g. pipe, fitting, tank, ductwork); temperature of environment; emissivity of surface; average wind speed where applicable; percentage of existing component covered with insulation; and condition of existing insulation, where applicable.

Energy Use

Existing and proposed energy use are computed as follows:

Pipes & Fittings

Heat Loss (Btu/h) = (Heat Loss / lin.ft. bare pipe) * (lin.ft. of pipe) * [1 – (%insulated)] +
(Heat Loss / lin.ft. insulated pipe) * (lin.ft. of pipe) * (%insulated)

Fuel Loss (MMBTU/yr) = (Heat Loss Btu/h) * (heating hrs/year) ÷ (efficiency)
Electric Loss (kWh/yr) = (Heat Loss Btu/h) * (cooling hrs/year) ÷ (12,000 Btu/ton-hr) x (cooling kW/ton)

Tanks, Plates, & Ductwork

Existing and proposed heat loss for tanks, plates, and ductwork are calculated as follows:

Heat Loss (Btu/h) = (Heat Loss / sq.ft.) * (sq.ft. of component) * (qty) * [1 – (%insulated)] +
(Heat Loss / sq.ft. insulated) * (qty) * (sq.ft. of component) * (%insulated)
Fuel Loss (MMBTU/yr) = (Heat Loss Btu/h) * (heating hrs/year) ÷ (efficiency)
Electric Loss (kWh/yr) = (Heat Loss Btu/h) * (cooling hrs/year) ÷ (12,000 Btu/ton-hr) x (cooling kW/ton)

Energy Savings

Energy savings are the difference between existing and proposed heat loss:

Fuel Savings (MMBTU/yr) = (Existing Fuel Loss) – (Proposed Fuel Loss)
Electric Savings (MMBTU/yr) = (Existing Electric Loss) – (Proposed Electric Loss)
Cost Savings ($/yr) = (Fuel Savings MMBTU/yr) * (Fuel Rate $/MMBTU) +
(Electric Savings kWh/yr) * (Electric Rate $/kWh)

Heat Transfer: Bare Systems

Bare systems are subject to convection and radiation heat transfer. We ignore conductive heat transfer through the pipe/fitting material (e.g. steel, copper, PVC etc.) as this is negligible as compared to heat transfer through insulation and air convection.

Pipes & Fittings

This section describes the heat transfer calculations for pipes and fittings for indoor systems subject to natural convection (no wind). The calculations for outdoor systems subject to forced convection (wind) are similar except that the formulas are more complicated. These methods are presented following this section.

For fittings (valves, elbows, strainers, etc.), we estimate heat loss based on equivalent length of straight pipe, which is the ratio of the area of the fitting to the area of 1 linear foot of pipe of the same size (fitting equivalent length = Area of fitting, ft^2 / Area of pipe of equivalent diameter, ft^2).

$$q_{pipe} = \frac{2 * \pi * \Delta T}{\frac{1}{h * \left(D_{outer}/2\right)}}$$

Where:
q_{pipe} = *heat loss per linear foot = Btu/h/lin.ft.*

$h = total\ convective\ heat\ transfer\ factor = h_{convection} + h_{radiation}$

$h_{convection} = 0.213 * \left(\frac{\Delta T}{D}\right)^{\left(\frac{1}{4}\right)}$ [ASHRAE 2005, Ch. 3, Eq. T10.16]

T = $T_{surface} - T_{air}$
$\Delta T = T_{surface} - T_{air}$
D = Outer diameter

$$h_{radiation} = \varepsilon * \sigma * \left(T_{surface}^4 - T_{air}^4\right) \Big/ \left(T_{surface} - T_{air}\right)$$

e = emissivity of surface
s = Stefan-Boltzmann constant = 0.1714 x 10-8 Btu / (hr-ft^2-°R^4)
$T_{surface} = Temperature\ of\ surface$
$T_{air} = Average\ ambient\ air\ temperature$

Heat Transfer: Insulated Systems

Insulated systems are subject to convection, radiation, and conductive heat transfer. We ignore conductive heat transfer through the pipe/fitting material (e.g. steel, copper, PVC etc.) as this is negligible when compared to heat transfer through insulation and air convection.

$$q_{pipe} = \frac{2 * \pi * \Delta T}{\frac{ln\left(D_{outer}/D_{inner}\right)}{k} + \frac{1}{h * \left(D_{outer}/2\right)}}$$

Where:

q_{pipe} = *heat loss per linear foot = Btu/h/lin.ft.*

$$h_{convection} = 0.213 * \left(\frac{\Delta T}{D}\right)^{\left(\frac{1}{4}\right)}$$ [ASHRAE 2005, Ch. 3, Eq. T10.16]

□T = $T_{surface} - T_{air}$

$\Delta T = T_{surface} - T_{air}$

D = Outer diameter

$$h_{radiation} = \varepsilon * \sigma * \left(T_{surface}^4 - T_{air}^4\right) / \left(T_{surface} - T_{air}\right)$$

e = emissivity of surface

s = Stefan-Boltzmann constant = 0.1714 x 10-8 Btu / (hr-ft^2-°R^4)

$T_{surface}$ = *Temperature of surface*

T_{air} = *Average ambient air temperature*

L = Pipe length or fitting equivalent length

Heat Transfer for Outdoor Systems

The methods for computing heat loss for outdoor systems subject to forced convection (wind) are identical to the methods for indoors systems described above except that the formulas to compute the convective heat transfer coefficient h is more complicated. These methods are described below:

Pipes & Fittings: Outdoor Systems

The convection heat transfer coefficient is:

$$h_{convection} = Nu * k\ /D_{outer}$$

$$Nu = Nussault\ number = \ 0.3 + \frac{0.62 * Re^{\left(\frac{1}{2}\right)} * Pr^{\left(\frac{1}{3}\right)}}{\left[1 + \left(\frac{0.4}{Pr}\right)^{\left(\frac{2}{3}\right)}\right]^{\left(\frac{1}{4}\right)}} * \left[1 + \left(\frac{Re}{282{,}000}\right)^{\left(\frac{5}{8}\right)}\right]^{\left(\frac{4}{5}\right)}$$

$$Re = Reynolds\ number = \frac{V * D_{outer}}{v}$$
$\mathrm{Pr} = Prandtl\ number = 0.7\ (for\ air)$
$v = kinematic\ viscosity\ of\ air$
$V = wind\ speed$
$D_{outer} = outer\ pipe\ diameter$

Plates, Tanks, Ductwork: Outdoor Systems

The convection heat transfer coefficient for flat surfaces is estimated as follows

$$h_{convection} = Nu * k\ /D_{outer}$$

$$Nu = Nussault\ number = \ 0.415 * \ Re^{\left(\frac{1}{2}\right)} * Pr^{\left(\frac{1}{3}\right)}$$

$$Re = Reynolds\ number = \frac{V * L}{v}$$

$\mathrm{Pr} = Prandtl\ number = 0.7\ (for\ air)$
$v = kinematic\ viscosity\ of\ air$
$V = wind\ speed$
$L = width\ or\ diameter\ of\ component$

Maintenance

The maintenance staff should maintain the newly installed equipment per manufacturers' recommendations. The manufacturer specification sheets will be provided for exact maintenance requirements.

Benefits

- Fuel energy savings

24-01 Educational Program

ECM Summary

Energy Systems Group is has a corporate-wide commitment to creating environments for achievement through programs that focus on energy, the environment, and classroom education. Through hands-on curriculum, activities, and posters, ESG promotes energy efficiency and conservation in grades K-12+ and encourages students to apply what they learn in the classroom to their personal and future professional lives.

Scope of Work

The following services will be provided during 4 different phases:

4 Phases of Paterson ESIP Project

1. **Educational Program**
    a. Summer Camp
        i. Backpack Kits
            1. Coloring Books
            2. Gaming
            3. Solar panels
            4. Curriculum
        ii. STEM Program
            1. Help Develop sponsorships
        iii. Neighborhood BBQs
            1. Sampling of each ward
            2. Summer of 2018
    b. Classroom Learning
        i. Utilize 8 Schools
                a. Sampling from each ward
        ii. 10-15 Children participating
            1. CHA- Drawing Piece/Engineering
            2. TriState LED- Lighting Demo
                a. Set up demo rooms
            3. Edison Energy
                a. CHP Demonstration
            4. ESG Project Management
                a. Hard Hats
                b. Safety Glasses
                c. Computer skills training
        iii. After School
                a. 1 hour per session, 2 sessions for the year
2. **Video Case Studies**
    a. Tell the story of before and after for all schools in phase 1
        i. Go Pro Cameras
            1. Before Retrofit shots
            2. Post Retrofit shots
        ii. Professional Film Crew
            1. Board member interviews

3. **Website**
    a. Start for September

   b. Add widgets to website based on grade levels.
   c. Clear communication to the community.

4. **Marketing**
   a. Complement current modes of communication
   b. E-Blast
   c. Flyers sent home
   d. Quotes from Board Members
   e. Local media engagement.

Benefits

- Curriculum Enhancement
- Energy Education
- Behavior Modification

25-01 Refrigeration Controls (eTemp)

☑ **ENERGY SAVINGS**	***Reduce Energy Consumption 20%***
☑ **EQUIPMENT SAVINGS**	***Reduce Compressor Cycles 50%***
☑ **FOOD SAFETY**	***NSF Certified***
☑ **ENVIRONMENT**	***Reduce CO2 Emissions (Green)***
☑ **PAYS FOR ITSELF**	***Less than 2 years***

ECM Summary

The kitchens throughout Paterson District Schools contain walk-in freezers, walk-in coolers, reach-in freezers and reach-in coolers. These units are controlled by a dry bulb temperature and as a result run continuously throughout the year. Installing an **eTemp** control retrofit was assessed. The refrigeration systems usually monitor circulating air temperature in order to decide when to switch on and off. The circulating air temperature tends to rise far more quickly than the food temperature, and as result, the refrigeration unit works harder than necessary to maintain stored products at the right temperature. This, in turn, leads to excessive electricity consumption and undue wear and tear on the equipment. With **eTemp**, the thermostat regulates the refrigeration temperature based upon product temperature rather than air temperature, thereby maintaining product at the proper temperature. Savings is a result of reduced frequency of the compressor cycles, which are now based on food temperature rather than volatile air temperature. The equipment present in the schools are shown in the table below.

Facilities Recommended for this Measure

Dale Avenue	Roberto Clemente Elementary	New International High School
Eastside High School	School 12	Rev. Dr. Martin Luther King Jr.
John F. Kennedy High School	School 18	Rosa L. Parks School
New Roberto Clemente School	Early Learning Center	School 17
Norman S. Weir	Edward Kilpatrick	School 28
School 6	Silk City 2000 Academy	School 7
School 13		

Scope of Work

- Furnish and install one (1) eTemp on the following locations.
- Fit eTemp to the thermostat sensor that controls the compressor.
- Provide start up and warranty.
- Provide training for maintenance personnel.
-

Savings Methodology

Energy savings will result from reducing the compressor cycling. In general, ESG uses the following approach to determine savings for this specific measure:

Savings Calculation Method		
Pre - kW	=	Compressor (HP) x 0.746 x Pre Cycles/hr
Post - kW	=	Compressor (HP) x 0.746 x Post Cycles/hr
Summer Season Hrs (Hs)	=	Total Hrs/yr x 55%
Winter Season Hrs (Hw)	=	Total Hrs/yr x 45%
Compressor Summer Cycling (% On) (Cs)	=	55%
Compressor Winter Cycling (% On) (Cw)	=	35%
Compressor Summer Operating (Hrs)	=	Hs x Cs
Compressor Winter Operating (Hrs)	=	Hw x Cw
Savings (kW)	=	Pre – Post (KW)
Savings (kWh)	=	(Compressor Summer Operating (Hrs)+ Compressor Winter Operating (Hrs)) x (Pre – Post (KW))

Maintenance

Periodically the equipment should be checked to ensure proper operation.

Benefits

- Electrical energy savings
- Reduce compressor run-time

27-01 Legend Power

ECM Summary

The SmartGATE™ system monitors and controls incoming voltage in a facility at 3 phase 208V and 480V level. The system consists of a high-efficiency autotransformer paired with a controller that can produce voltage reductions up to 8%. When installed, SmartGATE™ monitors the incoming voltage from the grid, identifies high voltage, and in real-time, reduces the voltage of the entire facility to produce power and energy reduction.

The SmartGATE™ system always keeps the facility well within the guidelines established by ANSI C84.1-2011. If the incoming voltage supplied by the grid is temporarily too low to support a reduction, the system simply goes into by-pass mode.

Facilities Recommended for this Measure

New Roberto Clemente Elementary School

Scope of Work

- Furnish and install one (1) SmartGATE™ on the following locations.
- Provide start up and warranty.
- Provide training for maintenance personnel.

Savings Methodology

Energy savings will result from reducing the voltage of the entire facility to produce power and energy reduction. In general, ESG uses the following approach to determine savings for this specific measure:

Savings Calculation Method		
Pre - kW	=	Pre Voltage (V) x Pre-Current (A) x Power Factor
Post - kW	=	Post Voltage (V) x Post-Current (A) x Power Factor
Pre-kWh	=	Pre-kW x Hrs.
Post-kWh	=	Post-kW x Hrs.
Savings (kW)	=	Pre – Post (kW)
Savings (kWh)	=	Pre – Post (kWh)

Maintenance

Periodically the equipment should be checked to ensure proper operation.

Benefits

- Electrical energy savings

Measurement & Verification (M&V) Methodologies

This section contains a description of the types of Measurement and Verification (M&V) methodologies that Energy Systems Group will use to guarantee the performance of this project.

They have been developed and defined by two independent authorities:

- International Performance Measurement and Verification Protocol (IPMVP)
- Federal Energy Management Program (FEMP)

There are four guarantee options that may be used to measure and verify the performance of a particular energy conservation measure. Each one is described below.

Option A – Retrofit Isolation: Key Parameter Measurement

Energy savings is determined by field measurement of the key parameters affecting the energy use of the system(s) to which an improvement measure was applied separate from the energy use of the rest of the facility. Measurement frequency ranges from short-term to continuous, depending on the expected variations in the measured parameter, and the length of the reporting period.

Measurement of key parameters means that those parameters not selected for field measurement will be estimated. Estimates can be based on historical data, manufacturer's specifications, or engineering judgment. Documentation of the source or justification of the estimated parameter will be described in the M&V plan in the contract. Energy savings is determined through engineering calculations of the baseline and post-retrofit energy used based on the combination of measured and estimated parameters, along with any routine adjustments.

Option B – Retrofit Isolation: All Parameter Measurement

Like Option A, energy savings is determined by field measurement of the energy use of the systems to which an improvement measure was applied separate from the energy use of the rest of the facility. However, all of the key parameters affecting energy use are measured; there are no estimated parameters used for Option B. Measurement frequency ranges from short-term to continuous, depending on the expected variations in the savings and the length of the reporting period. Energy savings is determined through engineering calculations of the baseline and post-retrofit energy used based on the measured parameters, along with any routine adjustments.

Option C – Whole Building Metering/Utility Bill Comparisons

Option C involves the use of utility meters or whole building sub-meters to assess the energy performance of a total building. Option C assesses the impact of any type of improvement measure, but not individually if more than one is applied to an energy meter. This option determines the collective savings of all improvement measures applied to the part of the facility monitored by the energy meter. In addition, since whole building meters are used, savings reported under Option C include the impact of any other change made in facility energy use (positive or negative).

Option C may be used in cases where there is a high degree of interaction between installed improvement measures or between improvement measures and the rest of the building or the isolation and measurement of individual improvement measures is difficult or too costly.

This Option is intended for projects where savings are expected to be large enough to be discernable from the random or unexplained energy variations that are normally found at the level of the whole facility meter. The larger the savings, or the smaller the unexplained variations in the baseline, the easier it will be to identify savings. In addition, the longer the period of savings analysis after installing the improvement measure, the less significant is the impact of short-term unexplained variations. Typically, savings should be more than 20% of the baseline energy use if they are to be separated from the noise in the baseline data.

Periodic inspections should be made of all equipment and operations in the facility after the improvement measure installation. These inspections will identify changes from baseline conditions or intended operations. Accounting for changes (other than those caused by the improvement measures) is the major challenge associated with Option C-particularly when savings are to be monitored for long periods.

Savings are calculated through analysis of whole facility utility meter or sub-meter data using techniques from simple comparison to regression analysis.

Option D – Calibrated Simulation

Option D involves the use of computer simulation software to predict energy use, most often in cases where baseline data does not exist. Such simulation models must be calibrated so that it predicts an energy use and demand pattern that reasonably matches actual utility consumption and demand data from either the base-year or a post-retrofit year.

Option D may be used to assess the performance of all improvement measures in a facility, akin to Option C. However, different from Option C, multiple runs of the simulation in Option D allow estimates of the savings attributable to each improvement measure within a multiple improvement measure project.

Option D may also be used to assess just the performance of individual systems within a facility, akin to Option A and B. In this case, the system's energy use must be isolated from that of the rest of the facility by appropriate meters.

Savings are calculated using energy use simulation models, calibrated with hourly or monthly utility billing data and/or end-use metering.

Selecting M&V Options for a Specific Project

The tailoring of your specific M&V option is based on the level of M&V precision required to obtain the desired accuracy level in the savings determination and is dependent on:

- The complexity of the Energy Conservation Measure
- The potential for changes in performance
- The measured savings value.

The challenge of the M&V plan is to balance three related elements:

- The cost of the M&V Plan
- Savings certainty
- The benefit of the particular conservation measure.

Savings can also be non-measured. If savings are non-measured, these savings are mutually agreed upon as achieved at substantial completion of the respective facility improvement measure and shall not be measured or monitored during the term of the performance contract. Non-measured energy savings are limited to no more than 10-15% of the overall project savings.

Recommended Performance Verification Steps

Energy Systems Group's performance verification methods are designed to provide the facility's administration with the level of M&V necessary to protect them from an under-performing ECM yet have a minimal impact on the project's financial success.

The selection of the M&V methods to be used is based on the criteria as detailed by IPMVP and Energy Systems Group's experience with hundreds of successful performance contracts in the K-12, state, and local government sectors. Following is a table illustrating how the savings of the major energy conservation measures proposed for this project will be verified.

ECM Description	Measurement and Verification Method - Summary	Detail of M&V Methodology
Interior LED Lighting (including lighting occupancy sensors)	Option A: One-time pre and post-retrofit kW measurement. Burn hours agreed upon with school district.	Pre M&V: Lighting power readings will be taken on a sample of lighting fixtures. Lighting burn hours were measured through the use of light loggers during the Phase 1 project and those hours will be used for this phase of the project. Post M&V: Lighting power readings will be taken on a sample of lighting fixtures. Measurements will occur once at the outset of the agreement. "Occupied" hours logged during the baseline data collection will be used as the post-installation burn hours. Energy Savings: Energy savings will be calculated using the actual measured wattage reduction and measured burn-hours.
Building Envelope	Option A: Savings are from the improved building envelope.	Pre M&V: The size of the cracks and joint deficiencies will be verified during the field audit. Post M&V: Once the installation is completed, the areas identified for infiltration reduction will be verified to be completed through the final as-built. Energy Savings: Savings are from the improved building envelope.
HVAC Piping Insulation	Option A: Savings are from installing pipe insulation and insulation blankets.	Pre M&V: The surface temperature and the size of the space requiring insulation installation were measured during the field audit. Post M&V: Following installation, the size and the surface temperature of the space where the insulation is installed will be verified. Energy Savings: Savings are from a reduction in heat loss through uninsulated pipes and valves.
Boiler Replacement (w/Steam)	Option A: Baseline energy consumption based on collected field data and combustion efficiency of existing boilers. Post	Pre M&V: Energy Systems Group will take a combustion efficiency test to verify the efficiency of existing boilers and estimate the fuel consumption of existing boilers based on collected field data and utility bills.

	installation energy consumption based on combustion efficiency of new boilers.	Post M&V: Energy Systems Group will take a combustion efficiency test to verify the efficiency of new boilers. Energy Savings: Savings for the new boilers will be determined using the base heating load and the difference in efficiencies between the existing boilers and new boilers.
Refrigeration Controls (E-Temp)	Non-Measured: Savings are from the reduced electric consumption of freezer and refrigerator.	Pre M&V: Manufacturer's data and operating parameters will be collected on the freezer and refrigerator. Post M&V: Once the installation is completed, the walk-in box control system will be inspected to ensure proper operation. Energy Savings: Savings are from the reduced electric consumption of freezer and refrigerator.
Combined Heat and Power	Option B: Savings are from the electric and heat provided by the cogeneration system.	Pre M&V: The baseline utility bills were analyzed to determine baseline heating and electric loads and the time that the cogeneration system is able to operate per year and the capacity of the cogeneration system. Post M&V: The electric generation output from the cogeneration system will be measured with an electric meter. The heat output from the cogeneration system will be determined by measuring the water inlet/outlet temperature and flow rate. The gas input to the cogeneration system will be measured with a gas meter. Combined, these data points will be used to verify the conversion efficiency of the cogeneration system. Energy Savings: Savings are from the electric and heat provided by the cogeneration system.
Steam Trap Replacements	Option A: Savings are from replacing failed working steam traps and/or fixing steam trap leakage.	Pre M&V: The existing steam traps were quantified during the field audit. Assumptions were made and agreed upon for failed and leaking traps. Post M&V: Following installation, the size and the quantities installed will be verified. Energy Savings: Savings are from a reduction in loss through leaking trap.
Building Automation Controls Upgrades - Central Plant	Option A: Savings are from implementing control strategies.	Pre M&V: Accepted engineering practices will be used to calculate energy consumption baselines. Field inspections and interviews with staff provided equipment operating schedules and conditions. Operating parameters of the system will be verified through BAS system. The temperature loggers and motor loggers will be installed to determine the space temperature and motor operation schedule where applicable on an as needed basis. Post M&V: Various control points within the

		building management system will be trended and/or totalized. Data logging equipment will also be deployed on an as needed basis. This data will be used to verify that all control strategies are in place and functioning as intended. Energy Savings: Savings are from implementing control strategies.
Building Automation Controls Upgrades - Primary AHUs	Option A: Savings are from implementing control strategies.	Pre M&V: Accepted engineering practices will be used to calculate energy consumption baselines. Field inspections and interviews with staff provided equipment operating schedules and conditions. Operating parameters of the system will be verified through BAS system. The temperature loggers and motor loggers will be installed to determine the space temperature and motor operation schedule where applicable on an as needed basis. Post M&V: Various control points within the building management system will be trended and/or totalized. Data logging equipment will also be deployed on an as needed basis. This data will be used to verify that all control strategies are in place and functioning as intended. Energy Savings: Savings are from implementing control strategies.
Boiler Controllers - Intellidyne	Non-Measured: Savings are from the optimized on and off cycles of the burner ignition	Pre M&V: Manufacturer's data and existing operating parameters will be collected on the boilers. Post M&V: The boiler controllers will be inspected following installation to verify proper operation Energy Savings: Savings are from the optimized on and off cycles of the burner ignition.
Demand Response - Energy Efficiency Credit	Non-Measured: Savings are from participating in the Energy Efficiency program of PJM with a permanent reduction in electric energy consumption.	Pre M&V: ESG will determine the energy efficiency value based on the FIM strategies proposed. kW measurement may be taken on a sample of equipment that will be replaced. Post M&V: ESG will verify the equipment are installed and operating properly. kW measurement may be taken on a sample of equipment that are installed. Loggers will be installed to verify the coincident factor Energy Savings: Savings are from participating in the Energy Efficiency program of PJM with a permanent reduction in electric energy consumption.
Legend Power	Non-Measured: This measure is a test installation from the manufacturer	Energy Savings: Savings are from reduction in the voltage of the entire facility to produce power.

Exhaust Fan Motor Replacement	Option A: Savings are from the improved fan motor efficiency	Pre M&V: Power readings (kW) will be taken on sample motors. Post M&V: Power readings (kW) will be taken on sample of motors. Measurements will occur once at the outset of the agreement. Operating hours agreed upon with Owner will be used for post operating hours. Energy Savings: Savings are from reduction in kW.
VFDs on Hot Water Pumps	Option A: Savings are from the reduced operating hours of the plugged in equipment.	Pre M&V: One time measurement of kW draw at constant speed will be performed. Annual hours of operation are agreed upon. Post M&V: Once the installation is complete, the VFD's will be inspected to ensure proper operation. A onetime verification of operating conditions verifying motors are being operated at part load will be performed. One time measurement of kW draw will be performed at different speeds. Annual hours of operation at specific speeds are agreed to per the calculation. Energy Savings: Savings are from the reduced kW load of the equipment at reduced speed.
Destratification Fans	Non Measured: Savings are from installing destratification fans eliminate waste heat energy	Pre M&V: Assumptions were determined for roof "U" value and square footage from audit. Post M&V: New equipment will be inspected following installation to ensure proper operation. Energy Savings: Savings are from the reduced heating costs required.
Liquid Pool Cover	Non Measured: Savings are from reduction in hot water evaporation	Pre M&V: Existing conditions in the pool room are inspected from audit. Post M&V: Once the installation is completed, the Liquid Pool Cover discharge system and the timer will be inspected to verify proper operation to release the liquid as required. Energy Savings: Savings are from reduced evaporation of hot water.
Pool System Upgrades	Non Measured: Savings are from new filtration system and upgraded pool pump with VFD	Pre M&V: Manufacturer's data and operating parameters will be collected on the existing Pool System (PS). The efficiency of the existing PS will be determined from manufacturer's documentation. Post M&V: Once the installation is completed, the new Pool System will be inspected to verify if they are working properly. The efficiency of the new Pool systems will be determined from manufacturer's written documentation. Energy Savings: Savings are from reduced electric usage and reduction in hot water leakage in the filtration system.

Data Analytics	Non Measured: Savings are from Data collected and analysis of all the HVAC equipment to ensure they are working as expected.	Pre M&V: Accepted engineering practices / building simulations will be used to calculate energy consumption baselines. Operating parameters of the system will be verified through BAS system. Post M&V: Various control points within the building management system will be trended and/or totalized. This data will be used to verify that all control strategies are in place and functioning as intended. Energy Savings: Savings are from optimizing the operation of the HVAC equipment to ensure they are working as expected.
RTU Replacement	Option A: Savings are from high efficiency Roof top units.	Pre M&V: Manufacturer's data and operating parameters will be collected on the existing Roof Top Units (RTUs). The EER of the existing RTUs will be determined from manufacturer's documentation. Post M&V: Once the installation is completed, the new RTUs will be inspected to verify if they are working properly. The EER of the new RTUs will be determined from manufacturer's written documentation. Energy Savings: Savings are from increased RTU operational efficiency
Domestic Fixtures (Sink Faucets)	Non Measured: Savings are from the reduced flow rate of the faucets *Note: Energy Savings will only be claimed for actual number of aerators installed*	Pre M&V: Manufacturer's data and operating parameters will be collected on the existing devices. The flow rates of the existing devices will be determined through the test. Post M&V: Once the installation is completed, the new devices will be inspected to verify if they are working properly. Energy Savings: Savings are from reduced hot water flow through the device.
Air Cooled Chiller Refurbishment	Non Measured: Savings are from the increased efficiency of the chiller.	Pre M&V: Manufacturer's data and operating conditions will be visually collected on the existing chiller to determine the efficiency. Post M&V: Once the chiller is refurbished, the chiller will be inspected to verify the chiller operation. Energy Savings: Savings are from improved efficiency of the chiller.

Measurement and Verification Services

Measurement and Verification Services will be provided in association with the guarantee provided by Energy Systems Group. The guarantee will be in effect for each year that the District elects to participate in the Measurement and Verification Services. The cost of the measurement and verification services is included in the business case in the "Annual Services" column as outlined in the table below:

Year	Annual Amount ($/Yr)
1	$60,669
Total	$60,669

ESG will provide the M&V Services set forth below in connection with the Assured Performance Guarantee.

- During the Installation Period, an ESG Performance Engineer will track Measured Project Benefits. ESG will report the Measured Project Benefits achieved during the Installation Period, as well as any Non-Measured Project Benefits applicable to the Installation Period, to Customer within 60 days of the commencement of the Guarantee Term.
- Within 60 days of each anniversary of the commencement of the Guarantee Term, ESG will provide Customer with an annual report containing:
  - An executive overview of the project's performance and Project Benefits achieved to date;
  - A summary analysis of the Measured Project Benefits accounting; and
  - Depending on the M&V Option, a detailed analysis of the Measured Project Benefits calculations.
- During the Guarantee Term, an ESG Performance Engineer will monitor the on-going performance of the Improvement Measures, as specified in this Agreement, to determine whether anticipated Measured Project Benefits are being achieved. The Performance Engineer will visit Customer regularly and assist Customer on-site or remotely, with respect to the following activities:
  - Review of information furnished by Customer from the facility management system to confirm that control strategies are in place and functioning;
  - Advise Customer's designated personnel of any performance deficiencies based on such information;
  - Coordinate with Customer's designated personnel to address any performance deficiencies that affect the realization of Measured Project Benefits; and
  - Inform Customer of opportunities to further enhance project performance and of opportunities for the implementation of additional Improvement Measures.
  - Track utility bills on a monthly basis to determine current utility rate costs and to identify any billing anomalies.
- For specified Improvement Measures, ESG will:
  - Conduct pre and post installation measurements required under this Agreement;
  - Confirm the building management system employs the control strategies and set points specified in this Agreement; and
  - Analyze actual as-built information and adjust the Baseline and/or Measured Project Benefits to conform to actual installation conditions (e.g., final lighting benefits calculations will be determined from the as-built information to reflect the actual mix of retrofits encountered during installation).

- o Confirm that the appropriate metering and data points required to track the variables associated with the applicable Improvement Measures' benefits calculation formulas are established; and
- o Set up appropriate data capture systems (e.g., trend and totalization data on the facility management system) necessary to track and report Measured Project Benefits for the applicable Improvement Measure.

Maintenance Impacts/ On-Going Service

New pieces of equipment that are installed as part of the ESIP project will be provided with the standard manufacturer warranty. Once installation of the equipment is complete, the remaining warranty period will be transferred to Paterson Public Schools; any warranty issues will be handled directly with the equipment manufacturer rather than with Energy Systems Group.

a) ESG subcontractors will warranty the installation for a period of 12 months, beginning at substantial completion.

b) In addition, ESG will facilitate warranty related issues for a period of 12 months, beginning at substantial completion. Extended manufacture warranties beyond the 12-month installation warranty period will be facilitated by the District.

The installation of the recommended measures will reduce the amount of emergency maintenance required by the district through the installation of new equipment; however, preventative maintenance is still required in order to ensure the correct operation of the equipment for the expected lifetime. A service agreement cannot be included as part of this project per the New Jersey Local Finance Notice 2009-11. Once the scope is finalized and bids are received, Energy Systems Group will assist the District in preparing bids for any preventative service agreement that is felt necessary for the new equipment. The service agreement will cover recommended maintenance per each equipment manufacturer. Training on the proper maintenance and operation of each piece of equipment has also been included as part of the ESIP project which will allow the District to complete the majority of maintenance and repair in-house in order to utilize District resources.

In order to ensure the District is fully capable of achieving the energy savings and fully utilizing the new HVAC and Building Automation Systems, Energy Systems Group has included training for district employees.

Energy Systems Group recommends the District go out to bid for the following 3rd party service contracts in order to achieve the continuous savings throughout the term of the Energy Savings Improvement Program:

- Cogeneration Service Agreement to allow for emergency service and preventative maintenance on the new cogeneration systems. In order to receive the incentives for the cogeneration system, a 10-year maintenance contract must be in place. Energy Systems Group has shown the savings paying for this maintenance agreement but has not included the agreement within the ESIP.

Services for Lighting, Boiler Replacements, Combined Heat and Power, Plug Load Management, and walk-in freezer controller upgrades, such as filter changes and on-going maintenance can be completed by District staff.

Design and Compliance Issues

Paterson Public Schools will work closely with Energy Systems Group and Highland Resource Group (HRG) to oversee and complete all design engineering for the purposes of public bidding of the work as well as completing construction drawings.

As part of the Energy Savings Plan development, Energy Systems Group completed a thorough analysis of the building electrical and mechanical systems including light level readings throughout the spaces. The existing light levels are typically within 10-20% of current Illumination Engineering Society (IES) recommendations, which is reasonable given the varying age of lamps throughout the District. The proposed lighting solution will continue to adhere to current IES and NJ Education Code guidelines for light levels, which in many cases may increase the current light levels to the spaces. At this time, Energy Systems Group did not observe any compliance issues in the development of this Energy Savings Plan.

Customer Risks

Asbestos reports were obtained and reviewed for all schools as part of Energy Systems Group's safety policy. Based on the reports, asbestos materials will have to be abated prior to any work being performed. If any additional asbestos is found during the installation of the measures, Energy Systems Group will stop work and notify the School District. Any work associated with testing or remediation of asbestos containing material will be the responsibility of Paterson Public Schools. Based on the asbestos reports provided, we feel this is a low risk item.

The NJ SmartStart, Pay for Performance, Demand Response Energy Efficiency Credit, and Combined Heat and Power Incentives outline the anticipated incentive amounts to Paterson Public Schools. Energy Systems Group does not guarantee the rebate or state incentive structure. If the programs change or the incentive amounts differ, Paterson Public Schools will be responsible to make up the difference in received incentives for the financing. The difference could result from over performance of energy conservation measures, other rebates/ incentives that may be available, restructuring the loan payment for years 1 and 2, or capital contributions by the District.

Public Engagement and Community Outreach

Student Engagement in ESIP Development: ESG has involved students at all levels in the energy related fields. At Paterson, we plan to **expand on interests related to energy conservation throughout the district and would welcome and actively encourage student involvement in various phases of the proposed project. Furthermore, in line with our commitment, and with Paterson's concurrence, we propose to offer presentations to Energy Clubs, including them in** the process.

STEM EXPO Sponsorship: ESG has a history of sponsoring STEM programs for many school districts and Universities across the country. If selected, ESG would like to sponsor the Paterson's Annual STEM EXPO and further complement your Engineering/Technology Science curriculum.

Community Outreach Program: ESG is focused on creating a partnership with Paterson Public Schools that will extend beyond the scope of this project. Keeping the community informed and involved in the process is key to success. One way this can be achieved is thru a ***Community Scholarship Program.*** At Northern Illinois University (NIU), ESG established The **Energy Systems Group Scholarship Award in Engineering** to underscore our commitment. Established in 2001, ESG and NIU jointly select students for award of this scholarship. To date, we have awarded **$35,000** to NIU engineering students with superior academic excellence. ESG would like to establish a similar program for Paterson Public Schools.

ESG will seek to develop and build partnerships between The National Education Foundation (NEF) and the Paterson Public Schools. These partnerships were developed by ESG and the NEF, to bring engineering and engineering technology career opportunities to students through the educational programs offered by the University of Salt Lake City Utah. These programs help students who might not otherwise consider careers in these sciences or further expand the knowledge of the children who are participating in such class. In addition, this affords local colleges and Universities the opportunity to recruit future applicants from the local school boards. Some of these programs are listed below:

Student Engagement in ESIP Development: ESG has involved students at all levels in the energy related fields. At EBPS, we plan to **expand on interests related to energy conservation throughout the EBPS campus and would welcome and actively encourage student involvement in various phases of the proposed project. Furthermore, in line with our commitment, and with EBPS's concurrence, we propose to offer presentations to Energy Clubs, including them in** the process.

Solar Photovoltaic Systems at Work Grades 9-12: This program includes learning activities for the secondary levels and a supply kit to investigate solar energy and its uses. Additional instructional materials include the Renewable Energy Sources poster, Energist, the Electrical Generation poster and Energist, the Energy Basics CD, and the Eye Chart poster. The program can stand alone or complement Energy Fun, Energy Fundamentals, Energy Action Technology, or Energy Action Patrol.

Career Exploration, grades 11-12: Provides students with career related work experience while obtaining up to 40 hours of academic credit. The program allows students a superb opportunity to integrate classroom theory into the world of work, as well as providing career option exploration, skill development, work environment exposure, and professional contacts.

SECTION 7: IMPLEMENTATION SCHEDULE

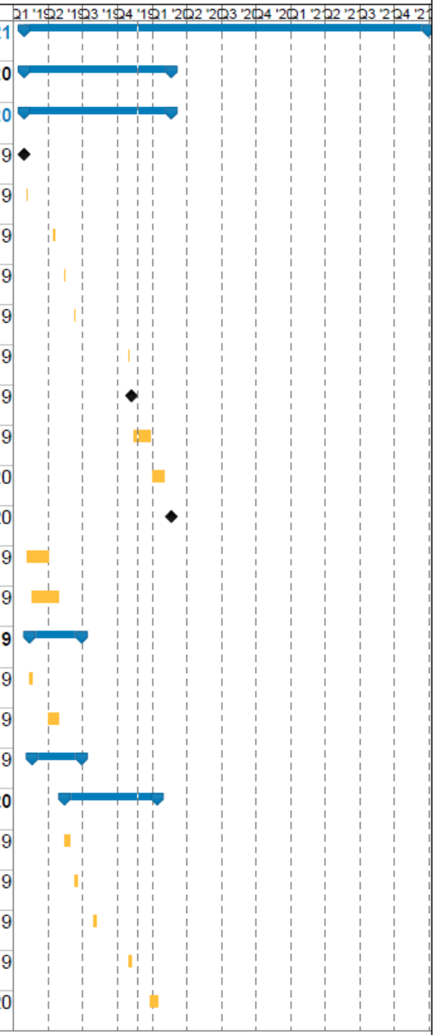
A preliminary installation schedule for the measures implemented as part of the ESP is included below to provide a reasonable expectation for the timeline of construction. Once final bids are received and financing of the project is complete, the installation will be finalized in much greater detail and reviewed with the team from Paterson Public School District to ensure agreement. A high-level review of the next steps in the process is shown below as well as the estimated time frame to complete each step:

- Accept Energy Savings Plan Pending Necessary Reviews – Dec 11, 2019
- Complete Third Party Engineering Review of Energy Savings Plan – 2 weeks (Dec12 - Dec27)
- Complete Board of Public Utilities Review of Energy Savings Plan – 14 days (Dec30 - Jan14)
- Approval resolution to contract with Energy Systems Group: Feb 19, 2020
- Financing of project: 3 Months (Dec 2019 – Feb 2020)
- Complete 100% design drawings and bid specifications – February 20, 2020
- Public bidding for Sub-Contractors – May - June 2020
- Installation – Feb 2020 (COOP) - Dec 2021
- Maintenance: On-going

The project plan on the following page details the Installation Phase schedule.

Paterson Public Schools
ESP Development & Installation Schedule

ID	Task Name	Duration	Start	Finish
1	**Paterson Public Schools Installation**	**761 days**	**Mon 1/28/19**	**Mon 12/27/21**
2	**Phase 1: Investment Grade Audit/ Energy Savings Plan**	**278 days**	**Mon 1/28/19**	**Wed 2/19/20**
3	**Major Milestone**	**278 days**	**Mon 1/28/19**	**Wed 2/19/20**
4	Signed Investment Grade Audit Agreement	0 days	Mon 1/28/19	Mon 1/28/19
5	Customer Kick-off Workshop	2 hrs	Mon 2/4/19	Mon 2/4/19
6	Baseline Utility Workshop	2 hrs	Tue 4/16/19	Tue 4/16/19
7	ECM Verification Workshop	2 hrs	Tue 5/14/19	Tue 5/14/19
8	Measurement & Verification Workshop	2 hrs	Tue 6/11/19	Tue 6/11/19
9	Business Case Workshop	2 hrs	Tue 10/29/19	Tue 10/29/19
10	IGEA Results Presented to Board	0 hrs	Wed 11/6/19	Wed 11/6/19
11	3rd Party Engineering Review	6 wks	Wed 11/13/19	Tue 12/24/19
12	Submit Energy Savings Plan to BPU for Review	21 days	Thu 1/2/20	Thu 1/30/20
13	Board Approval & Acceptance of ESP & ESG Contract	0 days	Wed 2/19/20	Wed 2/19/20
14	Detailed Site Visits	8 wks	Mon 2/4/19	Mon 4/1/19
15	Scope Design & Construction Cost Estimating	10 wks	Mon 2/18/19	Mon 4/29/19
16	**Detailed Energy Analysis**	**99.5 days**	**Mon 2/11/19**	**Fri 6/28/19**
17	Update Utility Bills	1 wk	Mon 2/11/19	Mon 2/18/19
18	Energy Saving Calculations	4 wks	Mon 4/1/19	Mon 4/29/19
19	Data Logging	94.5 days	Mon 2/18/19	Fri 6/28/19
31	**ESP Report Development**	**174.5 days**	**Tue 5/14/19**	**Mon 1/13/20**
32	Detailed Scope Write-up	10 days	Tue 5/14/19	Tue 5/28/19
33	Detailed Energy Savings Analysis	5 days	Tue 6/11/19	Tue 6/18/19
34	Develop Business Case	5 days	Tue 7/30/19	Tue 8/6/19
35	Energy Savings Plan Appendix	1 wk	Wed 10/30/19	Tue 11/5/19
36	Project Financing	14 days	Wed 12/25/19	Mon 1/13/20



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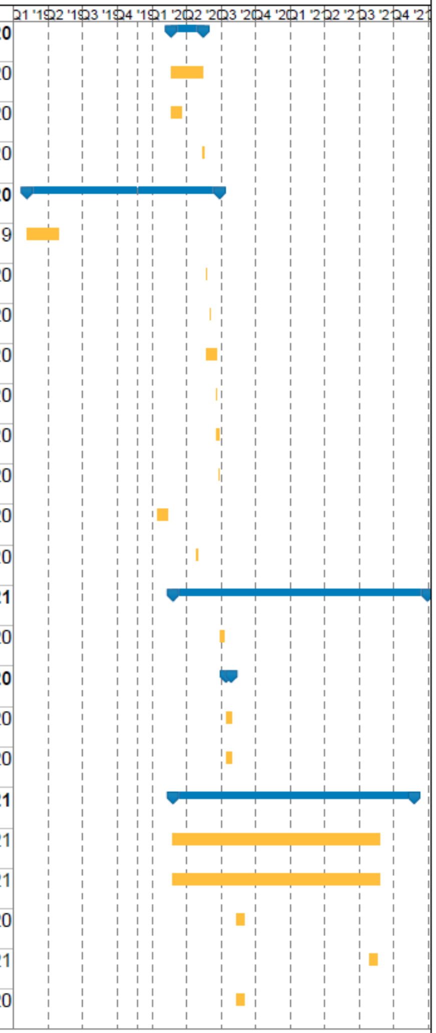
Paterson Public Schools
ESP Development & Installation Schedule

ID	Task Name	Duration	Start	Finish
37	**Phase 2: Design**	**61 days**	**Thu 2/20/20**	**Thu 5/14/20**
38	Final Design Engineering	12 wks	Thu 2/20/20	Wed 5/13/20
39	Bid Specification Development	4 wks	Thu 2/20/20	Wed 3/18/20
40	Final Design Review Workshop	1 day	Thu 5/14/20	Thu 5/14/20
41	**Phase 3: Procurement**	**364.75 days**	**Mon 2/4/19**	**Fri 6/26/20**
42	Pay for Performance	60 days	Mon 2/4/19	Mon 4/29/19
43	Advertise Bids	1 day	Fri 5/22/20	Fri 5/22/20
44	Pre-Proposal Conference & Site Visits	1 day	Mon 6/1/20	Mon 6/1/20
45	Bid Duration for Subcontractors	4 wks	Fri 5/22/20	Thu 6/18/20
46	Opening of Bids	1 hr	Thu 6/18/20	Thu 6/18/20
47	Evaluation of Bids and Confer on Selection of Sub-Contractors	1 wk	Fri 6/19/20	Thu 6/25/20
48	Subcontractor Selection	1 day	Fri 6/26/20	Fri 6/26/20
49	Release Lighting Material COOP	4 wks	Tue 1/14/20	Mon 2/10/20
50	Release Roofing Subcontractor	1 day	Tue 4/28/20	Tue 4/28/20
51	**Phase 4: Construction**	**480 days**	**Tue 2/25/20**	**Mon 12/27/21**
52	Issue Subcontracts	1 wk	Tue 6/30/20	Mon 7/6/20
53	**Pre- Construction Activities**	**10 days**	**Tue 7/14/20**	**Mon 7/27/20**
54	Planning / Engineering	10 days	Tue 7/14/20	Mon 7/27/20
55	Shop Drawing Approval	10 days	Tue 7/14/20	Mon 7/27/20
56	**Installation of Recommended ECMs**	**455 days**	**Tue 2/25/20**	**Mon 11/22/21**
57	Lighting Upgrades - LED	390 days	Tue 2/25/20	Mon 8/23/21
58	Lighting Upgrades - LED, Direct Install	390 days	Tue 2/25/20	Mon 8/23/21
59	Exhuast Fan Motor Replacement	15 days	Tue 8/11/20	Mon 8/31/20
60	VFDs on HW Pumps	15 days	Tue 7/27/21	Mon 8/16/21
61	Destratification Fans	15 days	Tue 8/11/20	Mon 8/31/20



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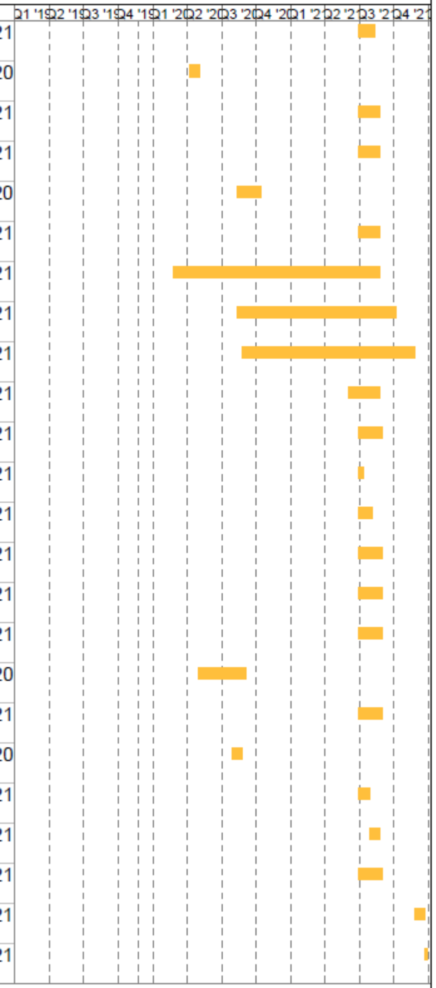
Paterson Public Schools
ESP Development & Installation Schedule

ID	Task Name	Duration	Start	Finish
62	Auditorium Air Conditioning (2) 20 Ton	30 days	Tue 6/29/21	Mon 8/9/21
63	Chiller Refurbishment	20 days	Tue 4/7/20	Mon 5/4/20
64	Gymnasium Air Conditioning (2) 20 Ton	40 days	Tue 6/29/21	Mon 8/23/21
65	Steam Boiler Replacement	40 days	Tue 6/29/21	Mon 8/23/21
66	Boiler Controls / Intellidyne	45 days	Tue 8/11/20	Mon 10/12/20
67	RTU Replacement	40 days	Tue 6/29/21	Mon 8/23/21
68	DI HVAC Controls - Direct Install	390 days	Tue 2/25/20	Mon 8/23/21
69	Building Controls - Central Plant	300 days	Tue 8/11/20	Mon 10/4/21
70	Building Controls - Distributions (AHU/RTU)	325 days	Tue 8/25/20	Mon 11/22/21
71	Building Envelope Upgrades	60 days	Tue 6/1/21	Mon 8/23/21
72	Domestic Fixtures (Sink Faucets)	45 days	Tue 6/29/21	Mon 8/30/21
73	Liquid Pool Cover	10 days	Tue 6/29/21	Mon 7/12/21
74	Pool System Upgrades	25 days	Tue 6/29/21	Mon 8/2/21
75	Cogeneration 35kw	45 days	Tue 6/29/21	Mon 8/30/21
76	DHW Heater Replacement	45 days	Tue 6/29/21	Mon 8/30/21
77	Steam Trap Replacements	45 days	Tue 6/29/21	Mon 8/30/21
78	Roof Restoration	90 days	Wed 4/29/20	Tue 9/1/20
79	HVAC Piping Insulation	45 days	Tue 6/29/21	Mon 8/30/21
80	Educational Program	20 days	Tue 7/28/20	Mon 8/24/20
81	Refrigeration Controls (E-Temp)	20 days	Tue 6/29/21	Mon 7/26/21
82	Legend Power	20 days	Tue 7/27/21	Mon 8/23/21
83	Energy Metering Upgrades	45 days	Tue 6/29/21	Mon 8/30/21
84	System Commissioning	4 wks	Tue 11/23/21	Mon 12/20/21
85	Project Close Out	5 days	Tue 12/21/21	Mon 12/27/21



Page 3 Mon 11/25/19

SECTION 8. SAMPLE ENERGY PERFORMANCE CONTRACT

A sample Energy Performance Contract has been provided electronically to the District for review.

APPENDIX 1. ENERGY CONSERVATION MEASURES INVESTIGATED BUT NOT RECOMMENDED AT THIS TIME

ECM: Install Occupancy- Based Light Sensors

ECM Summary

Older buildings do not have a neutral or ground in the switch box. They rely on older conduit that can be compromised because of age. Sensors today rely on technology that requires a ground. The next code cycle will not allow sensors to be installed with just a ground, anywhere there is not a good ground a sensor cannot be installed. Also, during special circumstances (School Lockdowns) lights off is a protocol for classrooms during lockdown. If the sensor is overridden, the lights will go off but only for the period of time out set and will go on if there is any movement in the classroom.

Facilities Considered for this Measure

- All buildings

ECM: Pool HVAC Upgrades

ECM Summary

- Norman S. Weir

Facilities Considered for this Measure

- All buildings

ECM: Replace Furnaces with High Efficiency Furnaces

ECM Summary

We recommend replacing existing standard efficiency furnaces with condensing furnaces. Improved combustion technology and heat exchanger design optimize heat recovery from the combustion gases which can significantly improve furnaces efficiency. The proposed systems will reduce heating costs compared to the existing equipment and will include DDC controls that can be easily integrated into the proposed Building Management System.

Facilities Considered for this Measure

- Department of Facilities

ECM: Window Film – Solar/Security Film

ECM Summary

Security window film mitigates hazards from shattered glass during natural disasters. Helps protect people from flying glass shards, one of the most common causes of blast-related injuries and fatalities. Micro-layered and tear resistant to help increase security and provide added protection against smash and grab burglaries. Solar Film shields ultraviolet rays in order to maintain heat loss and gain year-round. Total run time for air conditioning is often reduced in the summer, while heat is retained indoors during the colder months.

Facilities Considered for this Measure

- All buildings

ECM: Gosaver Fuel Catalyst Reformer

ECM Summary

GOsaver is a non-additive fuel reforming catalyst that improves oil, propane, natural gas and biodiesel combustion enabling it to burn hotter and more completely thereby releasing more of the BTUs that are already in the fuel - BTUs that are not being utilized now. With GOsaver, less fuel is needed to obtain the same amount of heat.

Facilities Considered for this Measure

- All buildings

APPENDIX 2. ENERGY SAVINGS CALCULATIONS

Energy Savings

Energy savings were calculated using an Excel based bin calculation workbook developed by Energy Systems Group; all savings calculations and field measurements will be provided electronically.

Operational Savings

New LED Fixtures

Annual operational savings are calculated based on the reduced amount of material needed for replacement of the lighting system. This is calculated by comparing the existing lifetime of the T8, HID and halogen lamps to the new lifetime of LED lighting. The calculations are based on replacements of T8 fixtures every three years, T8 ballasts every 5 years, HID lamps every 5 years and halogen lamps being replaced every 2 years. The table below highlights the various lamp types and associated replacement timing as well as total cost with replacement. These savings do not include any costs for labor to replace the bulbs or additional material needed for replacement such as lifts, replacement fixtures, new sockets, etc.

Material Type	Lifetime	Cost/ Unit
Linear fluorescent (T8)	3 years	$5
Electronic Ballast	5 years	$25
HID Lamp	5 years	$25
HID Ballast	5 years	$75
Halogen, PARs, BRs	2 years	$10
Incandescent, CFLs, MRs	2 years	$2

This methodology is used to determine the annual savings through the replacement of all lamp types with new LED lamps and fixtures. The fixture warranty associated with each of these replacements is 10 years. Operational savings have been claimed for a total of 5 years per the BPU regulations.

Mechanical Upgrades (Boiler Replacement & Controls Upgrades)

The annual operating expenses for Paterson Public Schools was provided to Energy Systems Group in order to determine the amount of emergency repair maintenance conducted annually at the District. The installation of new equipment along with manufacturers' warranties will effectively eliminate the need for these emergency repair costs. The operational savings for these measures have been claimed for 2 years per the BPU regulations. A complete breakdown of the operational analysis for the District is included on the following pages.

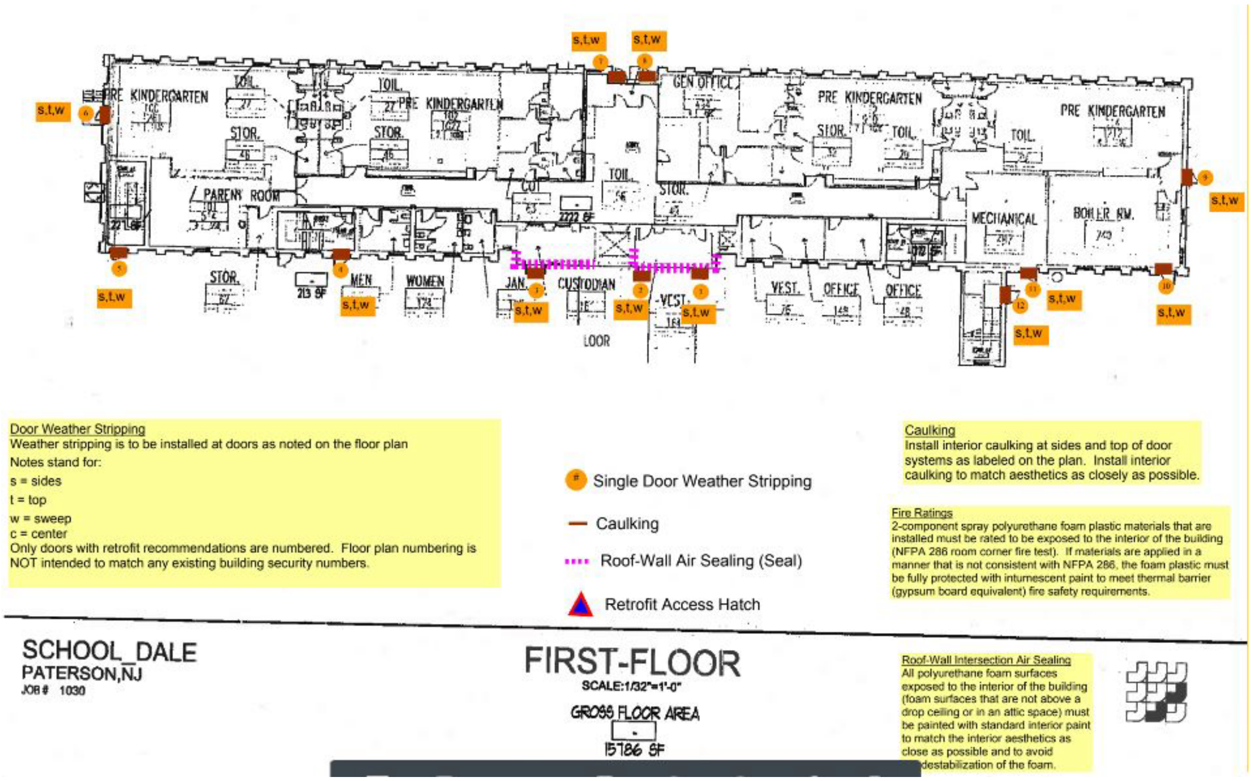
Operational Savings Summary

Energy Systems Group has worked with the District to quantify the exact sources of savings by going through past invoices and expenses. The table below summarizes the cost savings estimated from invoices provided by the District; these invoices are summarized only by the applicable ECMs and any non-recurring charge. Any preventative maintenance or service contracts that will remain were not factored into this analysis. The complete list of invoices is provided electronically. The operational savings will not be escalated.

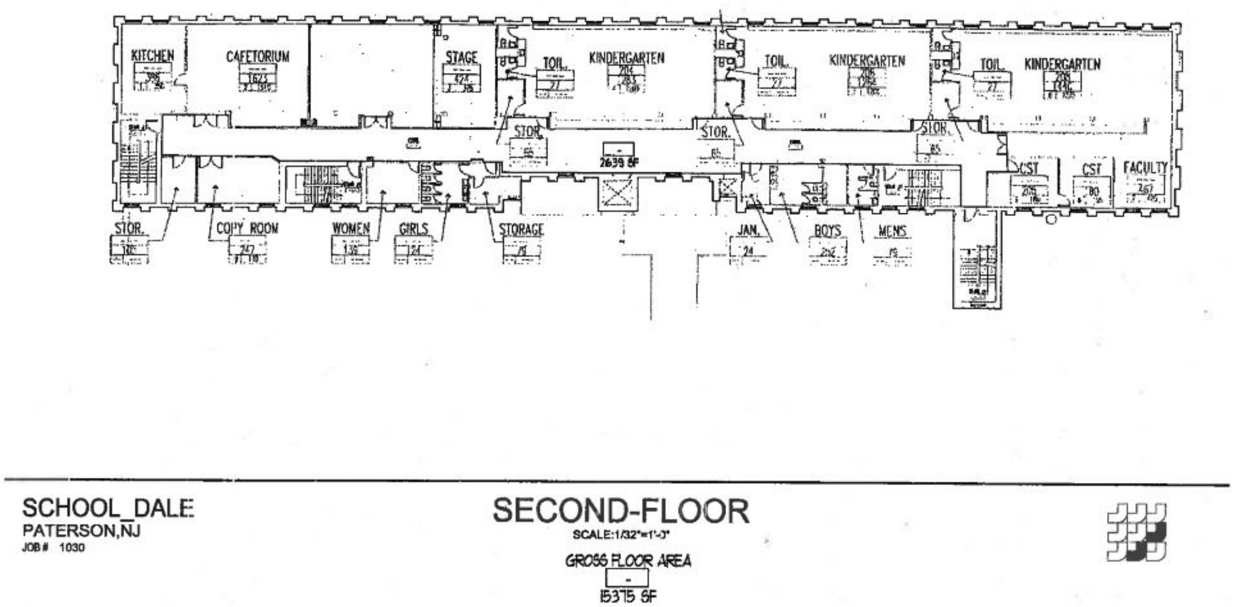
Operational Savings for Financial Model	
ECM Description	**Annual Savings**
LED Lighting Upgrades & Occupancy Sensors – District Wide (24 Schools)	$ 215,092
Direct Digital Controls (DDC) Upgrade – District Wide, Boiler Replacement – Steam Boilers – Dale Avenue	$ 387,782
Totals	**$ 602,874**

APPENDIX 3. BUILDING ENVELOPE SCOPE DRAWINGS

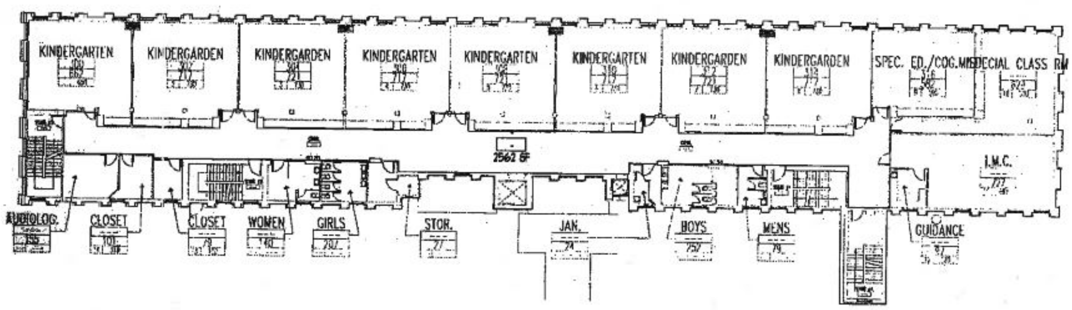
Dale Avenue



No Work Recommended on this Floor



No Work Recommended on this Floor



SCHOOL_DALE
PATERSON,NJ
JOB# 1030

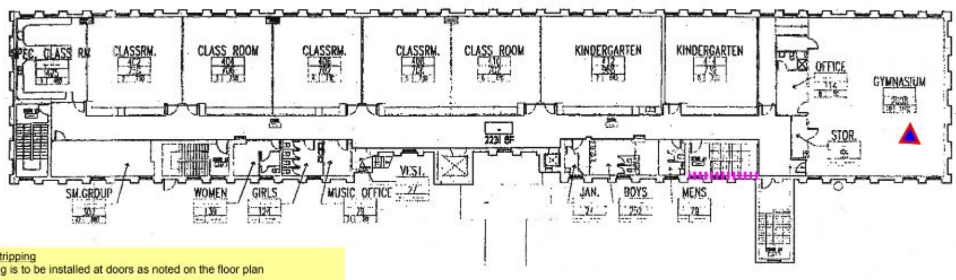
THIRD-FLOOR
SCALE:1/32"=1'-0"
Unnamed
15315 SF

Page 32

Roof-Wall Intersection Air Sealing
All polyurethane foam surfaces exposed to the interior of the building (foam surfaces that are not above a drop ceiling or in an attic space) must be painted with standard interior paint to match the interior aesthetics as close as possible and to avoid UV-destabilization of the foam.

Caulking
Install interior caulking at sides and top of door systems as labeled on the plan. Install interior caulking to match aesthetics as closely as possible.

Fire Ratings
2-component spray polyurethane foam plastic materials that are installed must be rated to be exposed to the interior of the building (NFPA 286 room corner fire test). If materials are applied in a manner that is not consistent with NFPA 286, the foam plastic must be fully protected with intumescent paint to meet thermal barrier (gypsum board equivalent) fire safety requirements.



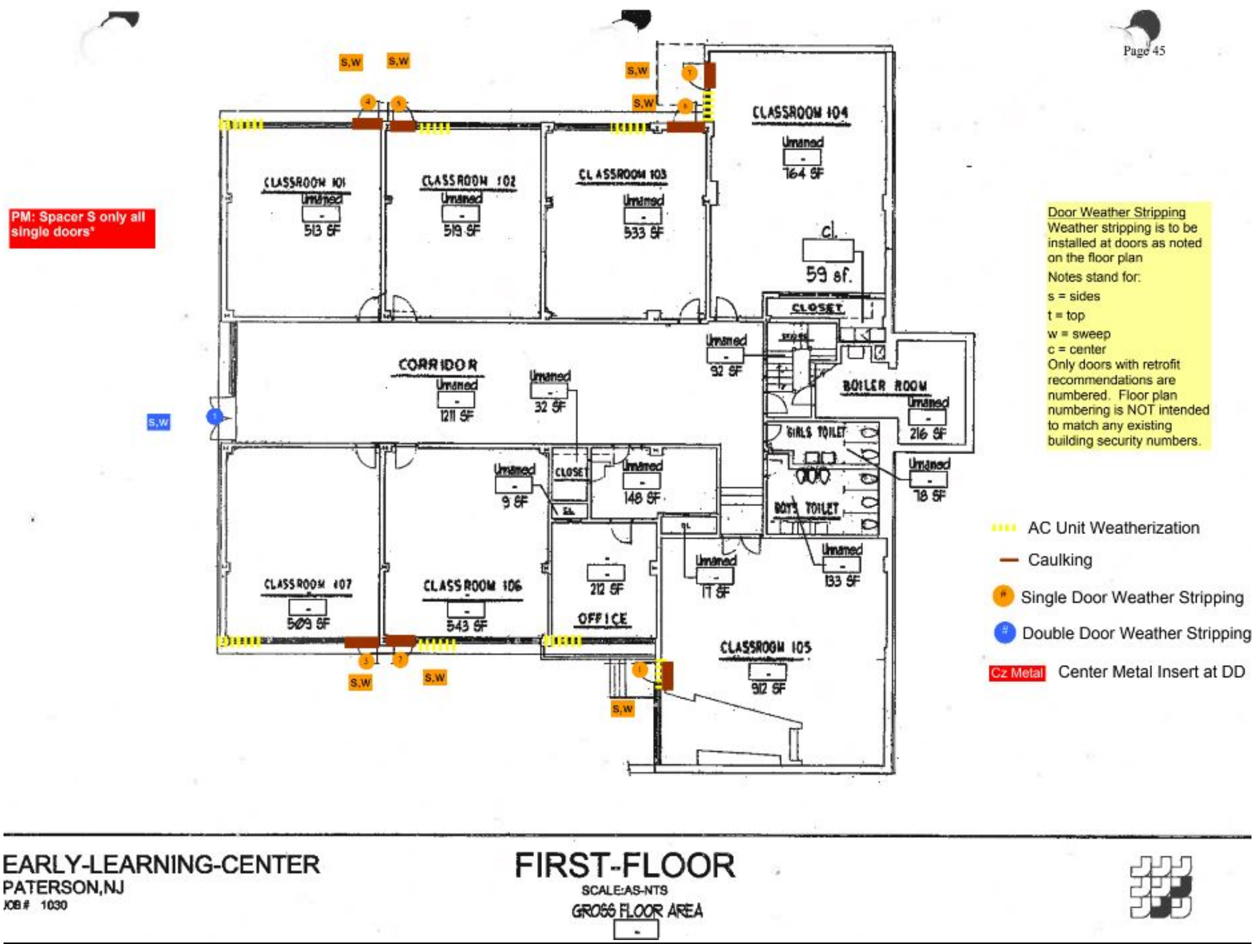
Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.

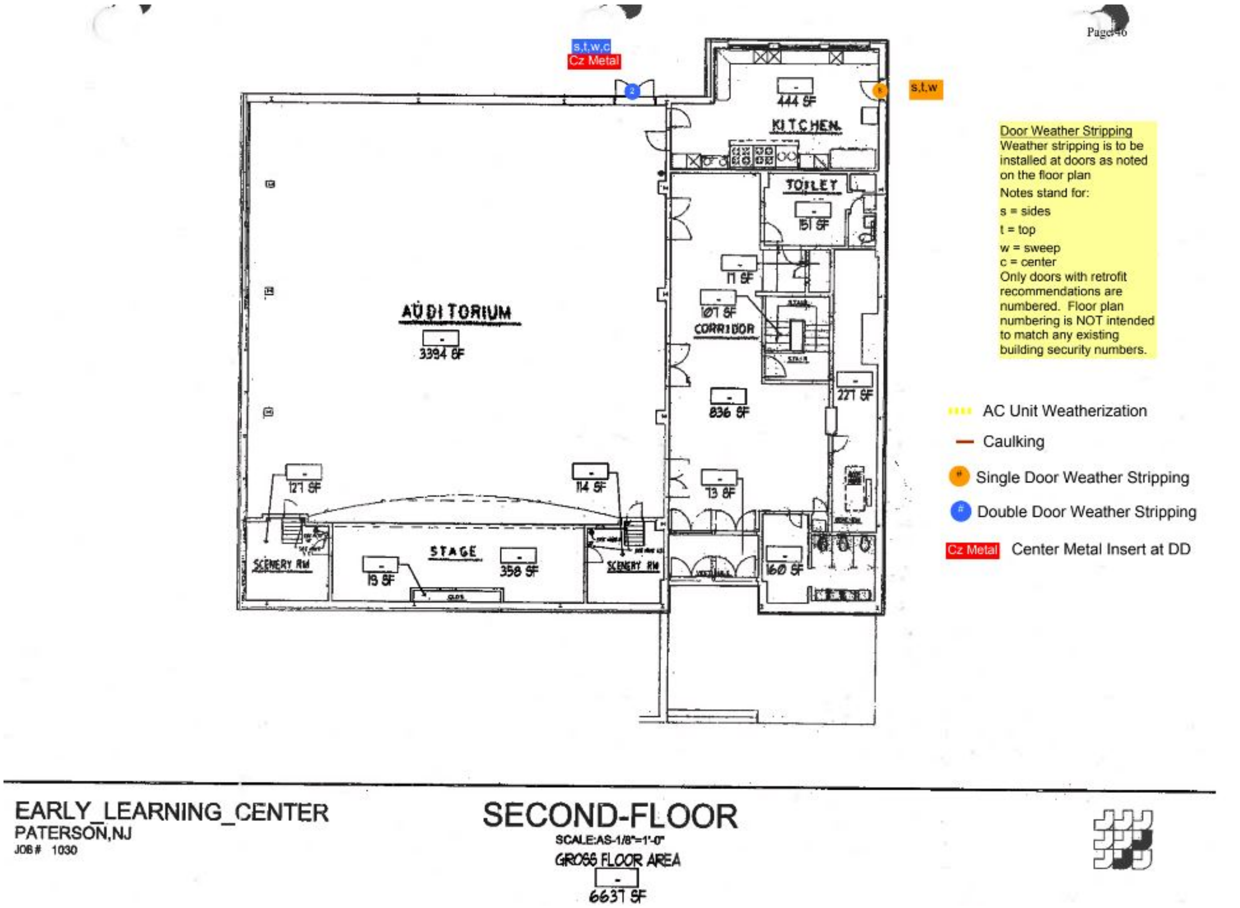
Single Door Weather Stripping
Caulking
Roof-Wall Air Sealing (Seal)
Retrofit Access Hatch

SCHOOL_DALE
PATERSON,NJ
JOB # 1030

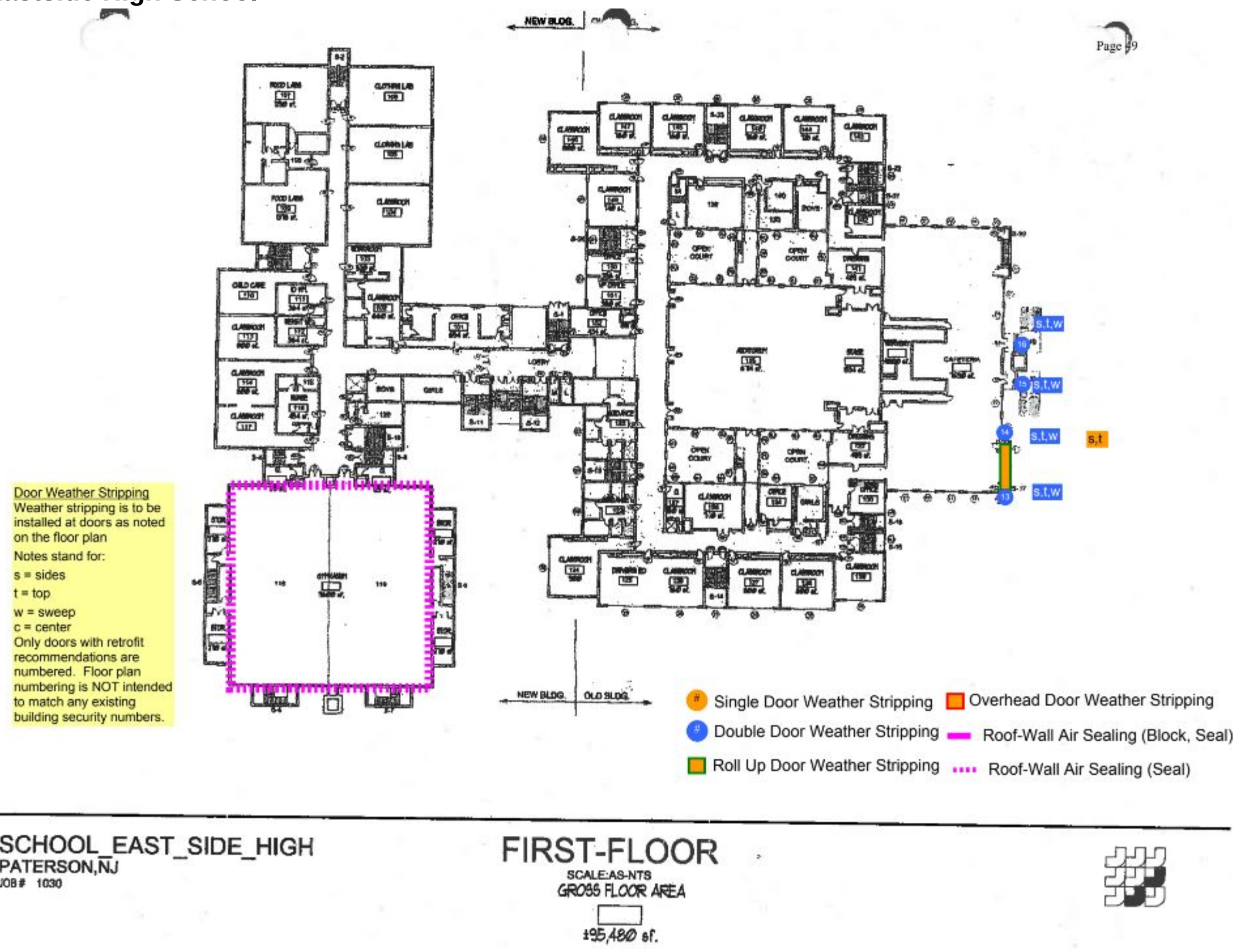
FOURTH-FLOOR
SCALE:1/32"=1'-3"
GROSS FLOOR AREA
15395 SF

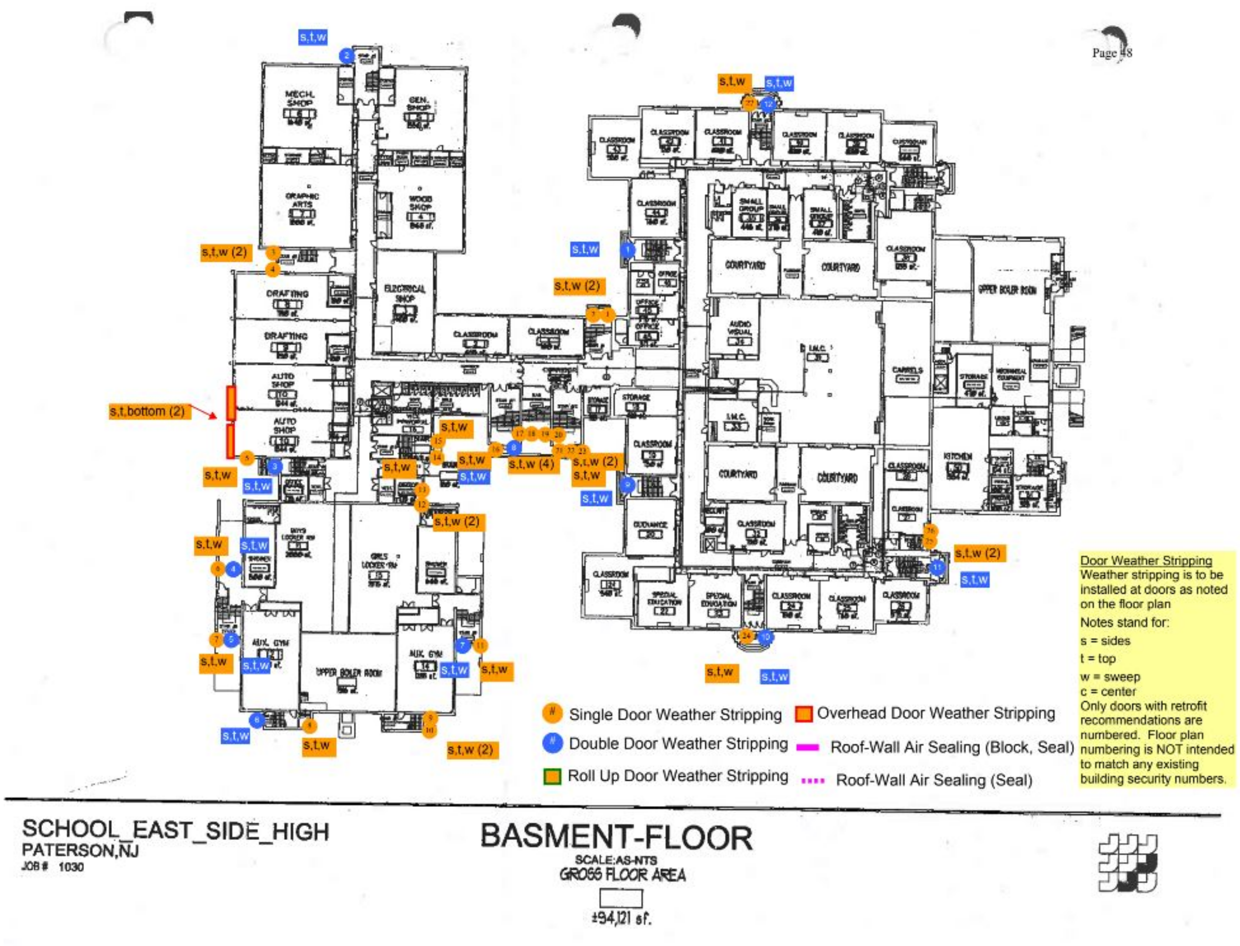
Early Learning Center

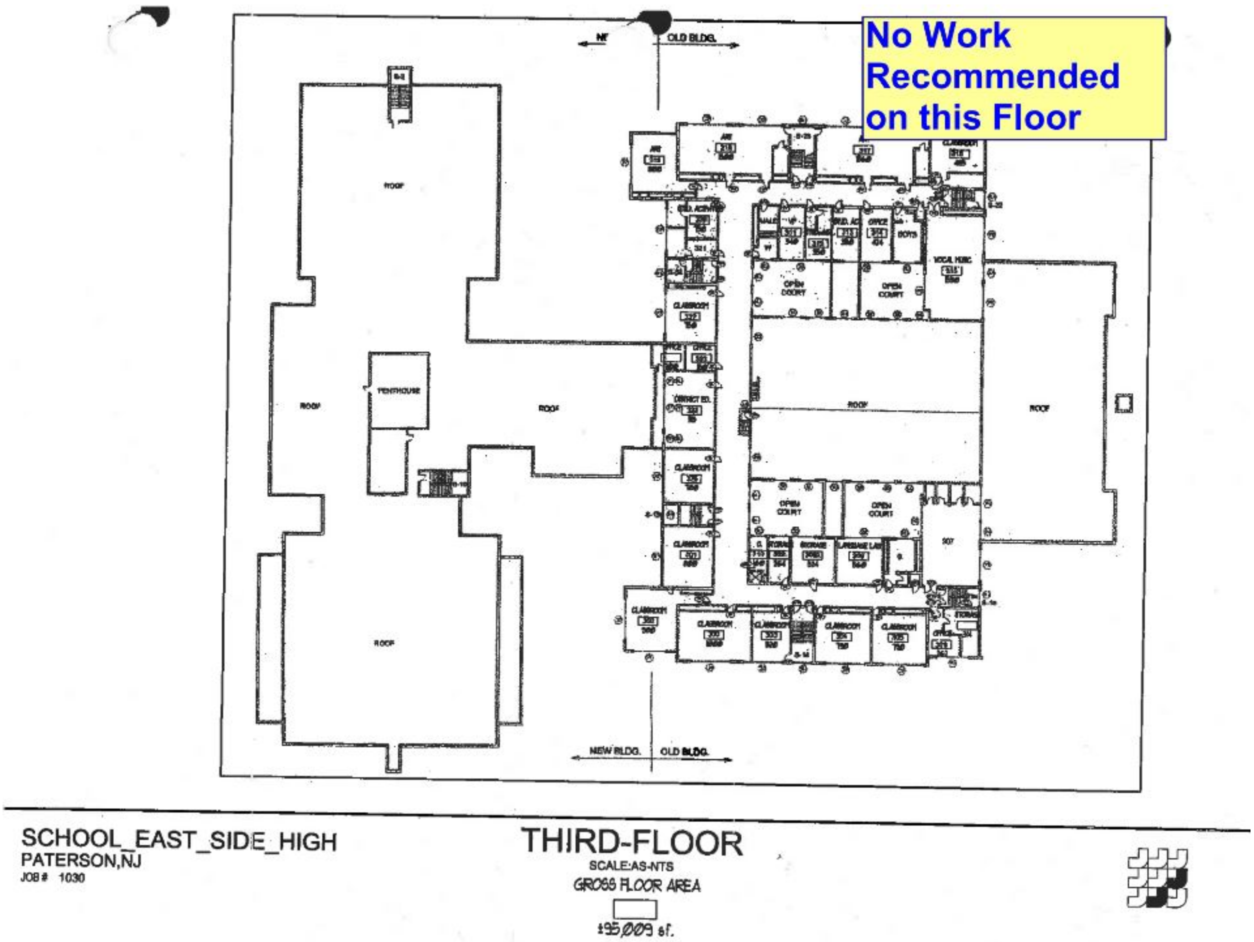



Page 46
s,t,w,c
Cz Metal
s,t,w
444 SF
KITCHEN
TOILET
151 SF
11 SF
107 SF
CORRIDOR
AUDITORIUM
3394 SF
836 SF
227 SF
121 SF
114 SF
13 SF
STAGE
SCENERY RM
19 SF
358 SF
SCENERY RM
160 SF
Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.
AC Unit Weatherization
Caulking
Single Door Weather Stripping
Double Door Weather Stripping
Cz Metal
Center Metal Insert at DD
EARLY_LEARNING_CENTER
PATERSON,NJ
JOB # 1030
SECOND-FLOOR
SCALE:AS-1/8"=1'-0"
GROSS FLOOR AREA
6637 SF

Eastside High School

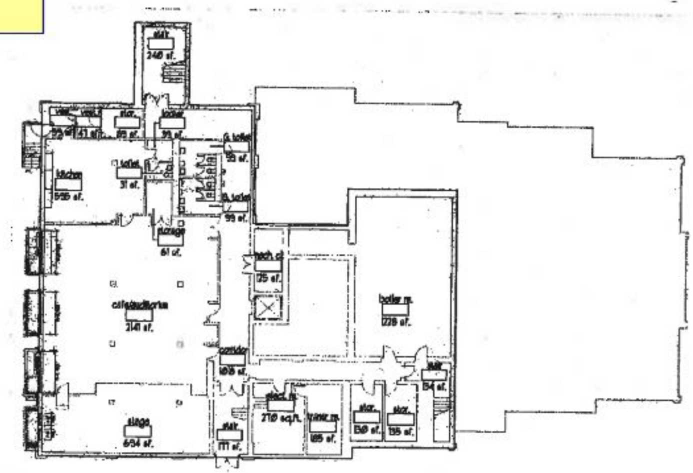



Page 48
Single Door Weather Stripping
Double Door Weather Stripping
Roll Up Door Weather Stripping
Overhead Door Weather Stripping
Roof-Wall Air Sealing (Block, Seal)
Roof-Wall Air Sealing (Seal)
Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.
SCHOOL_EAST_SIDE_HIGH
PATERSON,NJ
JOB # 1030
BASMENT-FLOOR
SCALE:AS-NTS
GROSS FLOOR AREA
±94,121 sf.


No Work Recommended on this Floor
OLD BLDG.
NEW BLDG.
ROOF
PENTHOUSE
OPEN COURT
CLASSROOM
SCHOOL_EAST_SIDE_HIGH
PATERSON,NJ
JOB # 1030
THIRD-FLOOR
SCALE:AS-NTS
GROSS FLOOR AREA

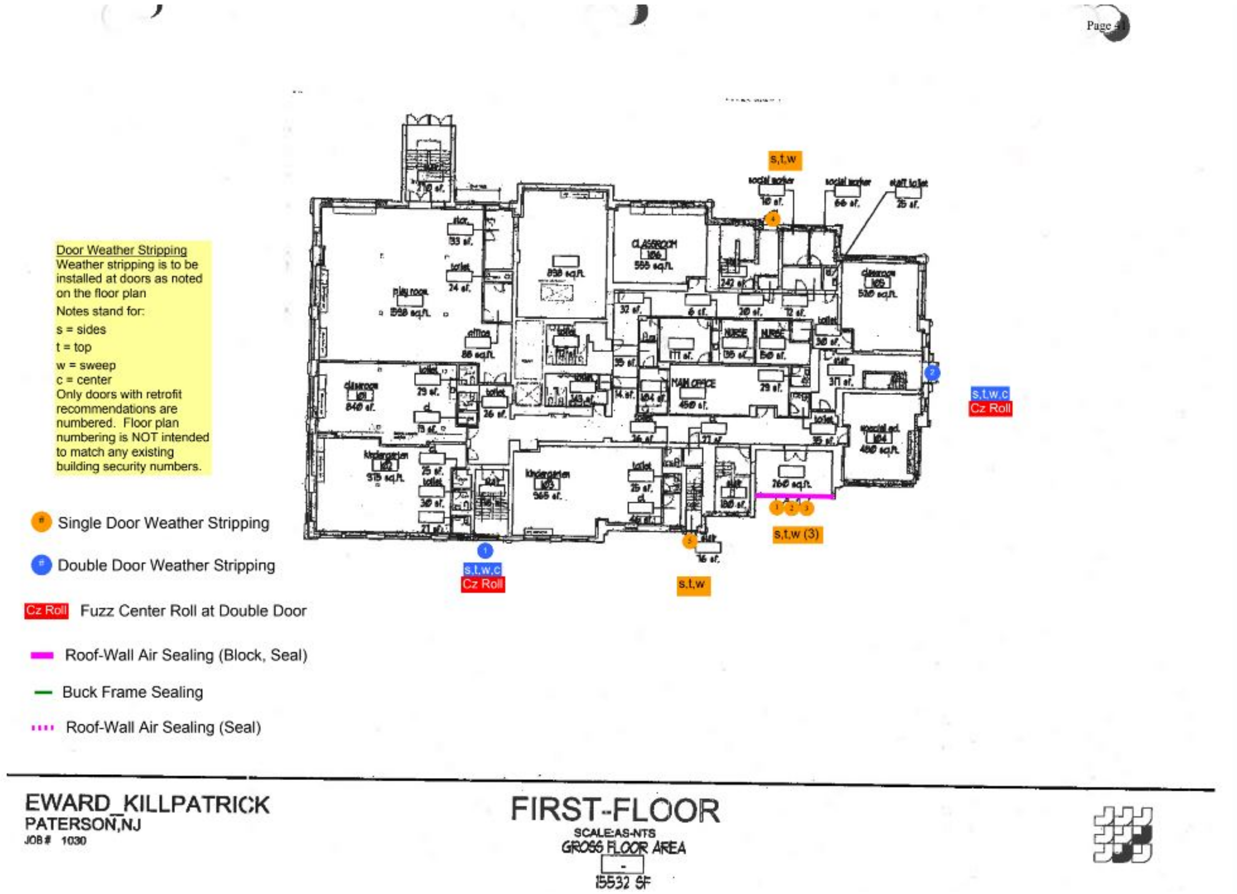
Edward Kilpatrick

No Work Recommended on this Floor

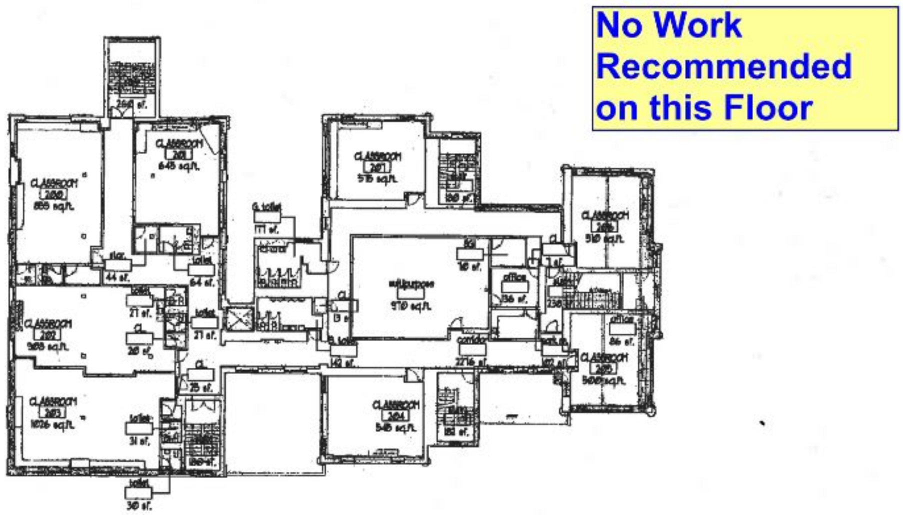


EWARD_KILLPATRICK
PATERSON,NJ
JOB # 1030

BASTMENT-FLOOR
SCALE:AS-NTS
GROSS FLOOR AREA
-
9442 SF


Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.
Single Door Weather Stripping
Double Door Weather Stripping
Cz Roll
Fuzz Center Roll at Double Door
Roof-Wall Air Sealing (Block, Seal)
Buck Frame Sealing
Roof-Wall Air Sealing (Seal)
s,t,w
s,t,w,c
Cz Roll
s,t,w (3)
s,t,w,c
Cz Roll
s,t,w
EWARD_KILLPATRICK
PATERSON,NJ
JOB# 1030
FIRST-FLOOR
SCALE:AS-NTS
GROSS FLOOR AREA
15532 SF

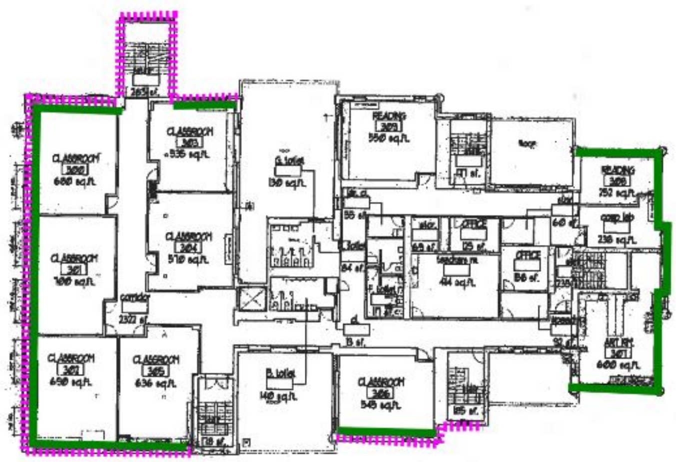
Page 42



EWARD_KILLPATRICK
PATERSON,NJ
JOB # 1030

SECOND-FLOOR
SCALE:AS-NTS
GROSS FLOOR AREA
13297 SF

Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.

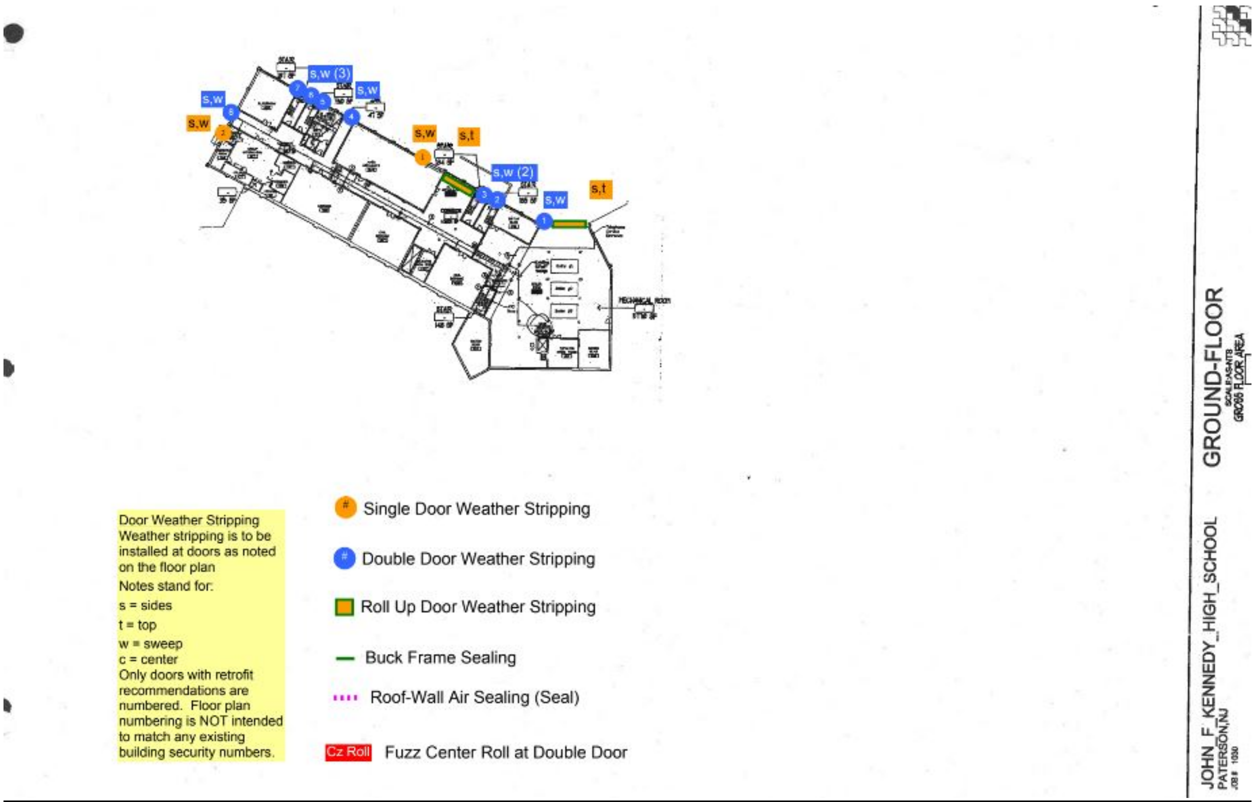


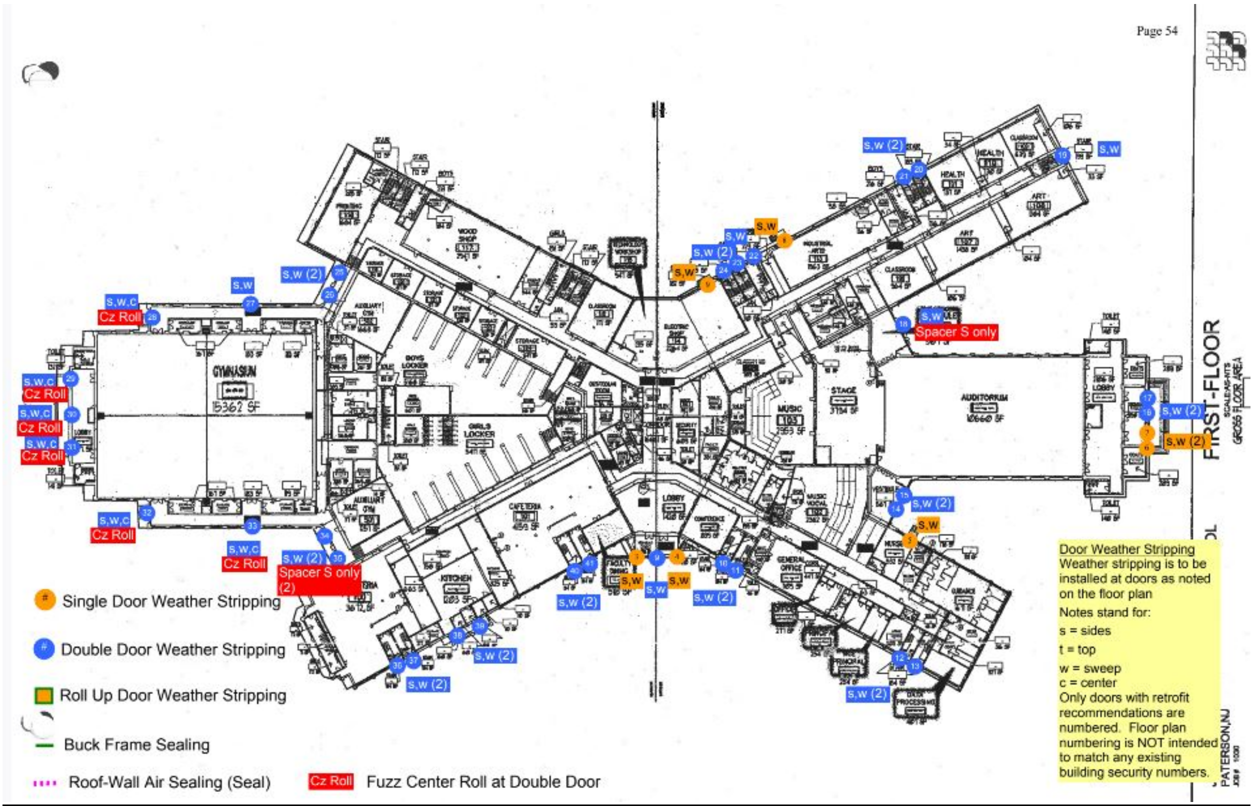
- Single Door Weather Stripping
- Double Door Weather Stripping
- Cz Roll Fuzz Center Roll at Double Door
- Roof-Wall Air Sealing (Block, Seal)
- Buck Frame Sealing
- Roof-Wall Air Sealing (Seal)

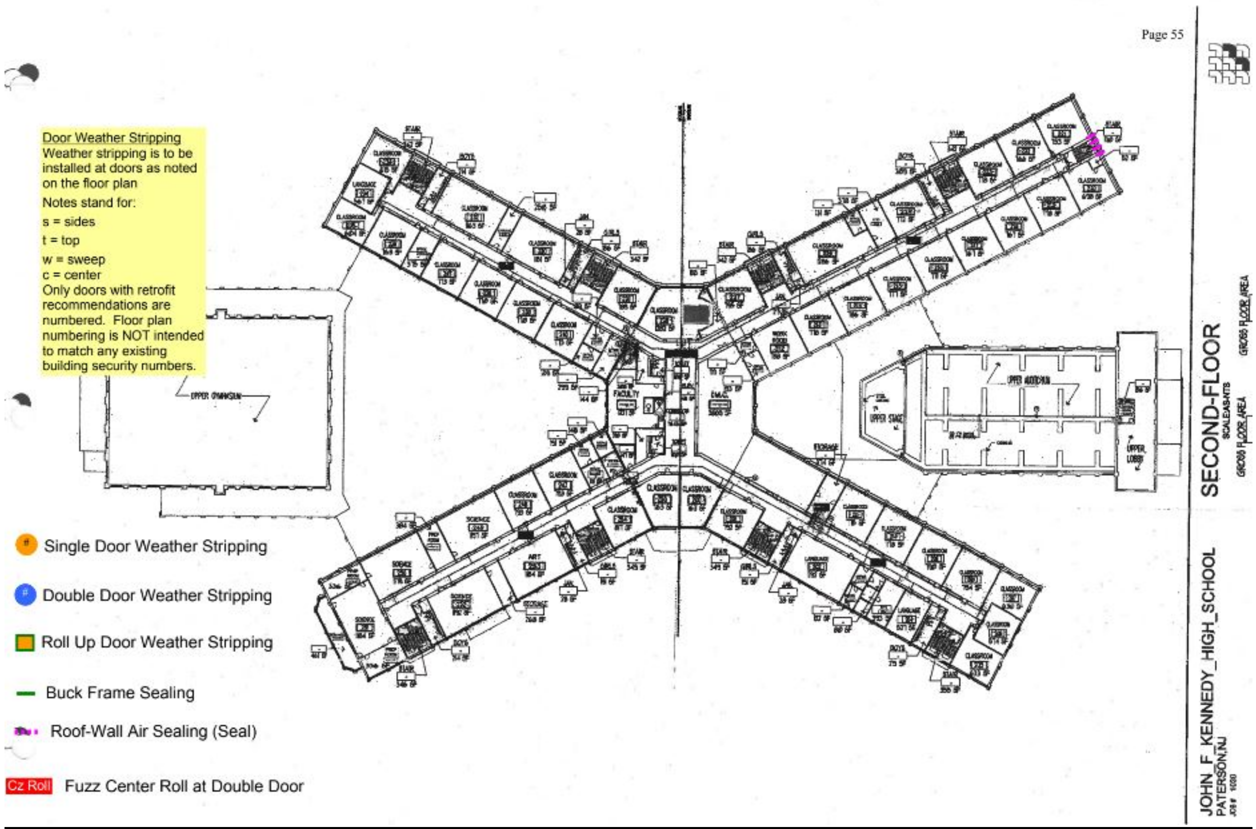
EWARD_KILLPATRICK
PATERSON,NJ
JOB# 1030

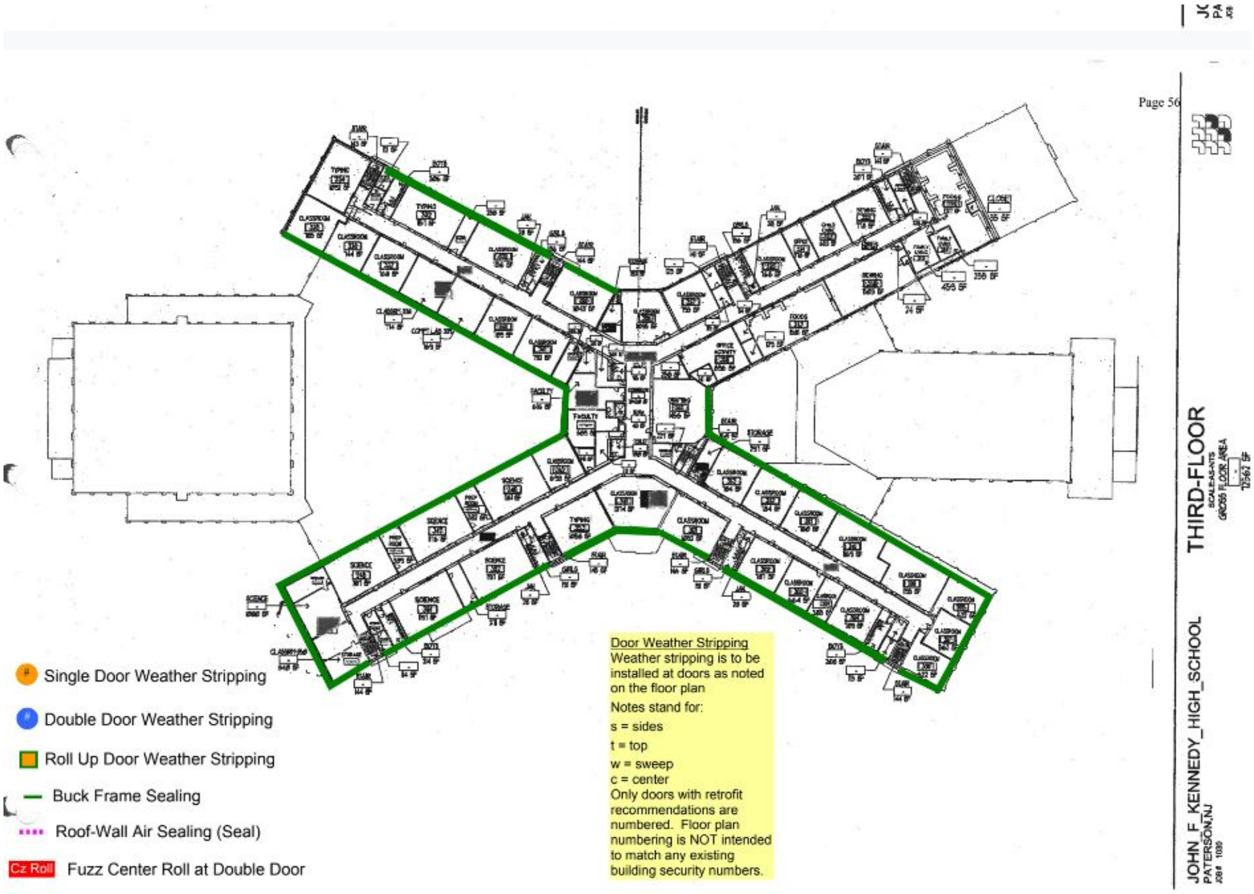
THIRD-FLOOR
SCALE:AS-NTS
GROSS FLOOR AREA
-
13250 SF

John F. Kennedy High School

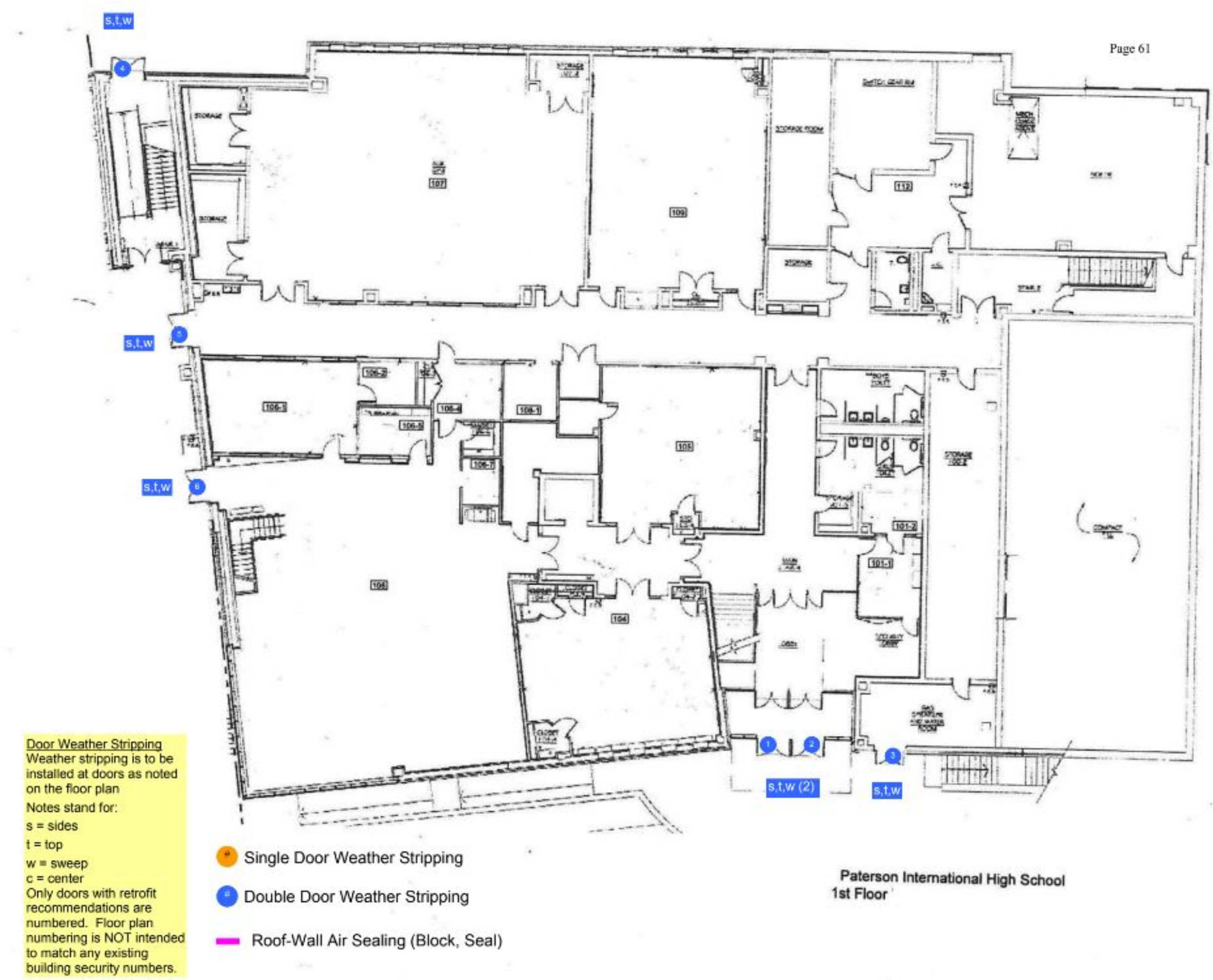


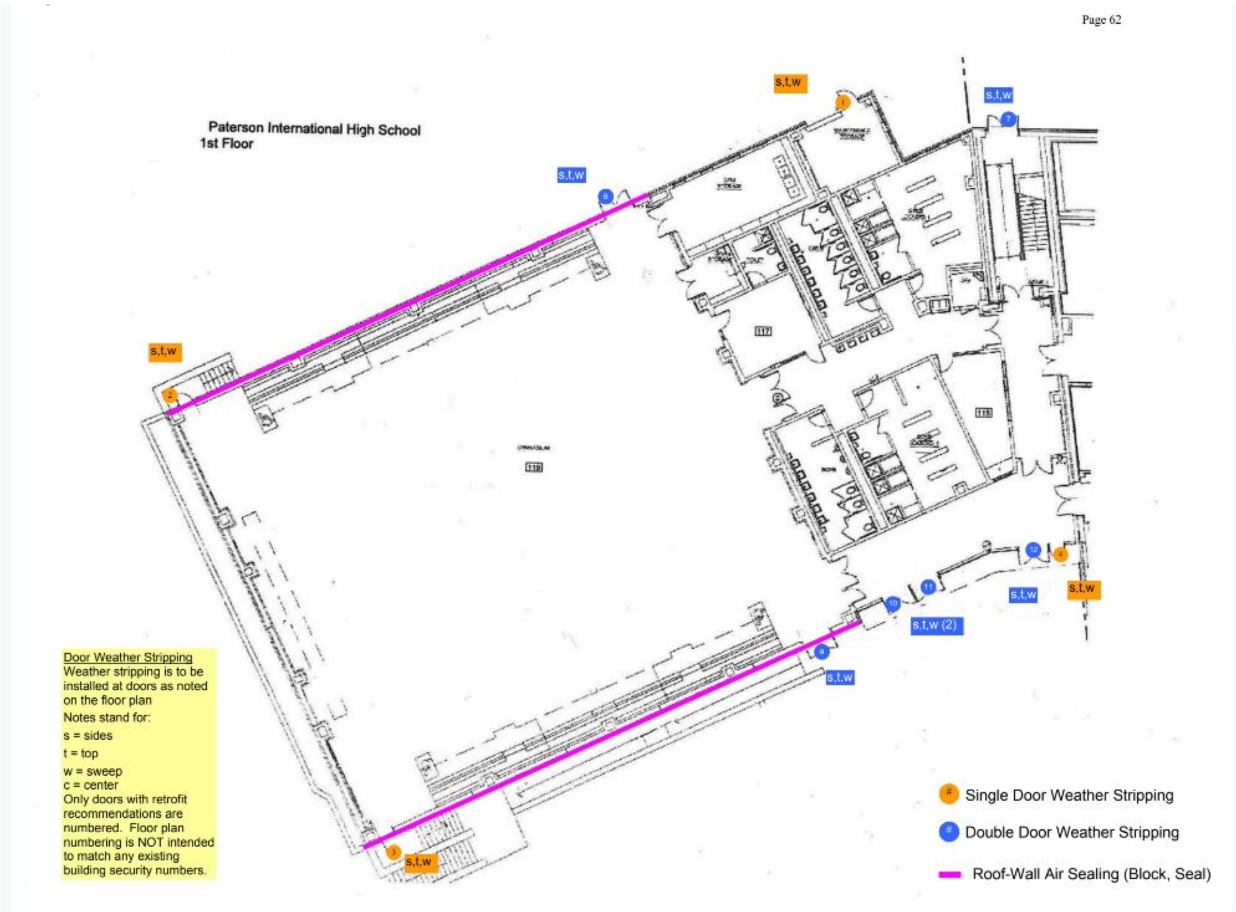

Page 54
FIRST-FLOOR
GYMNASIUM
15362 SF
AUDITORIUM
MUSIC
STAGE
CAFETERIA
KITCHEN
GIRLS LOCKER
BOYS LOCKER
LOBBY
GENERAL OFFICE
Spacer S only
Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.
Single Door Weather Stripping
Double Door Weather Stripping
Roll Up Door Weather Stripping
Buck Frame Sealing
Roof-Wall Air Sealing (Seal)
Cz Roll
Fuzz Center Roll at Double Door
PATERSON,NJ

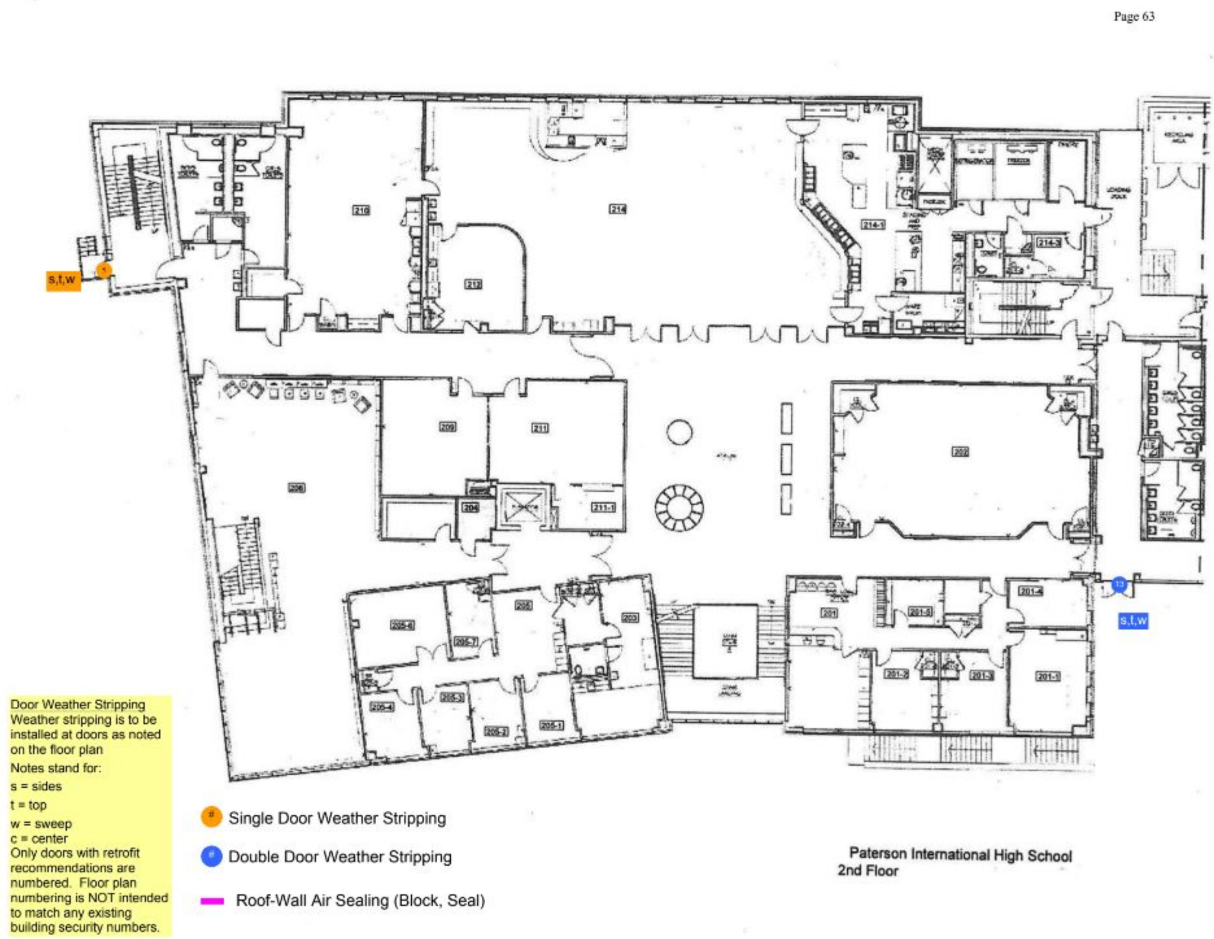

Page 55
Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.
Single Door Weather Stripping
Double Door Weather Stripping
Roll Up Door Weather Stripping
Buck Frame Sealing
Roof-Wall Air Sealing (Seal)
Cz Roll
Fuzz Center Roll at Double Door
SECOND-FLOOR
JOHN_F_KENNEDY_HIGH_SCHOOL
PATERSON,NJ

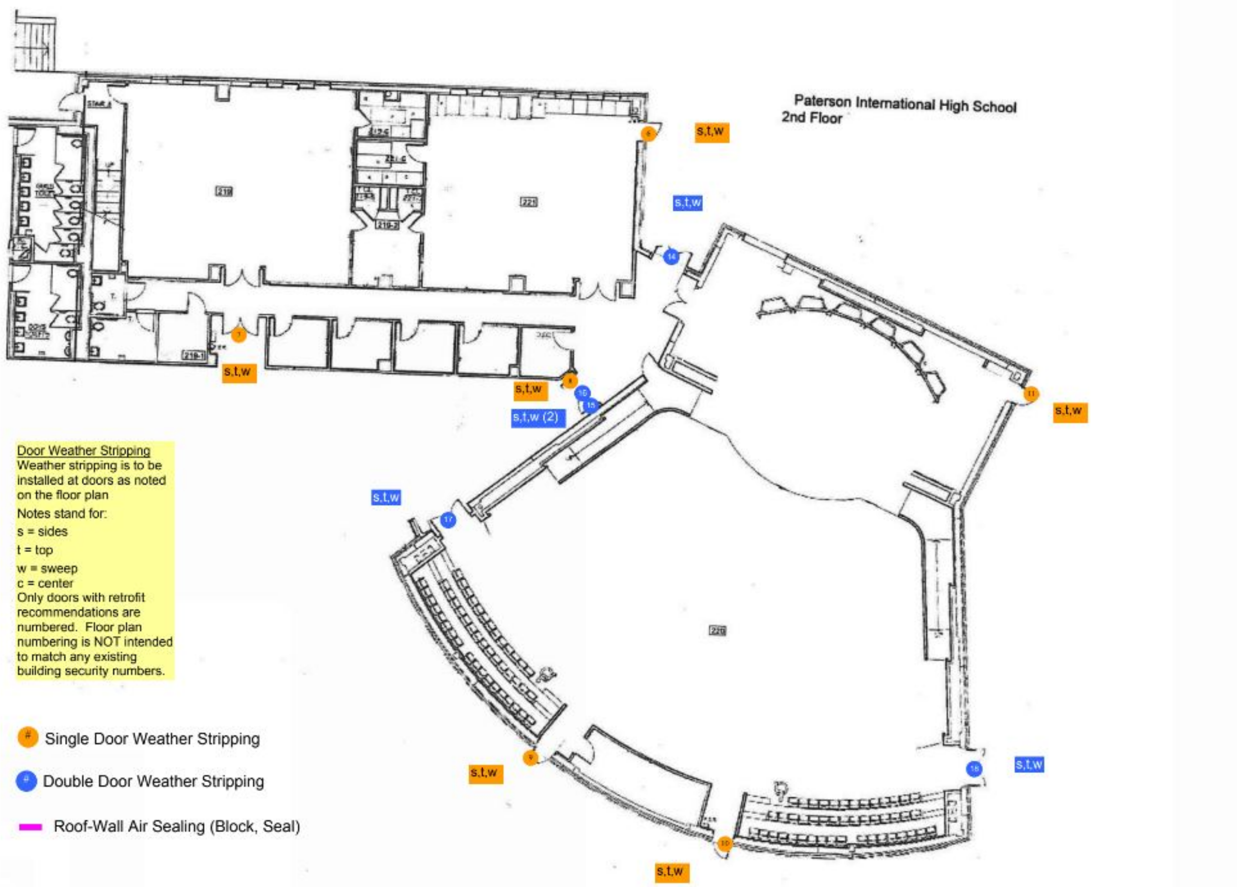

Page 56
Single Door Weather Stripping
Double Door Weather Stripping
Roll Up Door Weather Stripping
Buck Frame Sealing
Roof-Wall Air Sealing (Seal)
Cz Roll
Fuzz Center Roll at Double Door
Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.
THIRD-FLOOR
JOHN_F_KENNEDY_HIGH_SCHOOL
PATERSON,NJ

New International High School

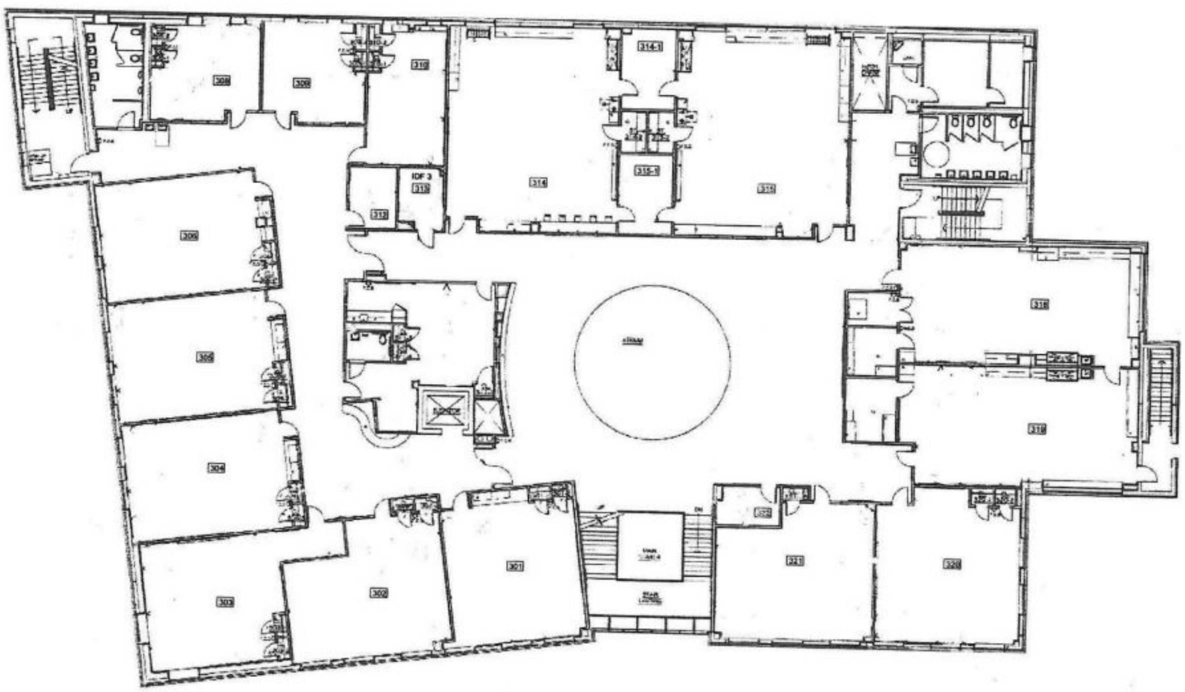



Page 62
Paterson International High School
1st Floor
s,t,w
s,t,w
s,t,w
s,t,w
s,t,w
s,t,w
s,t,w (2)
s,t,w
s,t,w
117
115
119
Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.
Single Door Weather Stripping
Double Door Weather Stripping
Roof-Wall Air Sealing (Block, Seal)


Page 63
s,t,w
s,t,w
Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.
Single Door Weather Stripping
Double Door Weather Stripping
Roof-Wall Air Sealing (Block, Seal)
Paterson International High School
2nd Floor


Paterson International High School
2nd Floor
s,t,w
s,t,w
s,t,w
s,t,w
s,t,w (2)
s,t,w
s,t,w
s,t,w
s,t,w
s,t,w
Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.
Single Door Weather Stripping
Double Door Weather Stripping
Roof-Wall Air Sealing (Block, Seal)

Page 65

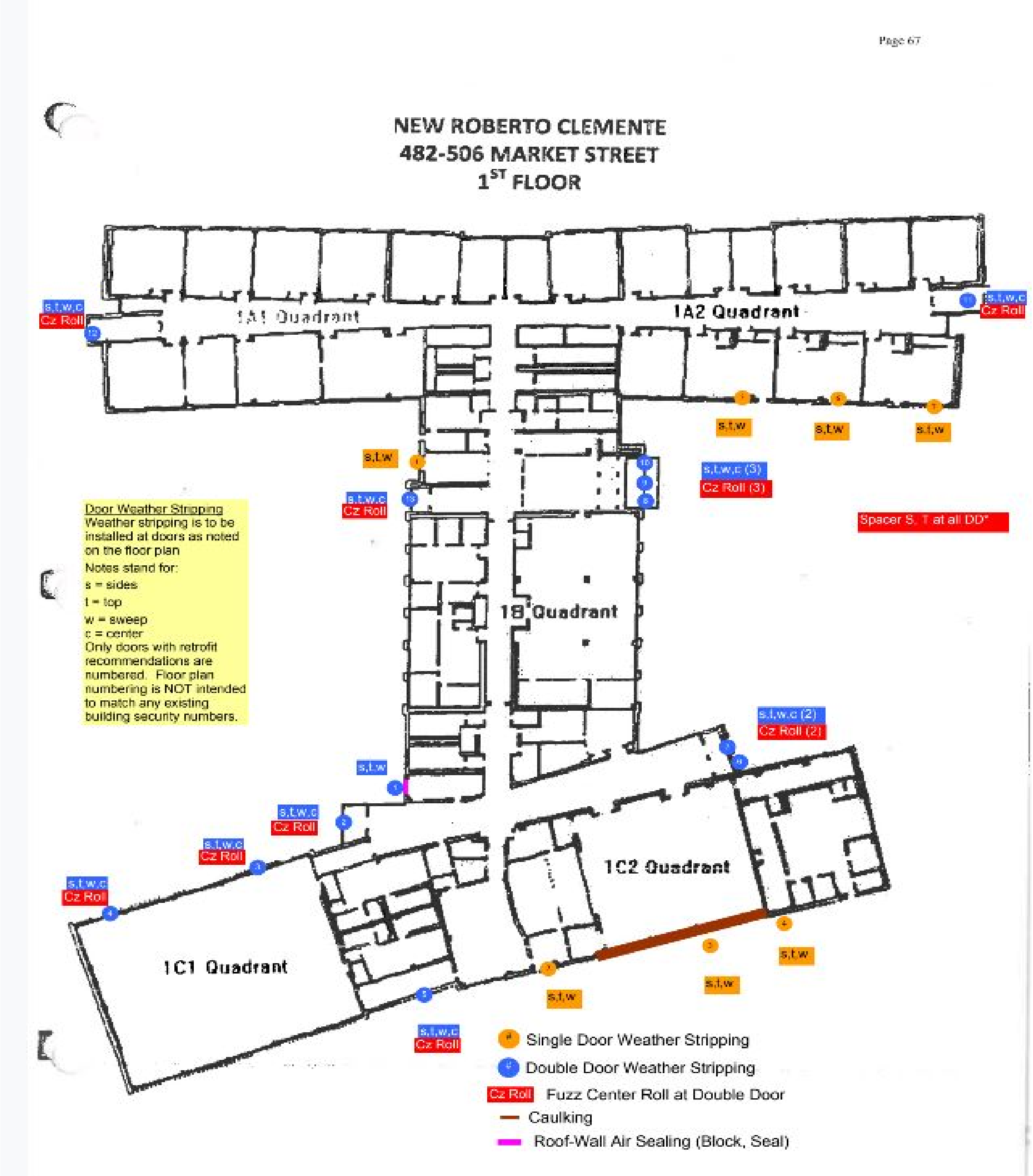


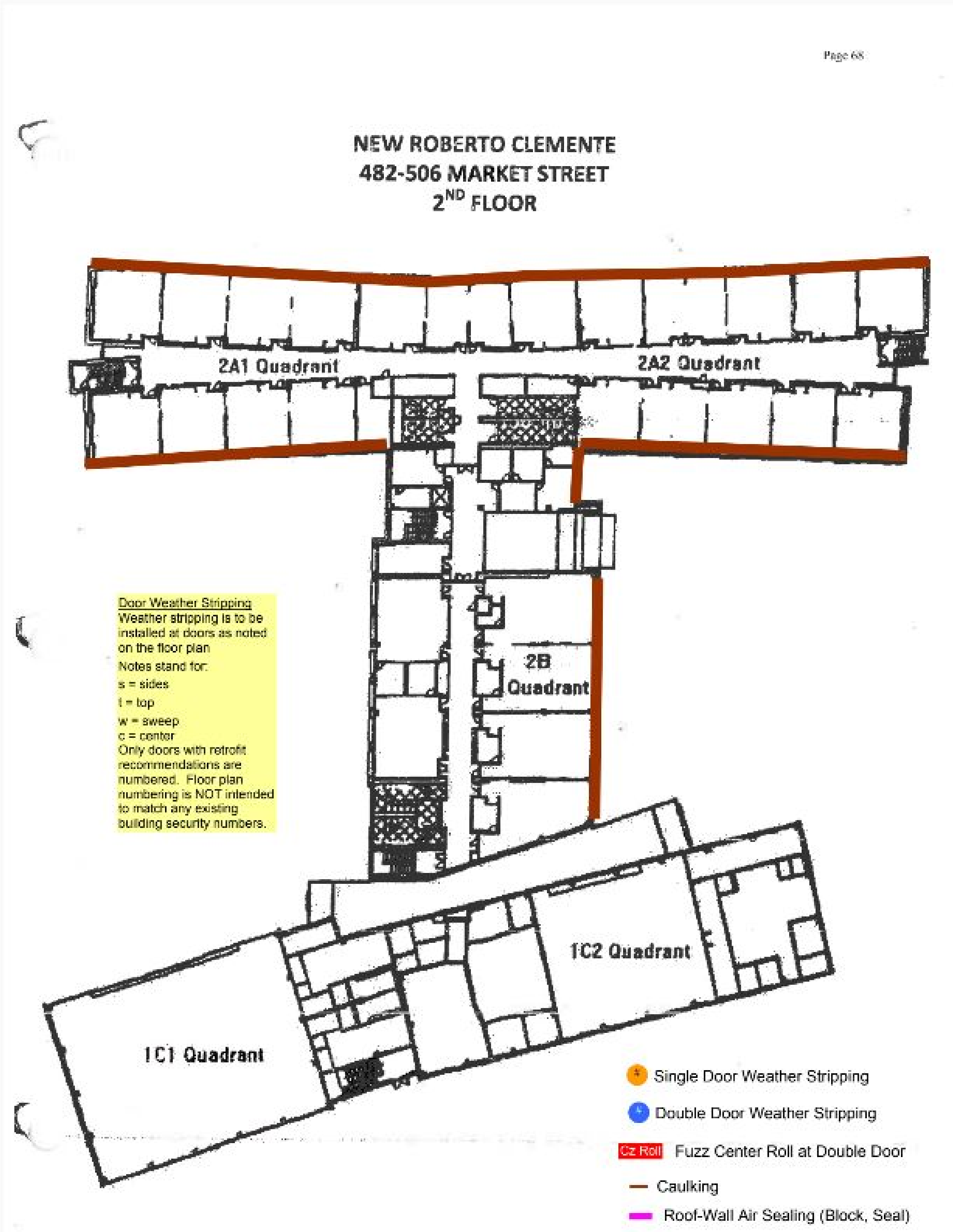
No Work Recommended on this Floor

Paterson International High School
3rd Floor

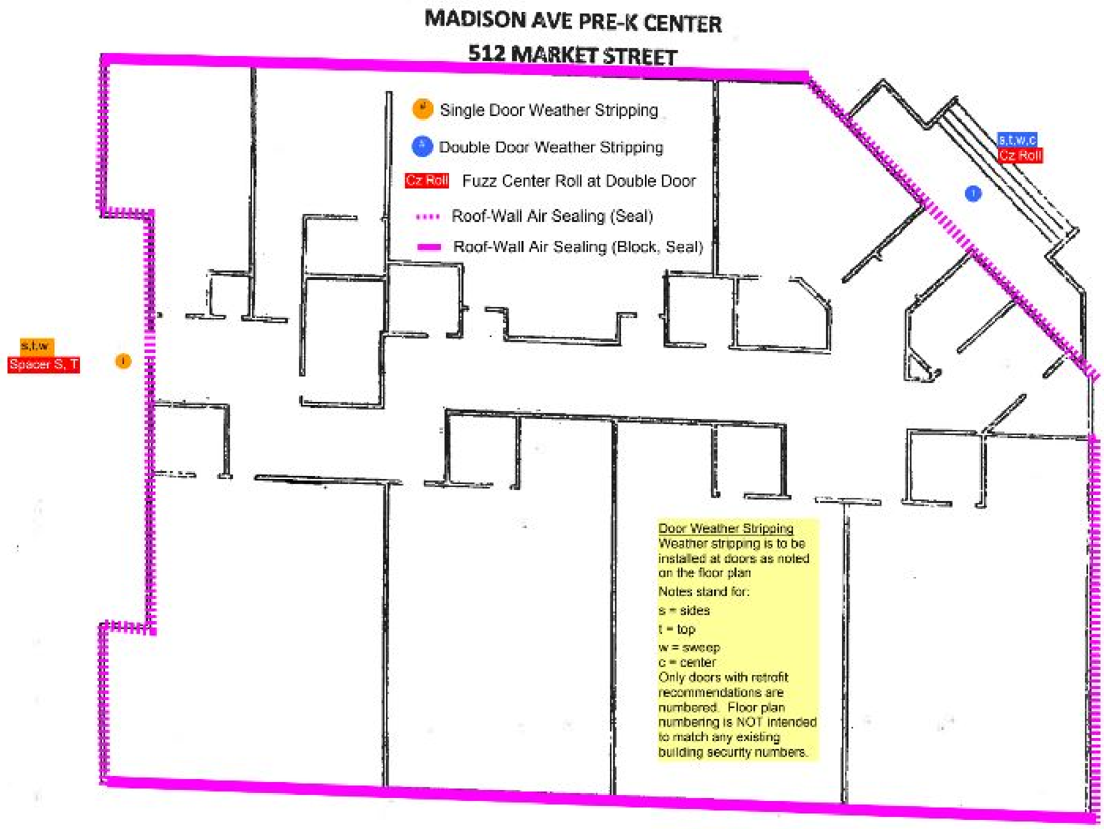

Page 66
Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.
Single Door Weather Stripping
Double Door Weather Stripping
Roof-Wall Air Sealing (Block, Seal)
Paterson International High School
4th Floor

New Roberto Clemente School

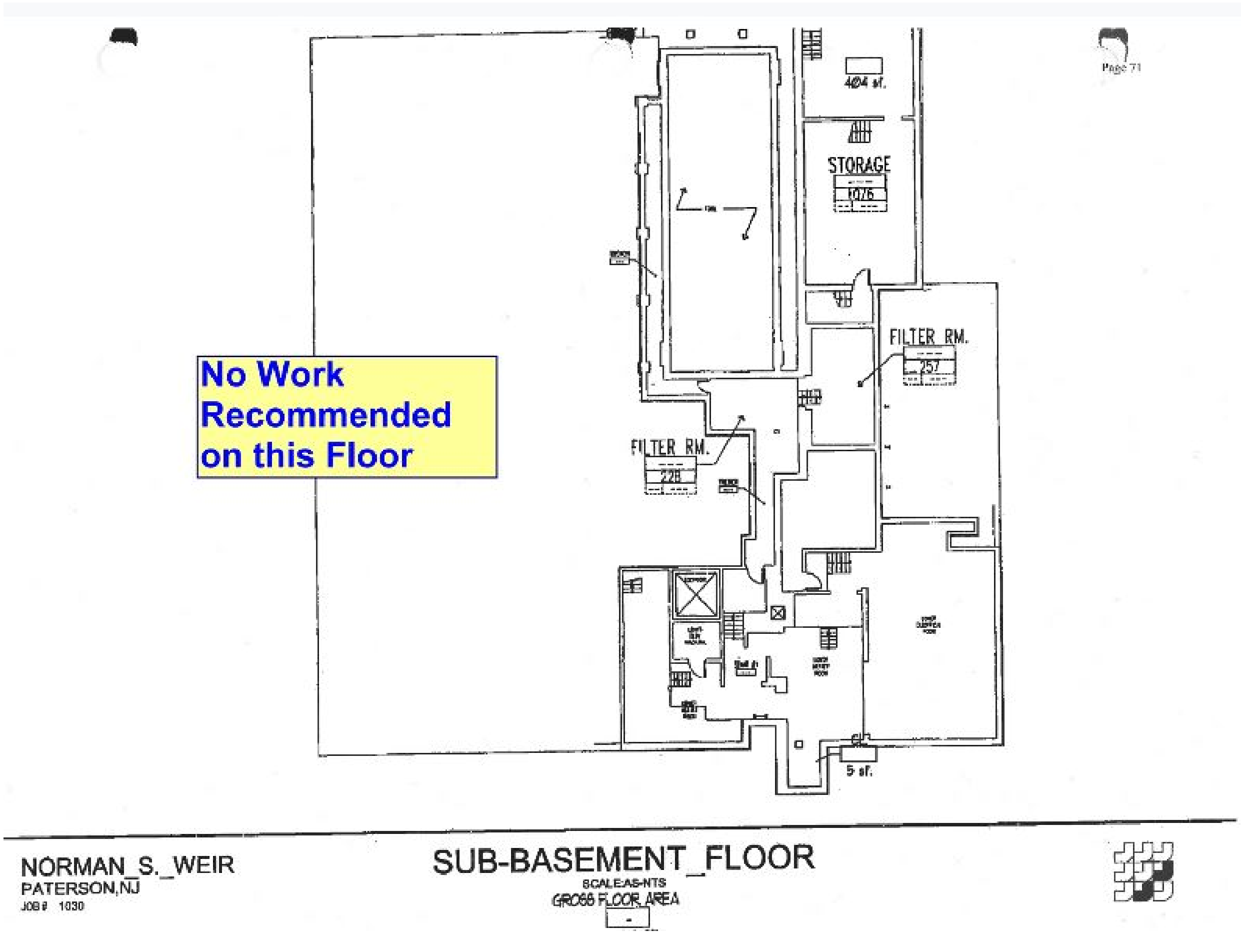


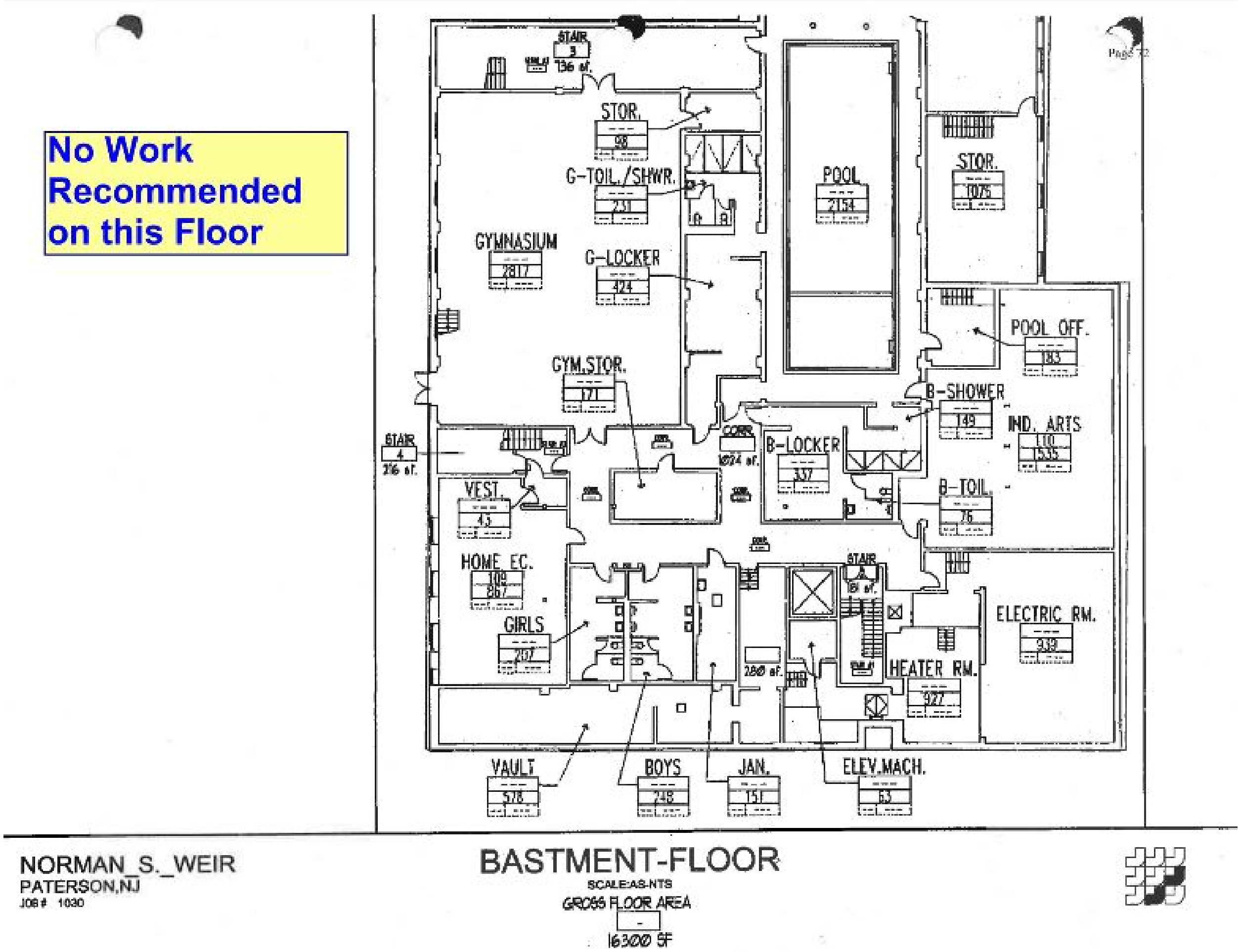

Page 68
NEW ROBERTO CLEMENTE
482-506 MARKET STREET
2ND FLOOR
2A1 Quadrant
2A2 Quadrant
2B Quadrant
1C2 Quadrant
1C1 Quadrant
Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.
Single Door Weather Stripping
Double Door Weather Stripping
Cz Roll Fuzz Center Roll at Double Door
Caulking
Roof-Wall Air Sealing (Block, Seal)

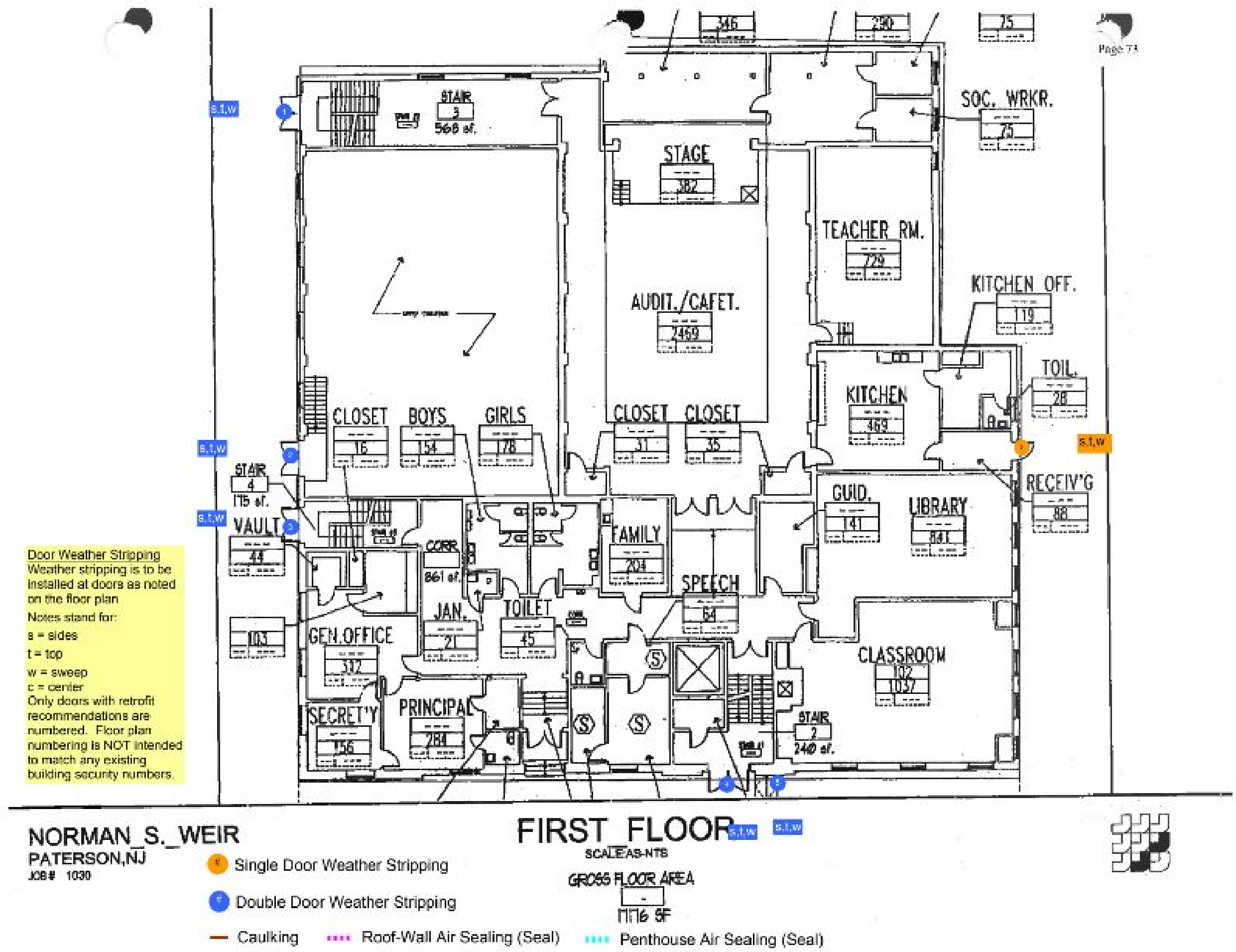
New Roberto K Center

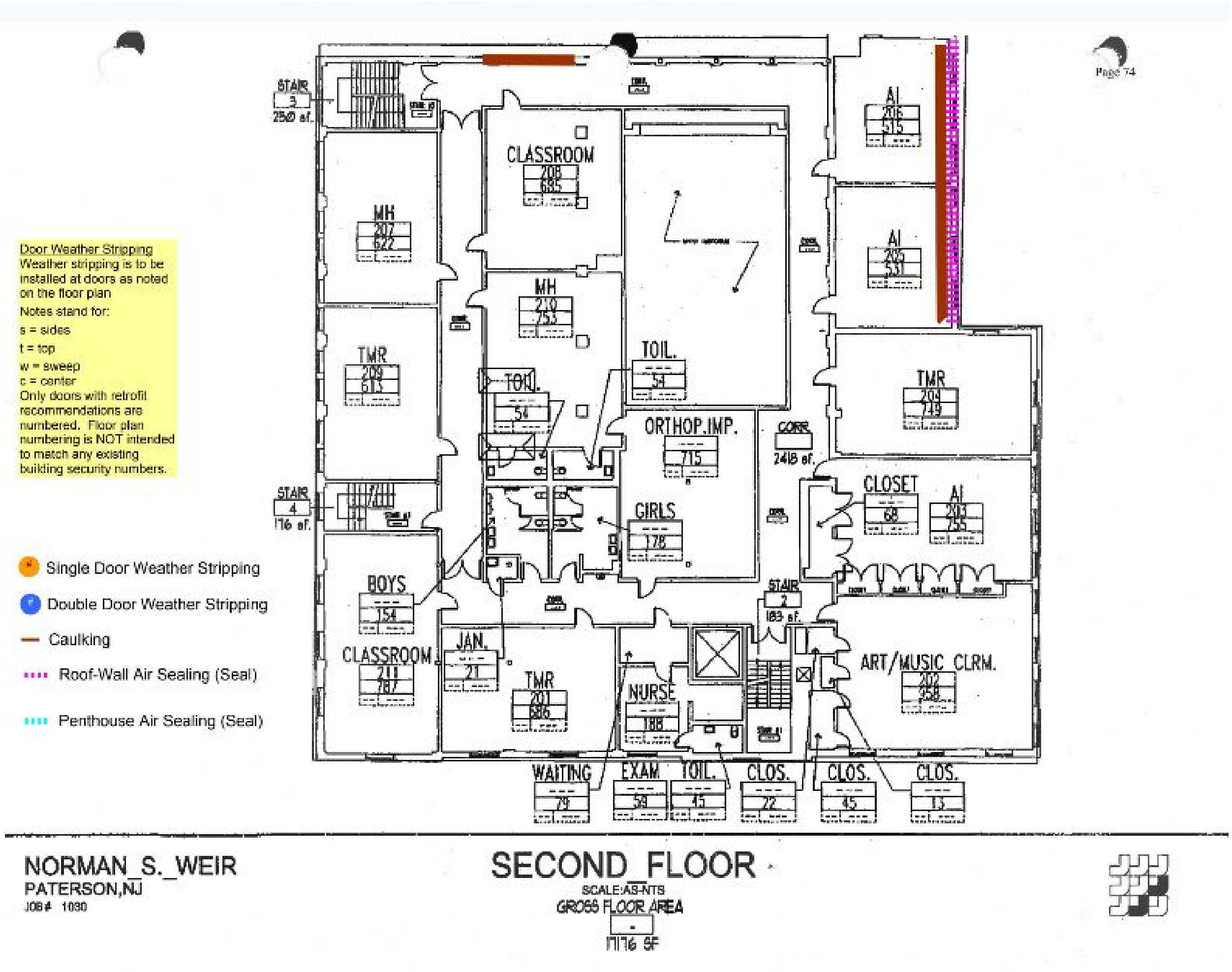


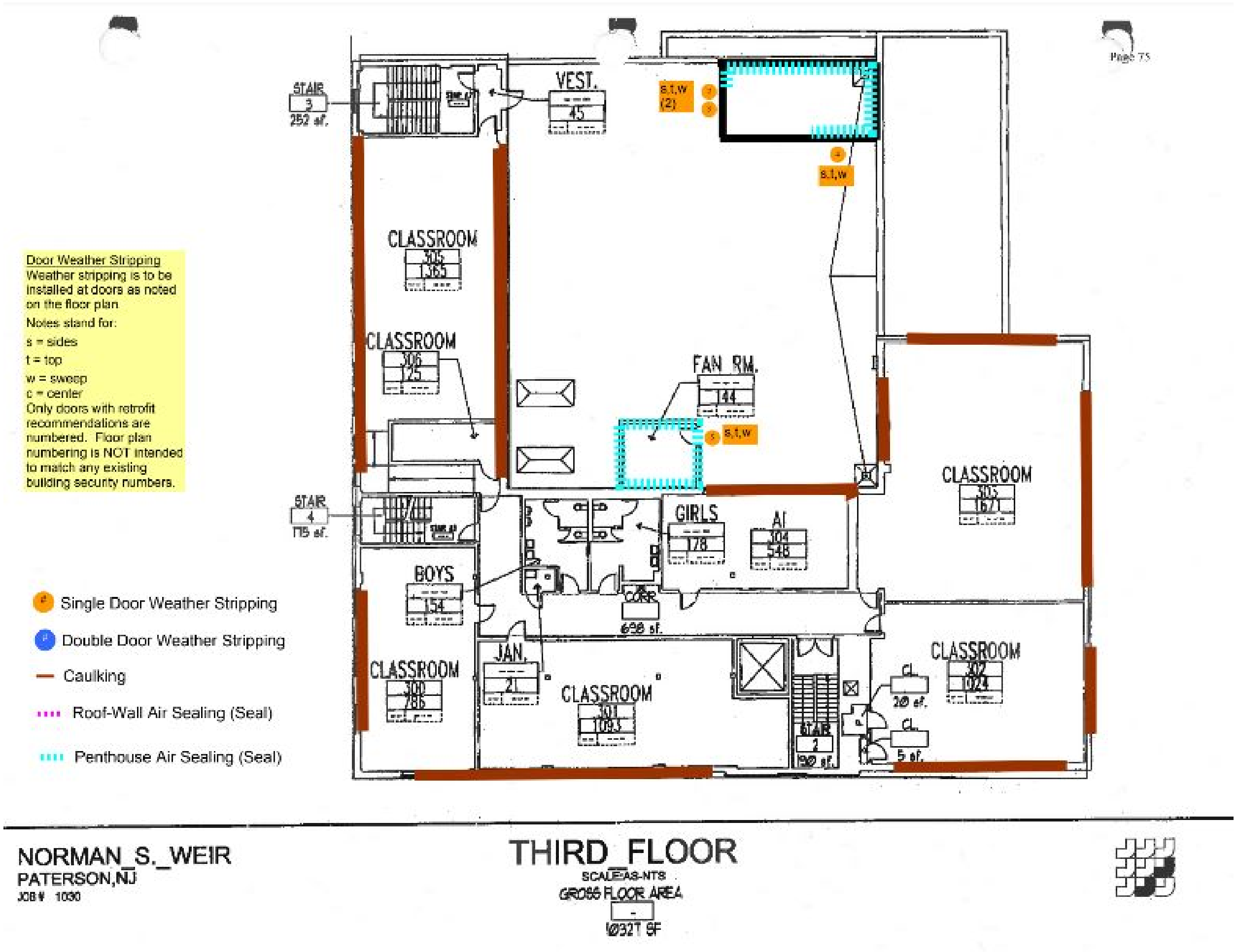
Norman S. Weir



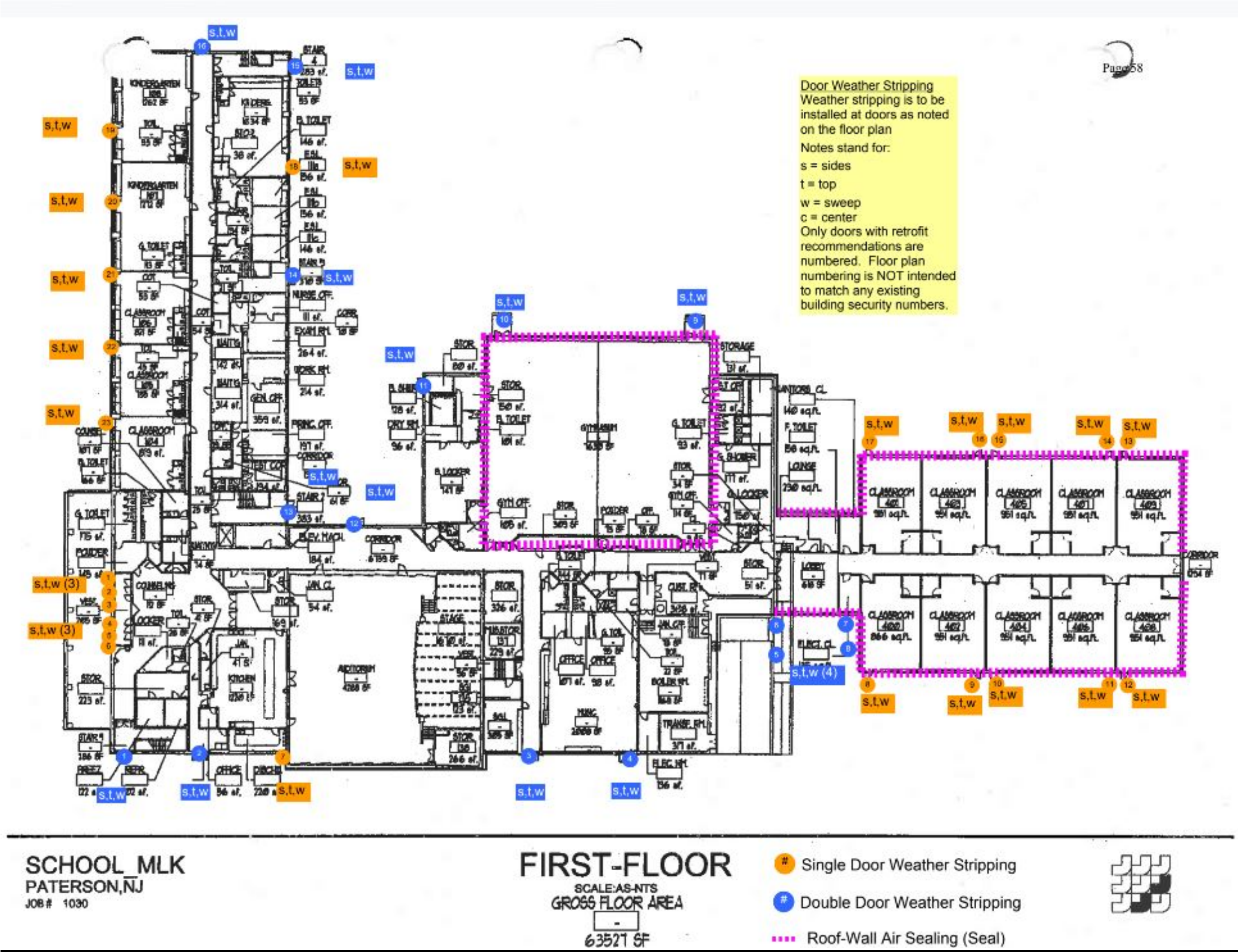

No Work Recommended on this Floor
STAIR 3 136 sf.
STOR. 98
G-TOIL./SHWR. 231
GYMNASIUM 2817
G-LOCKER 424
GYM.STOR. 171
POOL 2154
STOR. 1075
POOL OFF. 183
B-SHOWER 149
IND. ARTS 110 1535
STAIR 4 216 sf.
CORR. 1874 sf.
B-LOCKER 337
B-TOIL. 76
VEST. 43
HOME EC. 109 867
GIRLS 207
STAIR 5 61 sf.
280 sf.
ELECTRIC RM. 939
HEATER RM. 927
VAULT 578
BOYS 248
JAN. 151
ELEV.MACH. 63
NORMAN_S._WEIR
PATERSON,NJ
JOB# 1030
BASTMENT-FLOOR
SCALE:AS-NTS
GROSS FLOOR AREA
16300 SF

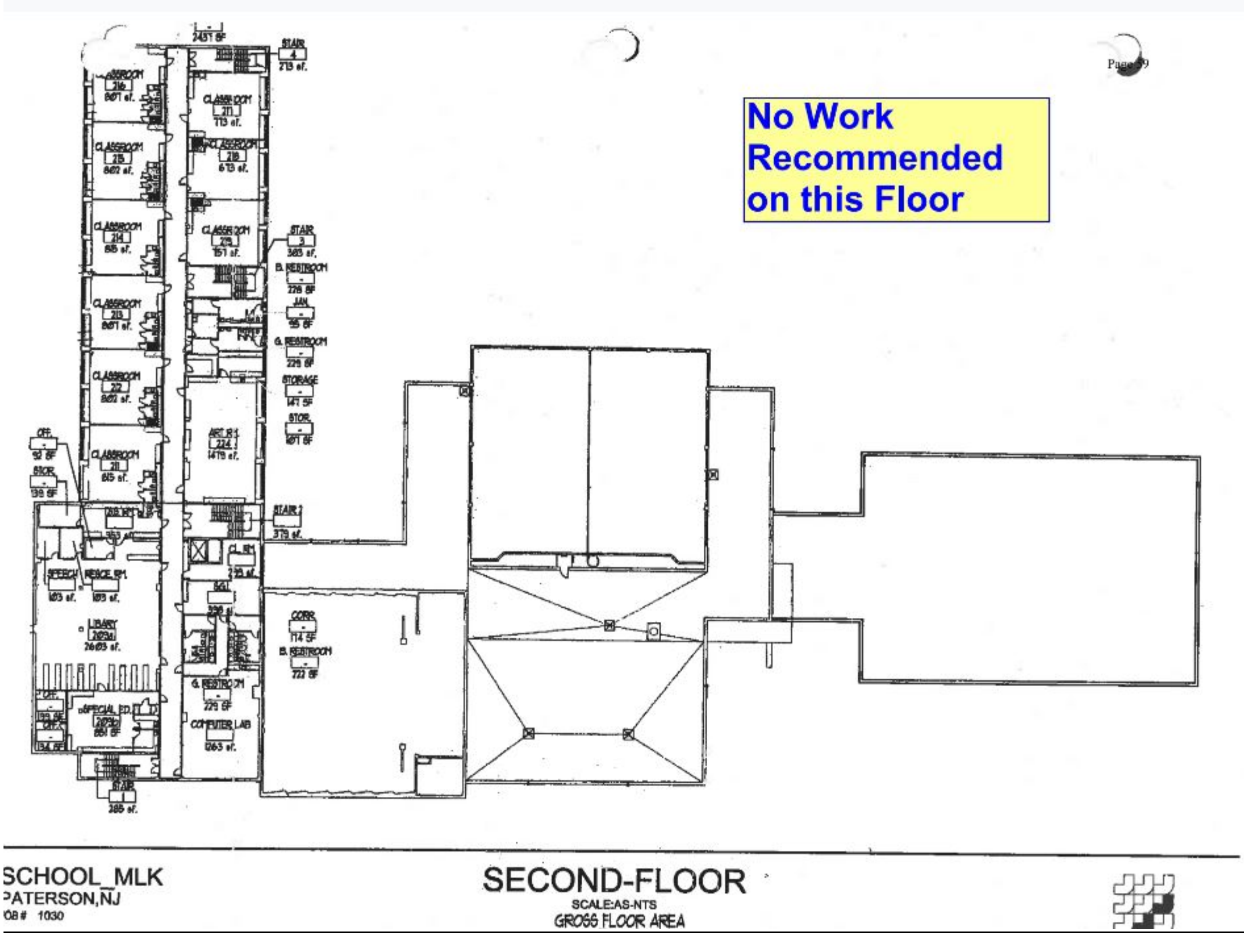

STAIR 3 568 sf.
SOC. WRKR. 75
STAGE 382
TEACHER RM. 729
KITCHEN OFF. 119
AUDIT./CAFET. 2469
TOIL. 28
KITCHEN 469
CLOSET 16
BOYS 154
GIRLS 178
CLOSET 31
CLOSET 35
RECEIV'G 88
STAIR 4 115 sf.
VAULT 44
GUID. 141
LIBRARY 841
FAMILY 204
CORR. 861 sf.
SPEECH 64
JAN. 21
TOILET 45
GEN.OFFICE 332
CLASSROOM 102 1037
SECRET'Y 156
PRINCIPAL 284
STAIR 2 240 sf.
s,t,w
Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.
NORMAN_S._WEIR
PATERSON,NJ
JOB # 1030
FIRST FLOOR
SCALE AS-NTS
GROSS FLOOR AREA
11116 SF
Single Door Weather Stripping
Double Door Weather Stripping
Caulking
Roof-Wall Air Sealing (Seal)
Penthouse Air Sealing (Seal)

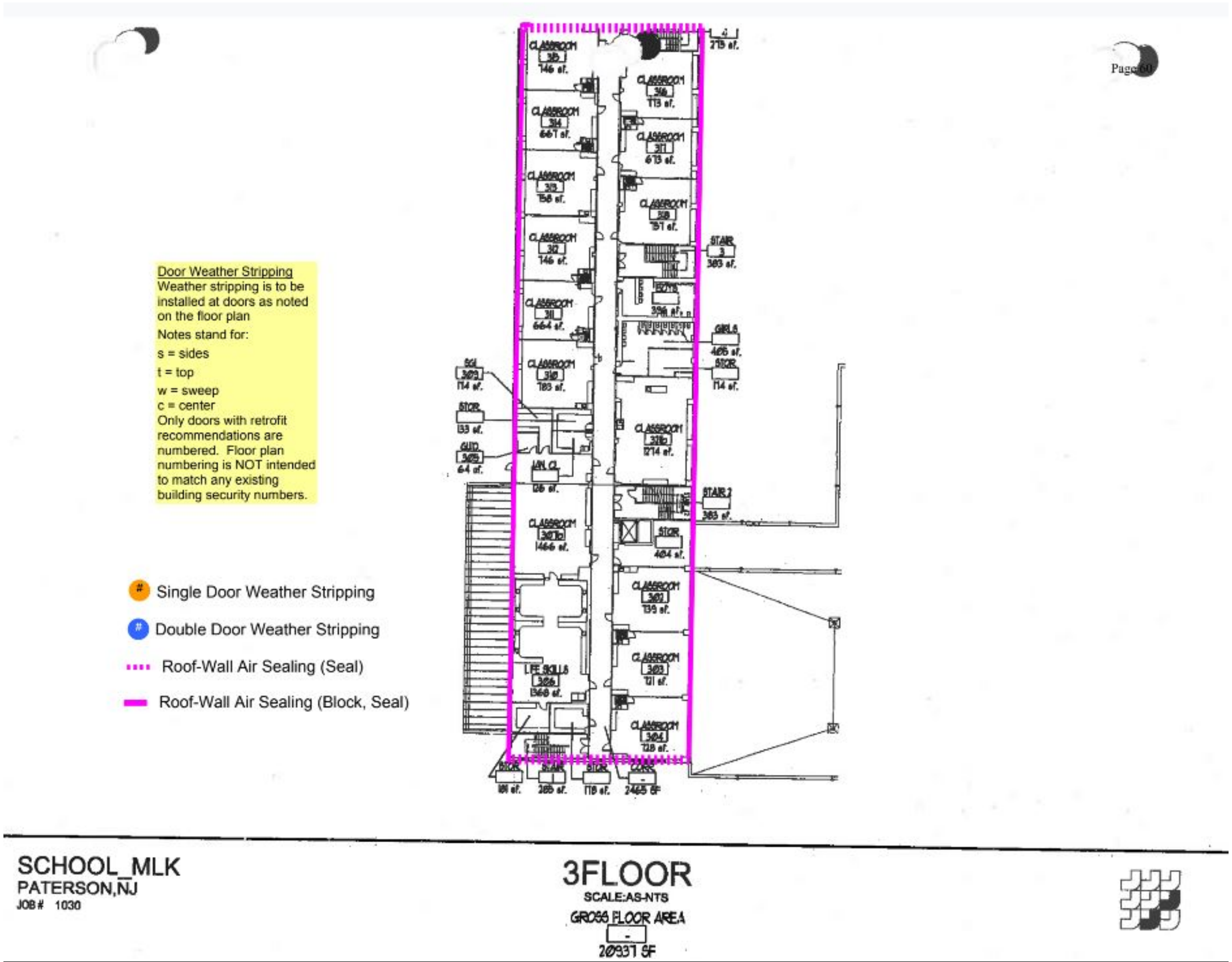

Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.
Single Door Weather Stripping
Double Door Weather Stripping
Caulking
Roof-Wall Air Sealing (Seal)
Penthouse Air Sealing (Seal)
CLASSROOM 208 685
MH 207 622
MH 210 753
TMR 209 613
TOIL. 54
ORTHOP.IMP. 715
GIRLS 178
BOYS 154
CLASSROOM 211 787
JAN. 21
TMR 201 686
NURSE 188
AI 206 515
AI 205 531
TMR 204 749
CLOSET 68
AI 203 755
ART/MUSIC CLRM. 202 958
WAITING 79
EXAM 58
TOIL. 45
CLOS. 22
CLOS. 45
CLOS. 13
STAIR 3 250 sf.
STAIR 4 176 sf.
STAIR 2 183 sf.
CORR. 2418 sf.
NORMAN_S._WEIR
PATERSON,NJ
JOB# 1030
SECOND_FLOOR
SCALE:AS-NTS
GROSS FLOOR AREA
17176 SF


Page 75
STAIR 3 252 sf.
VEST. 45
s,t,w (2)
s,t,w
Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.
CLASSROOM 305 1365
CLASSROOM 306 125
FAN RM. 144
s,t,w
STAIR 4 115 sf.
GIRLS 178
AI 304 548
CLASSROOM 303 1671
BOYS 154
CORR. 698 sf.
Single Door Weather Stripping
Double Door Weather Stripping
Caulking
Roof-Wall Air Sealing (Seal)
Penthouse Air Sealing (Seal)
CLASSROOM 300 786
JAN. 21
CLASSROOM 301 1093
STAIR 2 190 sf.
CL 20 sf.
CL 5 sf.
CLASSROOM 302 1024
NORMAN S. WEIR
PATERSON,NJ
JOB # 1030
THIRD FLOOR
SCALE:AS-NTS
GROSS FLOOR AREA
10327 SF

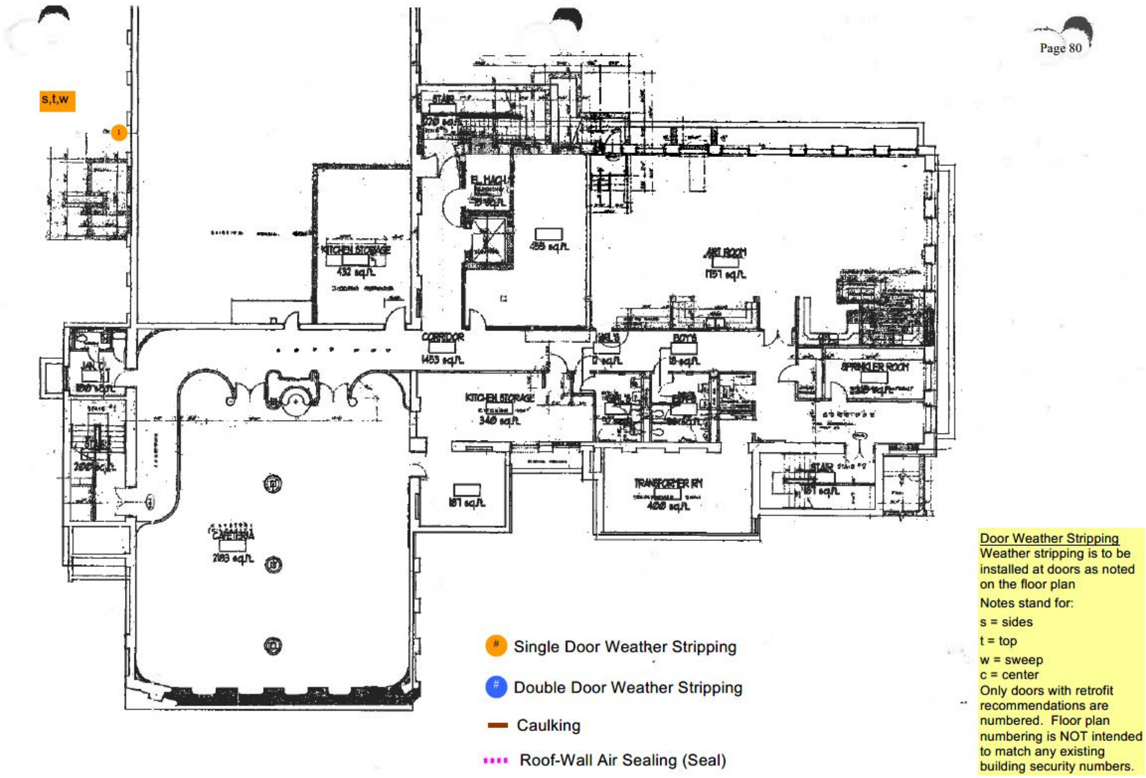
Rev. Dr. Martin Luther King Jr.

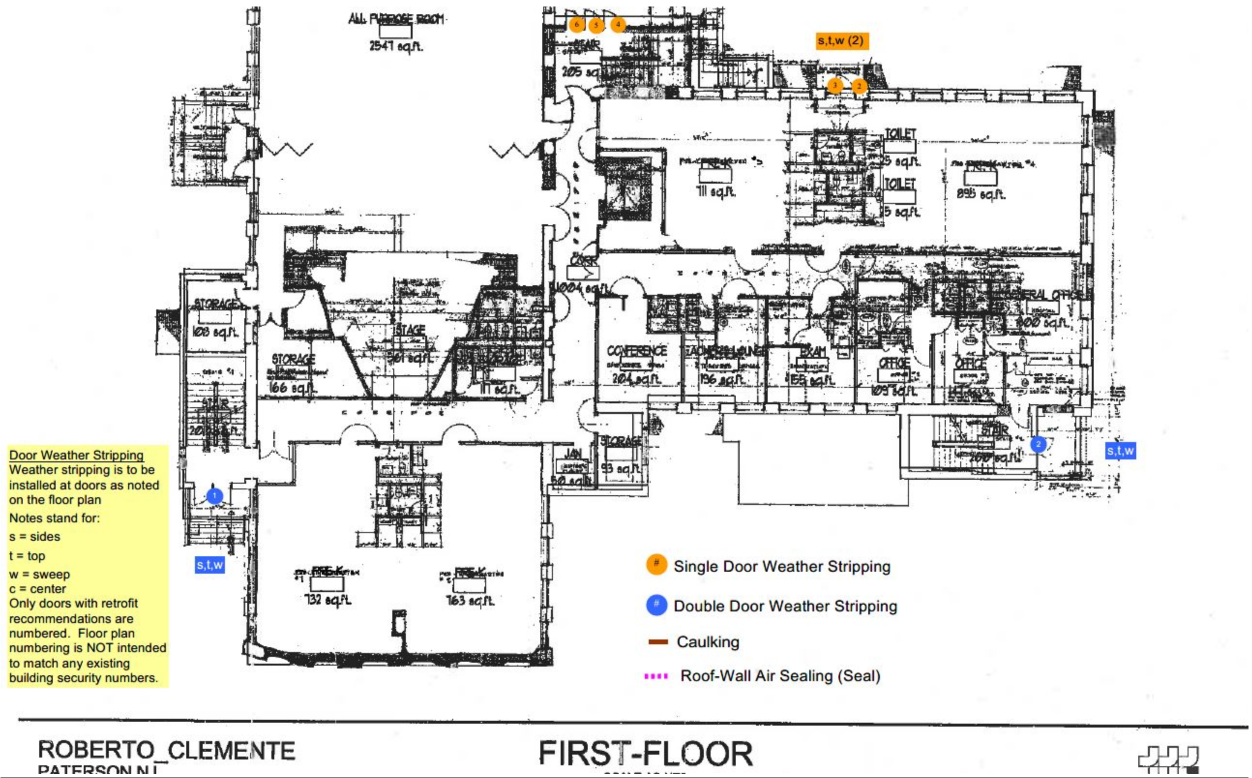


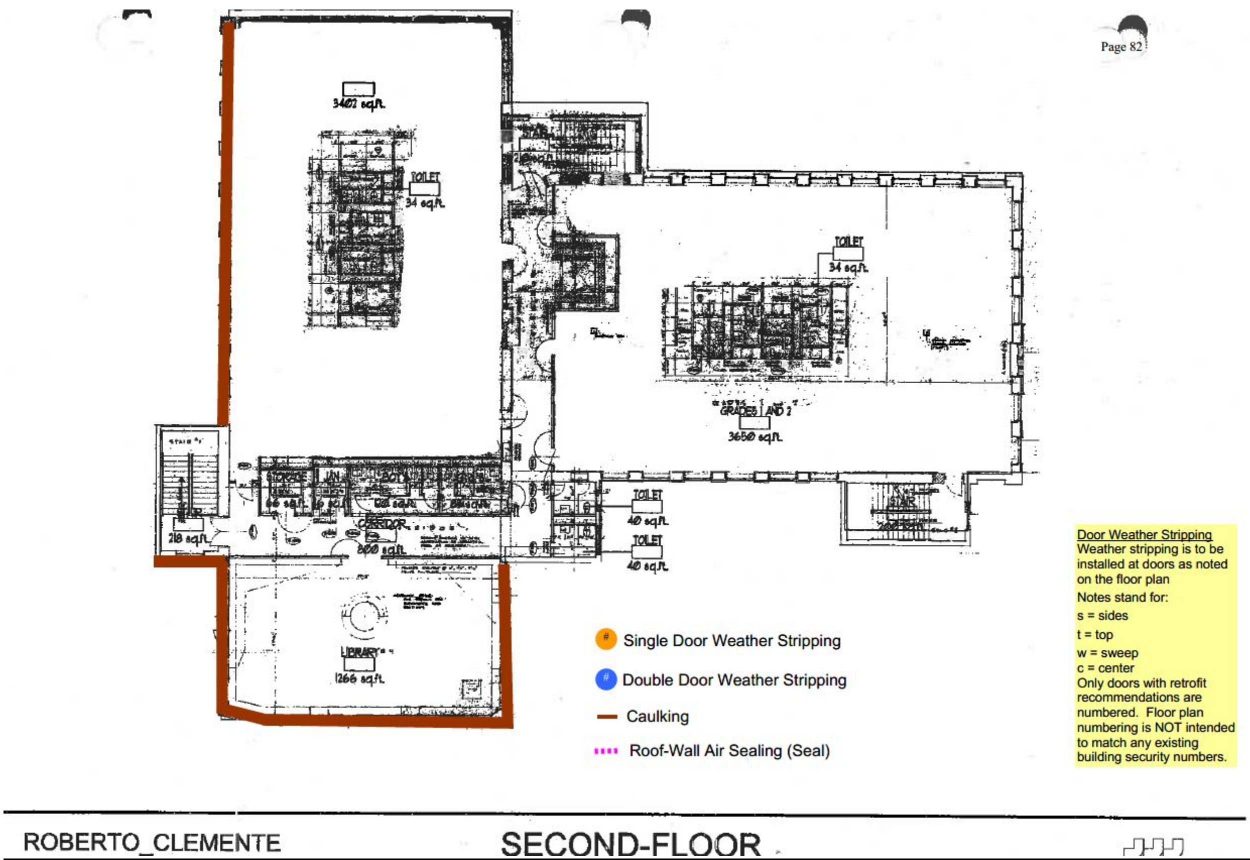

No Work Recommended on this Floor
SCHOOL_MLK
PATERSON,NJ
JOB# 1030
SECOND-FLOOR
SCALE:AS-NTS
GROSS FLOOR AREA

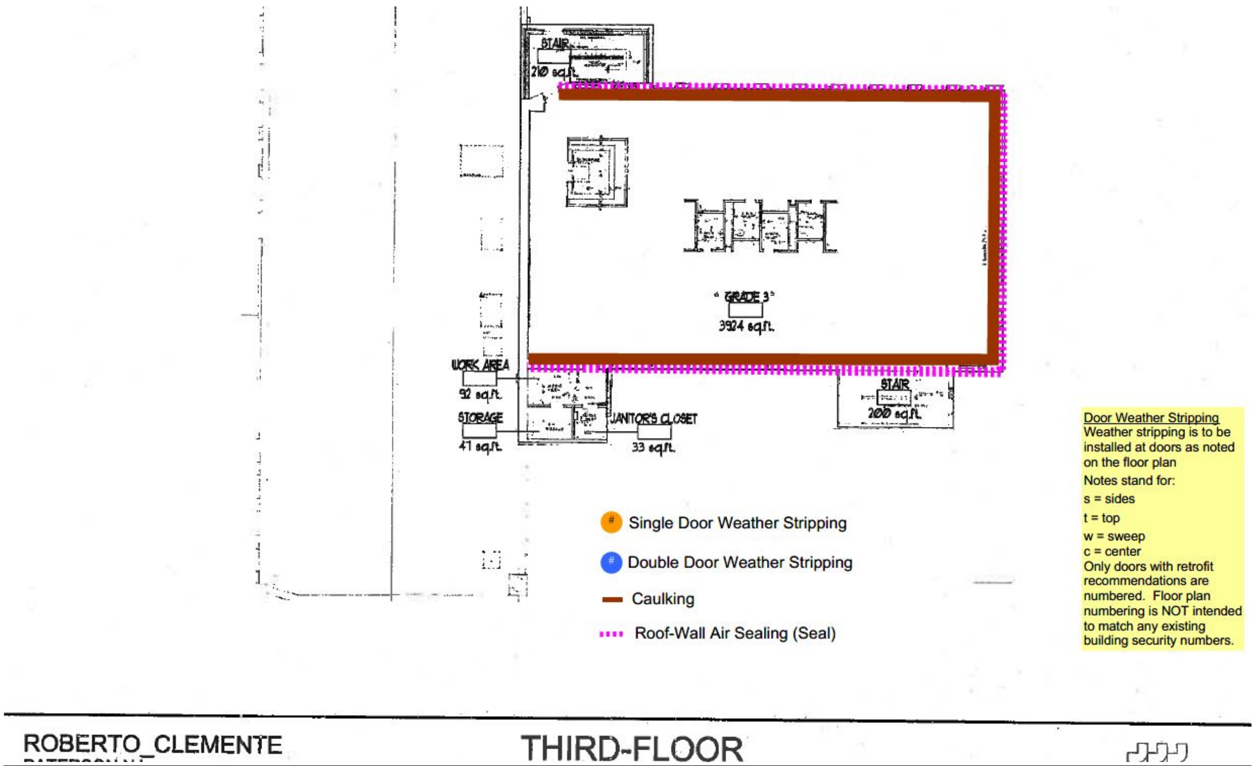

Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.
Single Door Weather Stripping
Double Door Weather Stripping
Roof-Wall Air Sealing (Seal)
Roof-Wall Air Sealing (Block, Seal)
SCHOOL_MLK
PATERSON,NJ
JOB # 1030
3FLOOR
SCALE:AS-NTS
GROSS FLOOR AREA
20931 SF

Roberto Clemente Elementary

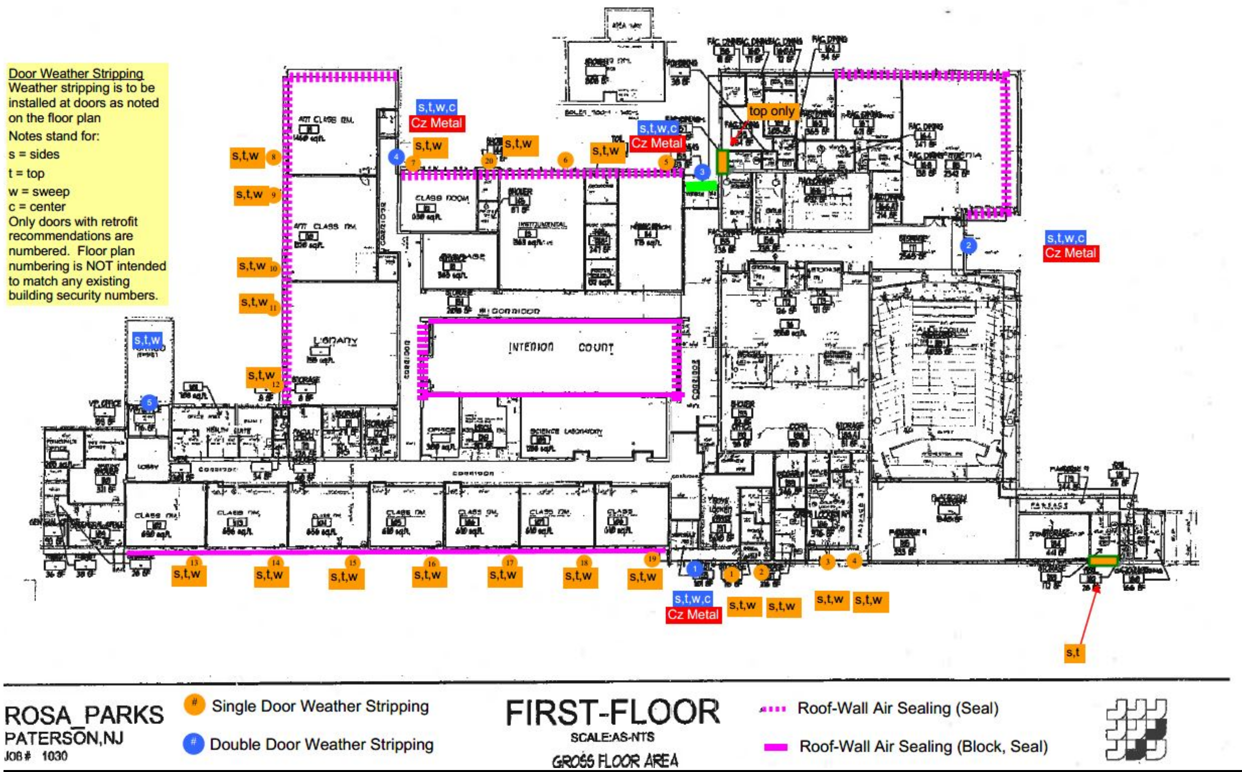


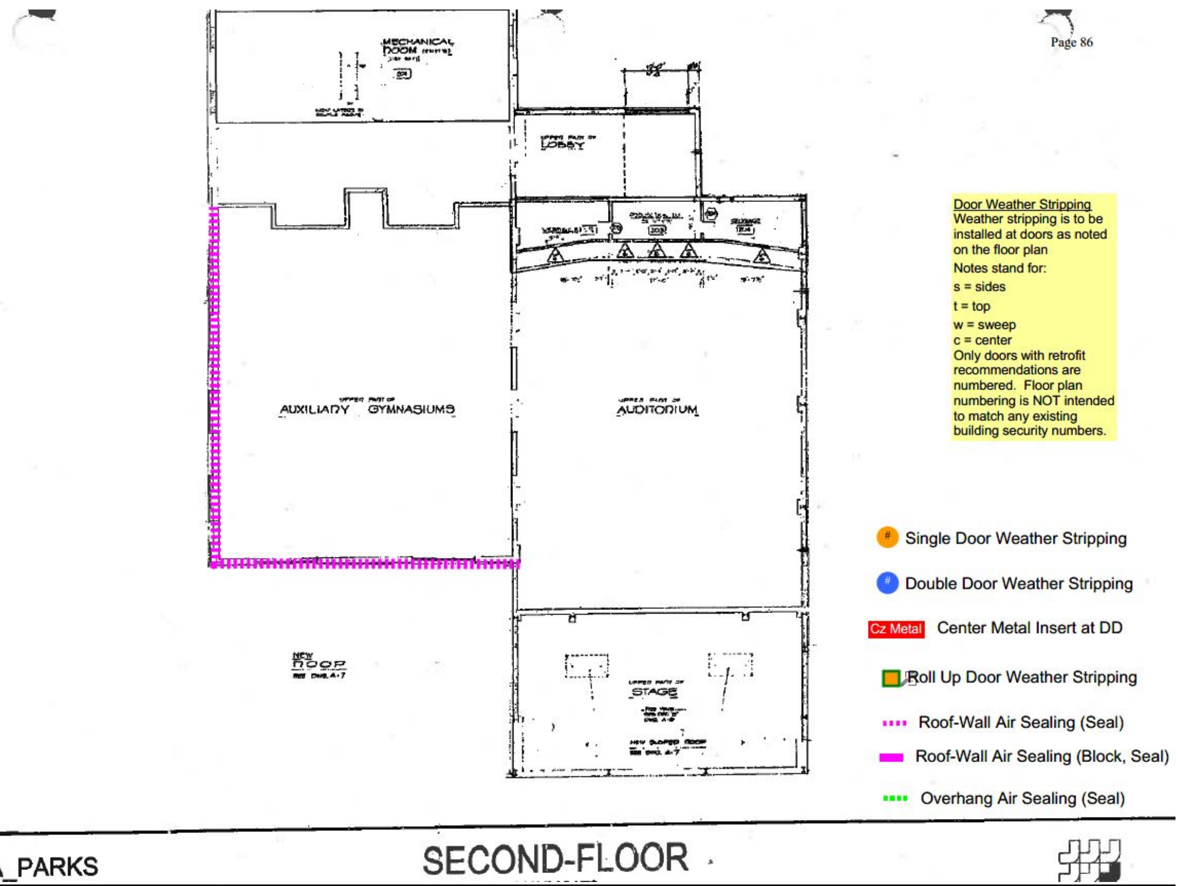

ALL PURPOSE ROOM
2547 sq.ft.
s,t,w (2)
TOILET
TOILET
STORAGE
168 sq.ft.
STORAGE
166 sq.ft.
STAGE
CONFERENCE
204 sq.ft.
OFFICE
OFFICE
JAN
STORAGE
93 sq.ft.
PRE-K
732 sq.ft.
PRE-K
763 sq.ft.
s,t,w
s,t,w
Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.
Single Door Weather Stripping
Double Door Weather Stripping
Caulking
Roof-Wall Air Sealing (Seal)
ROBERTO_CLEMENTE
FIRST-FLOOR


Page 82
3402 sq.ft.
TOILET
34 sq.ft.
TOILET
34 sq.ft.
GRADES 1 AND 2
3650 sq.ft.
TOILET
40 sq.ft.
TOILET
40 sq.ft.
218 sq.ft.
CORRIDOR
800 sq.ft.
LIBRARY
1266 sq.ft.
Single Door Weather Stripping
Double Door Weather Stripping
Caulking
Roof-Wall Air Sealing (Seal)
Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.
ROBERTO_CLEMENTE
SECOND-FLOOR

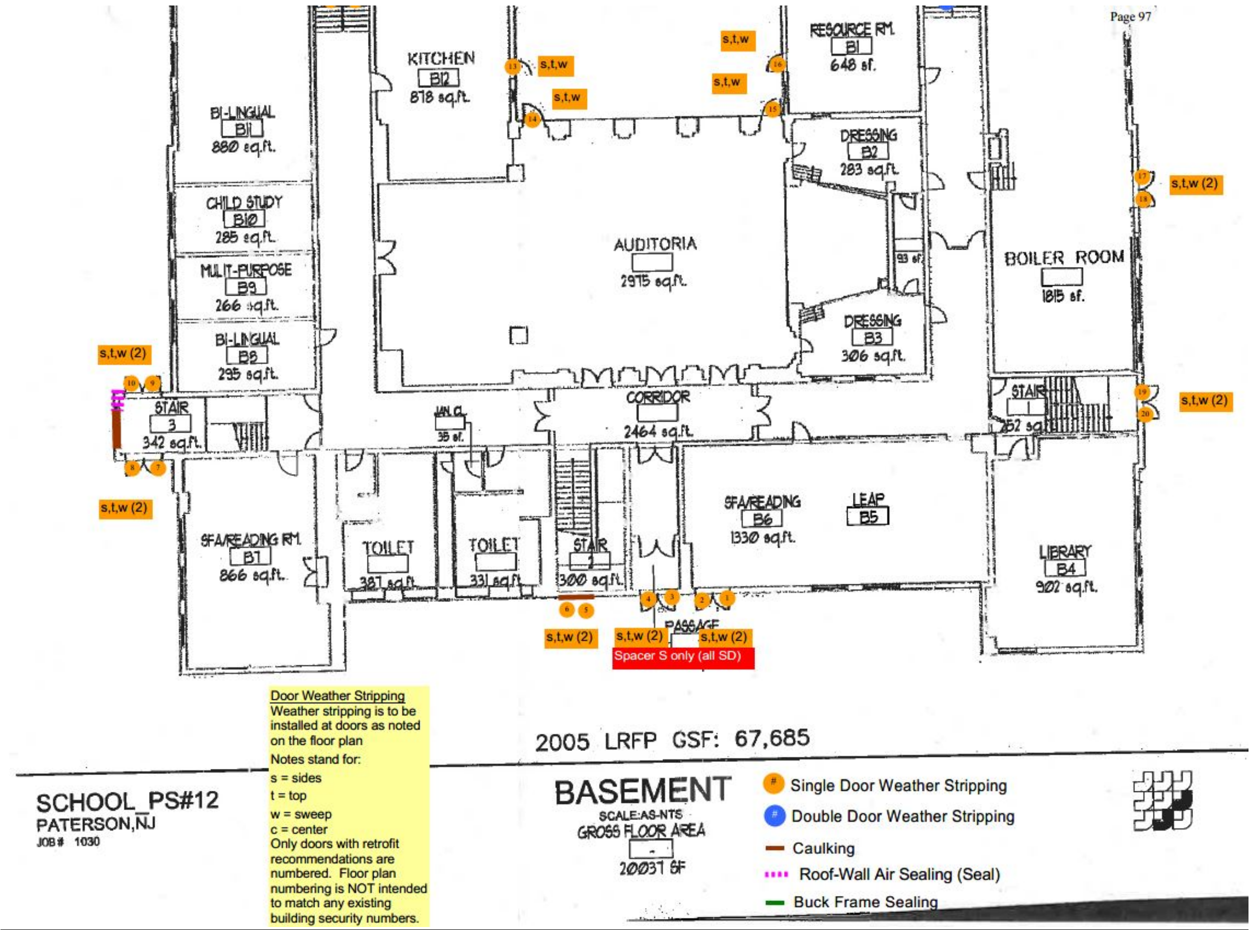


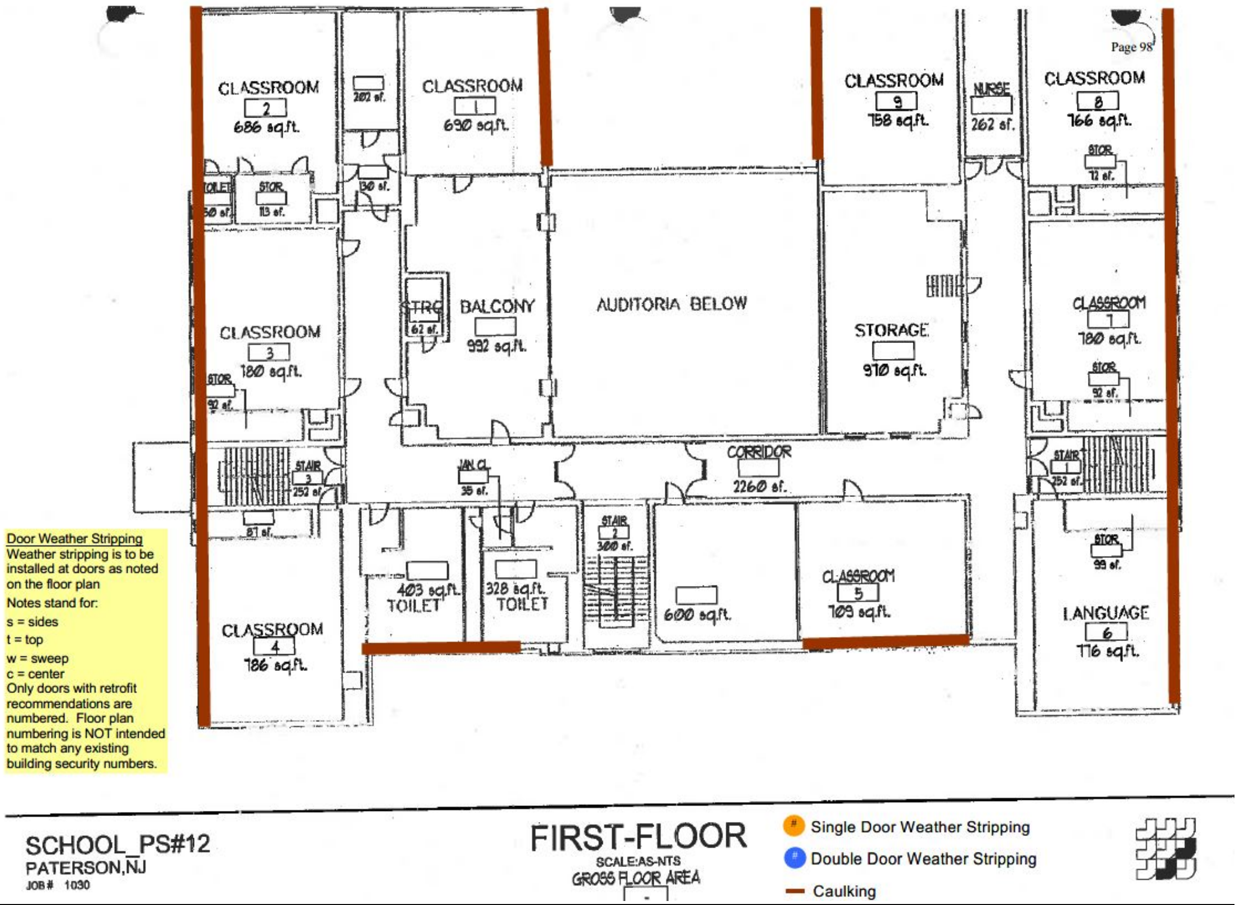
Rosa L. Parks School of Fine and Performing Arts

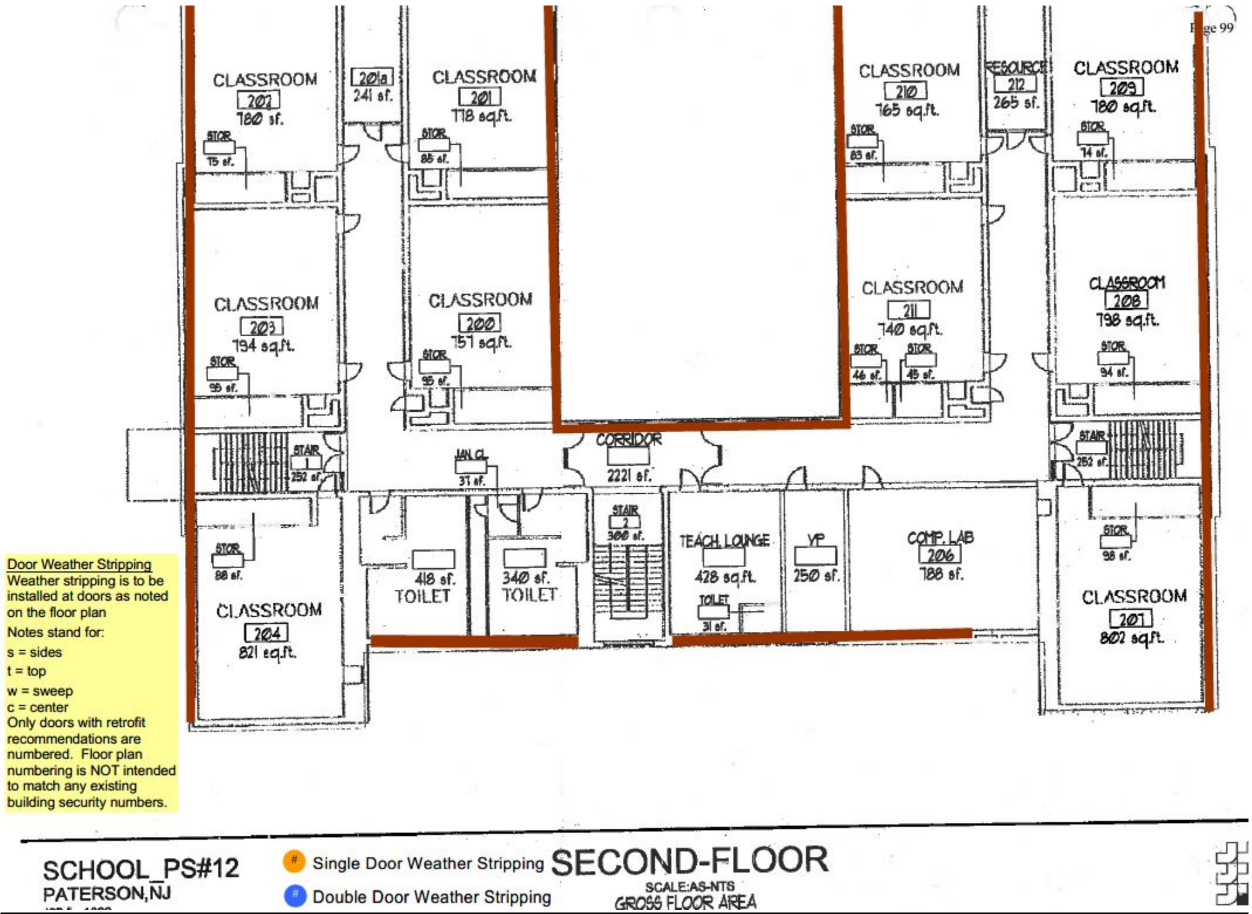

Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.
s,t,w,c
Cz Metal
s,t,w
top only
s,t
INTERIOR COURT
LIBRARY
ROSA_PARKS
PATERSON,NJ
JOB # 1030
Single Door Weather Stripping
Double Door Weather Stripping
FIRST-FLOOR
SCALE:AS-NTS
GROSS FLOOR AREA
Roof-Wall Air Sealing (Seal)
Roof-Wall Air Sealing (Block, Seal)

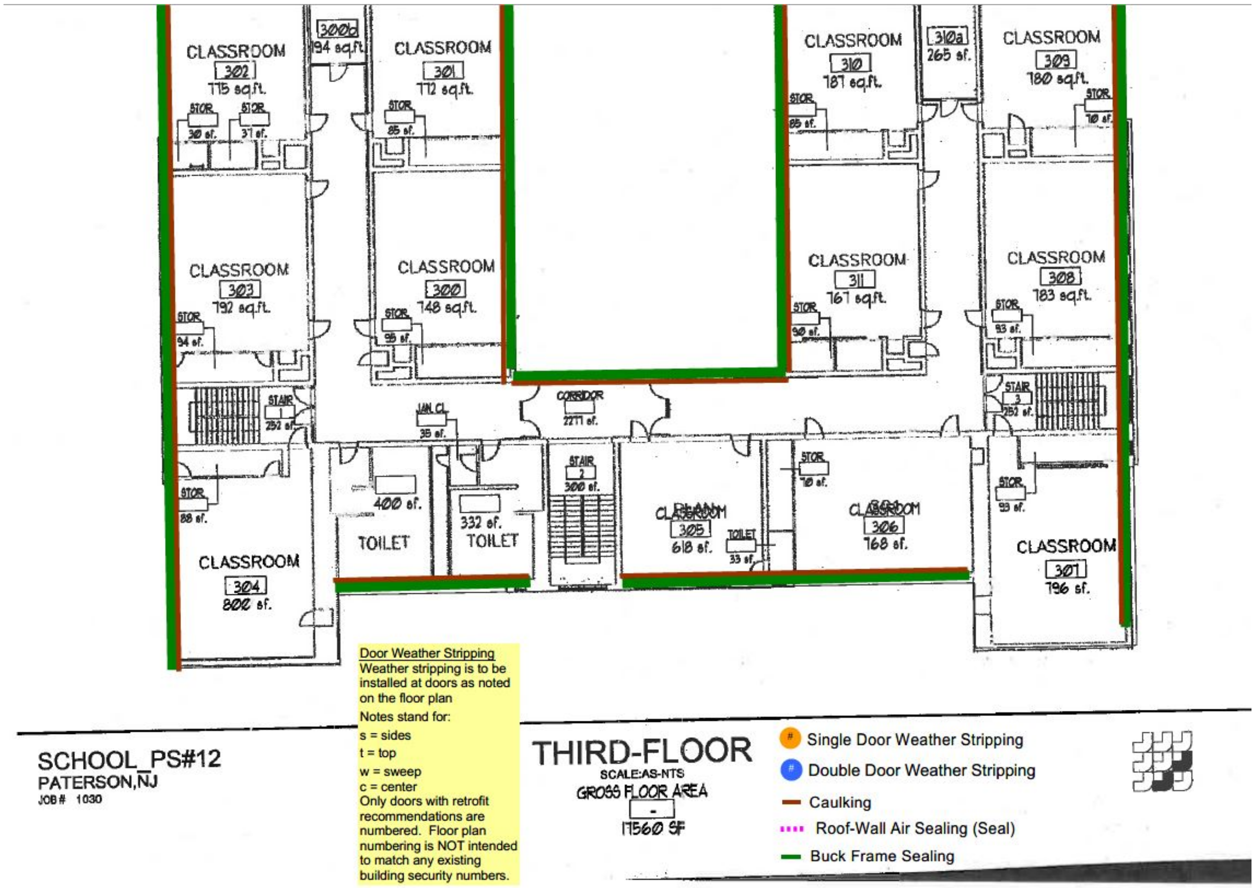

Page 86
MECHANICAL ROOM
LOBBY
AUXILIARY GYMNASIUMS
AUDITORIUM
STAGE
NEW ROOF
Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.
Single Door Weather Stripping
Double Door Weather Stripping
Cz Metal
Center Metal Insert at DD
Roll Up Door Weather Stripping
Roof-Wall Air Sealing (Seal)
Roof-Wall Air Sealing (Block, Seal)
Overhang Air Sealing (Seal)
ROSA_PARKS
SECOND-FLOOR

School 12

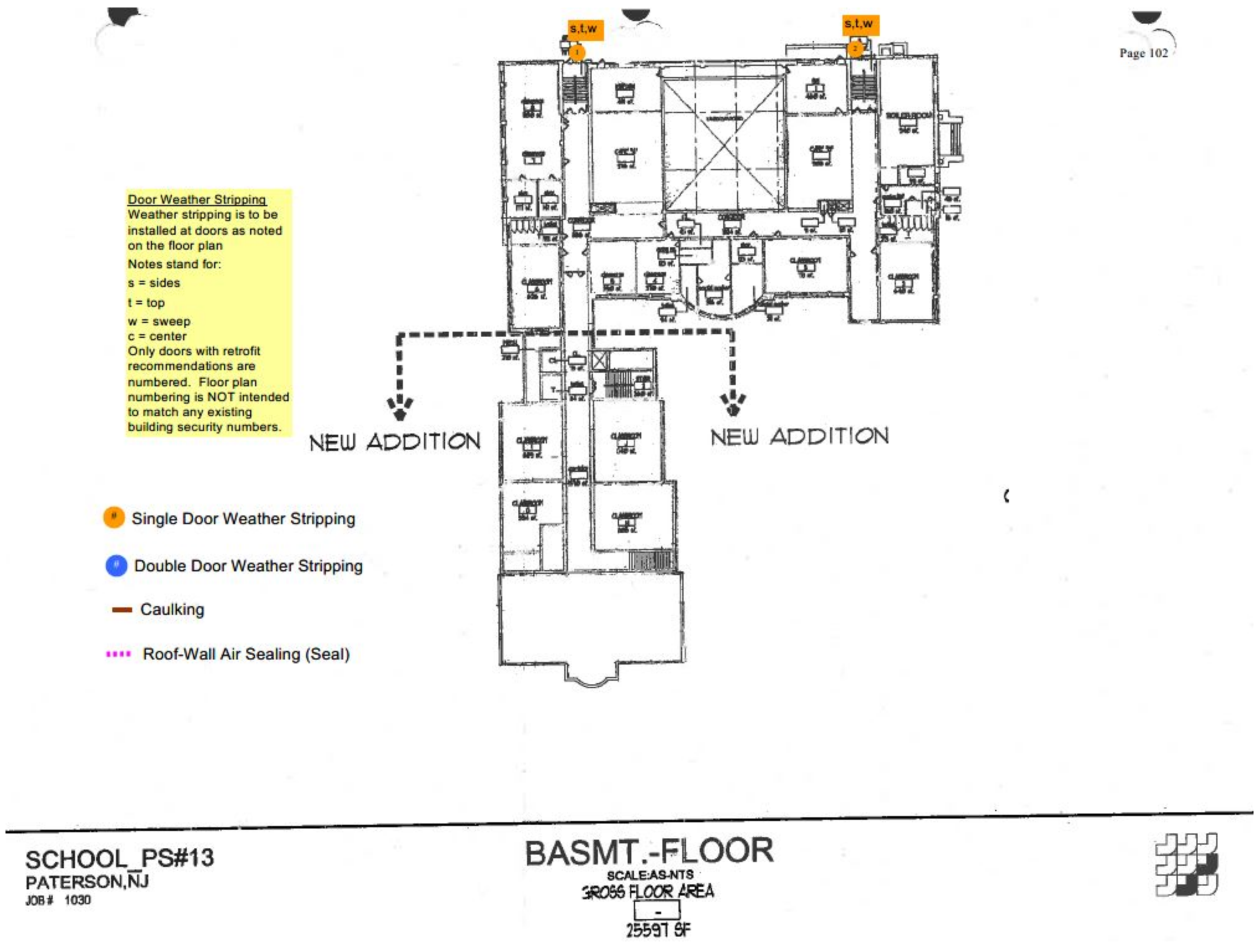

Page 97
KITCHEN
B12
878 sq.ft.
RESOURCE RM.
B1
648 sf.
BI-LINGUAL
B11
880 sq.ft.
CHILD STUDY
B10
285 sq.ft.
MULTI-PURPOSE
B9
266 sq.ft.
BI-LINGUAL
B8
295 sq.ft.
AUDITORIA
2975 sq.ft.
DRESSING
B2
283 sq.ft.
DRESSING
B3
306 sq.ft.
BOILER ROOM
1815 sf.
STAIR
3
342 sq.ft.
CORRIDOR
2464 sq.ft.
SFA/READING
B6
1330 sq.ft.
LEAP
B5
SFA/READING RM.
B7
866 sq.ft.
TOILET
387 sq.ft.
TOILET
331 sq.ft.
STAIR
300 sq.ft.
LIBRARY
B4
902 sq.ft.
PASSAGE
s,t,w
s,t,w (2)
Spacer S only (all SD)
Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.
2005 LRFP GSF: 67,685
SCHOOL PS#12
PATERSON,NJ
JOB# 1030
BASEMENT
SCALE:AS-NTS
GROSS FLOOR AREA
20037 SF
Single Door Weather Stripping
Double Door Weather Stripping
Caulking
Roof-Wall Air Sealing (Seal)
Buck Frame Sealing

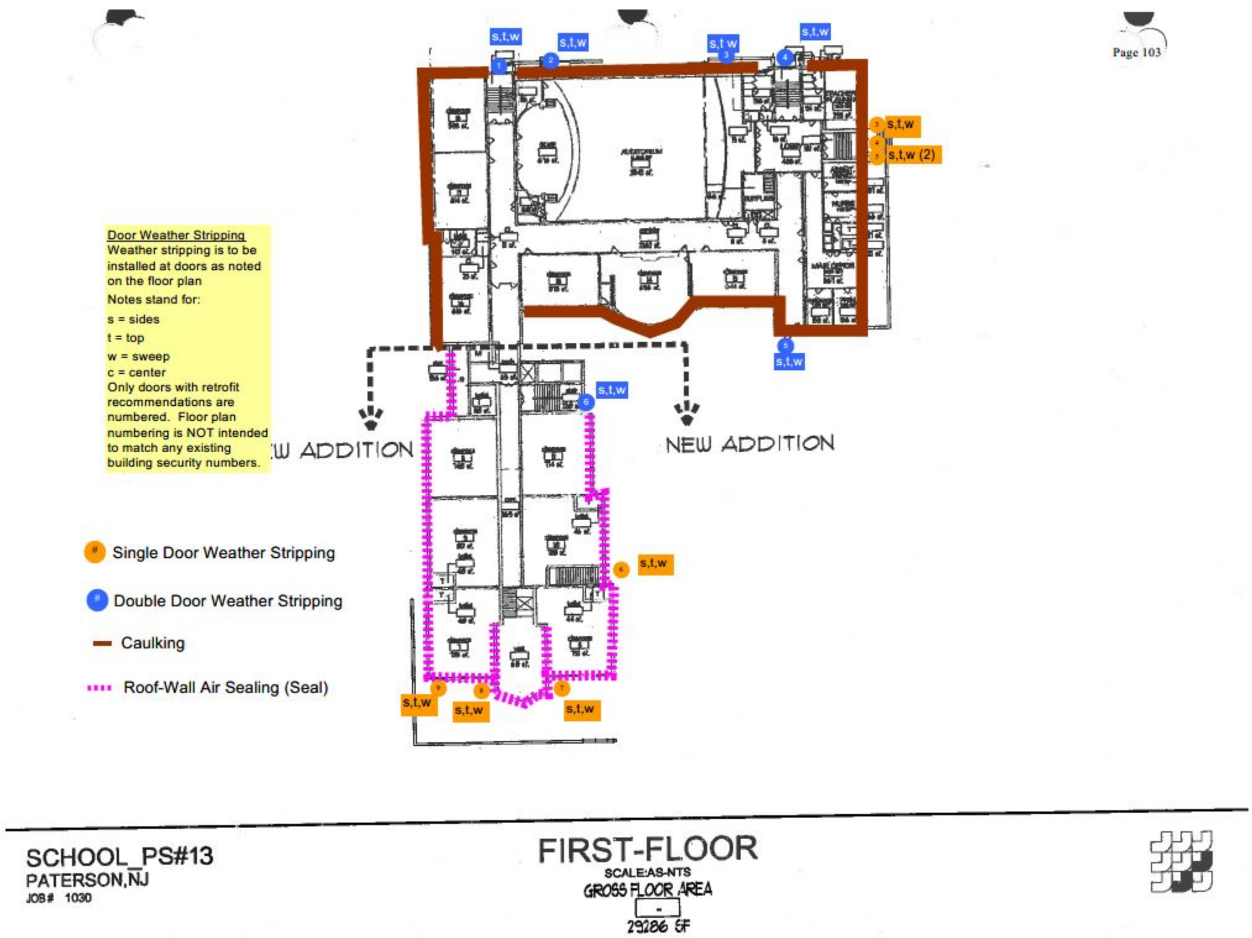

Page 98
CLASSROOM 2 686 sq.ft.
CLASSROOM 1 690 sq.ft.
CLASSROOM 9 758 sq.ft.
NURSE 262 sf.
CLASSROOM 8 766 sq.ft.
BALCONY 992 sq.ft.
AUDITORIA BELOW
STORAGE 910 sq.ft.
CLASSROOM 3 780 sq.ft.
CLASSROOM 7 780 sq.ft.
CORRIDOR 2260 sf.
403 sq.ft. TOILET
328 sq.ft. TOILET
600 sq.ft.
CLASSROOM 5 709 sq.ft.
CLASSROOM 4 786 sq.ft.
LANGUAGE 6 716 sq.ft.
Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.
SCHOOL_PS#12
PATERSON,NJ
JOB # 1030
FIRST-FLOOR
SCALE:AS-NTS
GROSS FLOOR AREA
Single Door Weather Stripping
Double Door Weather Stripping
Caulking


CLASSROOM 202 780 sf.
STOR 75 sf.
201a 241 sf.
CLASSROOM 201 778 sq.ft.
STOR 85 sf.
CLASSROOM 210 765 sq.ft.
STOR 83 sf.
RESOURCE 212 265 sf.
CLASSROOM 209 780 sq.ft.
STOR 74 sf.
CLASSROOM 203 794 sq.ft.
STOR 95 sf.
CLASSROOM 200 757 sq.ft.
STOR 95 sf.
CLASSROOM 211 740 sq.ft.
STOR 46 sf.
STOR 45 sf.
CLASSROOM 208 798 sq.ft.
STOR 94 sf.
STAIR 252 sf.
JAN CL 31 sf.
CORRIDOR 2221 sf.
STAIR 252 sf.
STAIR 2 300 sf.
STOR 88 sf.
418 sf. TOILET
340 sf. TOILET
TEACH. LOUNGE 428 sq.ft.
TOILET 31 sf.
VP 250 sf.
COMP. LAB 206 788 sf.
STOR 98 sf.
CLASSROOM 204 821 sq.ft.
CLASSROOM 207 802 sq.ft.
Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.
SCHOOL_PS#12
PATERSON,NJ
Single Door Weather Stripping
Double Door Weather Stripping
SECOND-FLOOR
SCALE:AS-NTS
GROSS FLOOR AREA

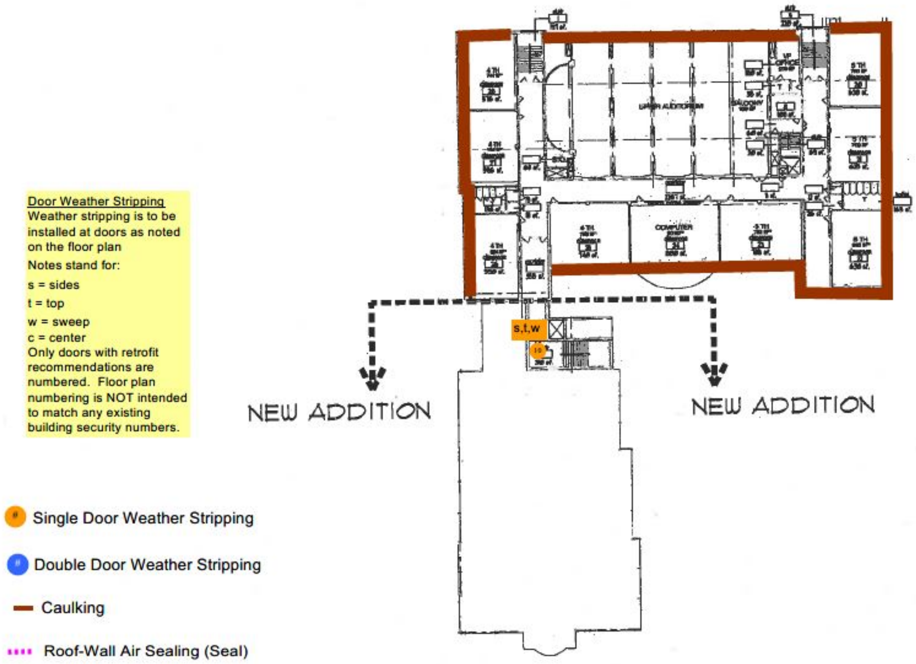

CLASSROOM 302 775 sq.ft.
300a 94 sq.ft.
CLASSROOM 301 772 sq.ft.
CLASSROOM 310 787 sq.ft.
310a 265 sf.
CLASSROOM 309 780 sq.ft.
CLASSROOM 303 792 sq.ft.
CLASSROOM 300 748 sq.ft.
CLASSROOM 311 767 sq.ft.
CLASSROOM 308 783 sq.ft.
CORRIDOR 2271 sf.
400 sf. TOILET
332 sf. TOILET
CLASSROOM 305 618 sf.
CLASSROOM 306 768 sf.
CLASSROOM 304 800 sf.
CLASSROOM 307 796 sf.
Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.
SCHOOL_PS#12
PATERSON,NJ
JOB# 1030
THIRD-FLOOR
SCALE:AS-NTS
GROSS FLOOR AREA
17560 SF
Single Door Weather Stripping
Double Door Weather Stripping
Caulking
Roof-Wall Air Sealing (Seal)
Buck Frame Sealing

School 13


s,t,w
s,t,w
Page 102
Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.
NEW ADDITION
NEW ADDITION
Single Door Weather Stripping
Double Door Weather Stripping
Caulking
Roof-Wall Air Sealing (Seal)
SCHOOL_PS#13
PATERSON,NJ
JOB# 1030
BASMT.-FLOOR
SCALE:AS-NTS
GROSS FLOOR AREA
-
25597 SF

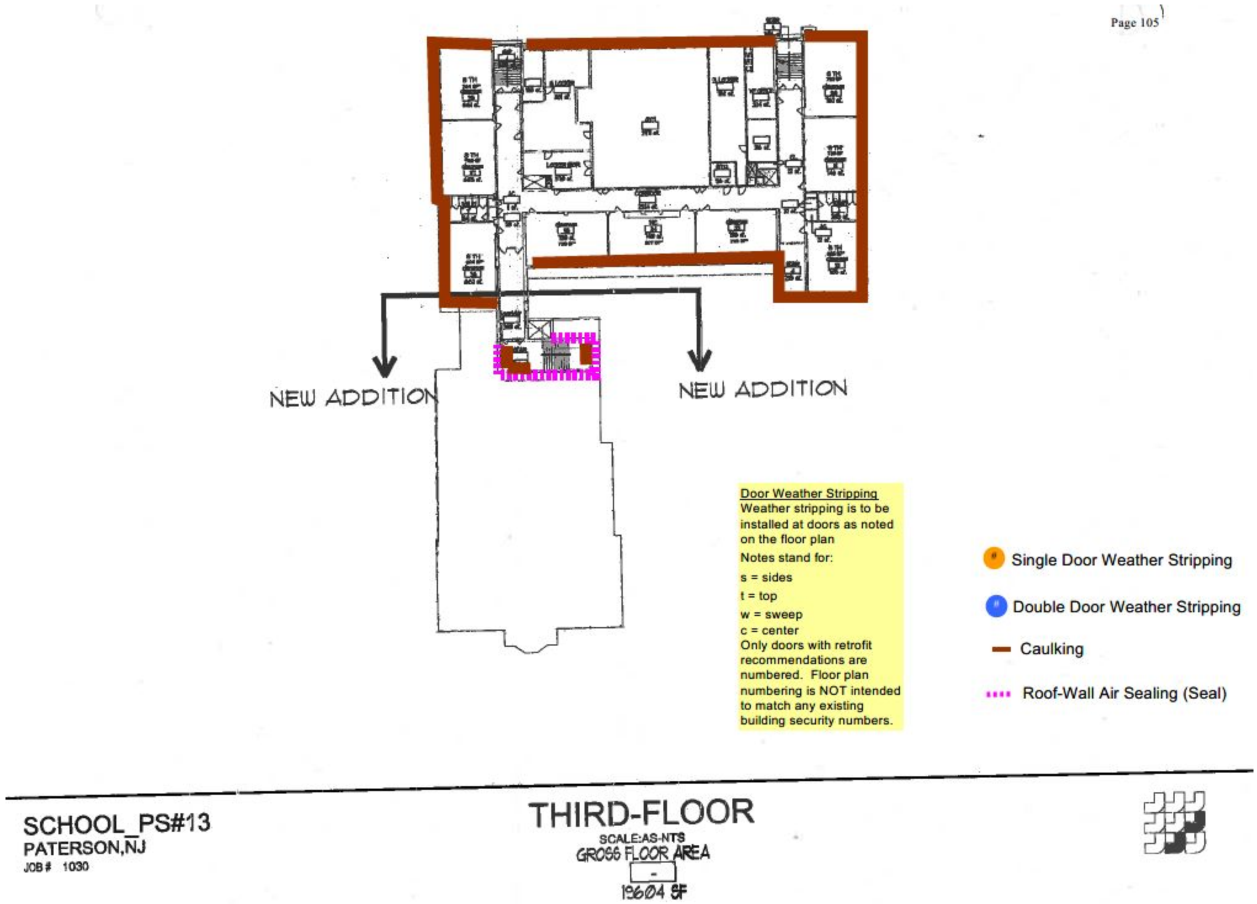

Page 103
Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.
Single Door Weather Stripping
Double Door Weather Stripping
Caulking
Roof-Wall Air Sealing (Seal)
s,t,w
s,t,w (2)
NEW ADDITION
NEW ADDITION
SCHOOL_PS#13
PATERSON,NJ
JOB# 1030
FIRST-FLOOR
SCALE:AS-NTS
GROSS FLOOR AREA
29286 SF

Page 104

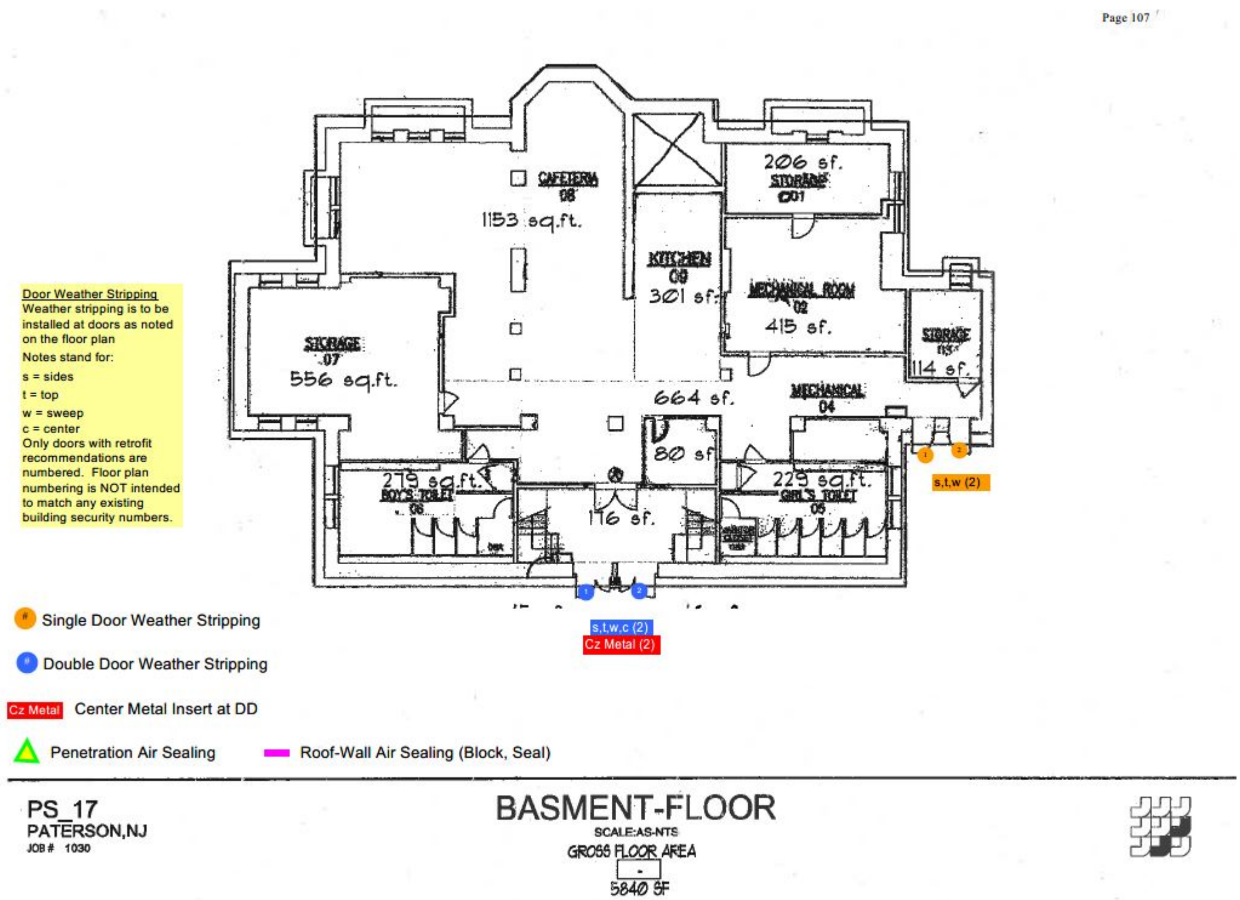


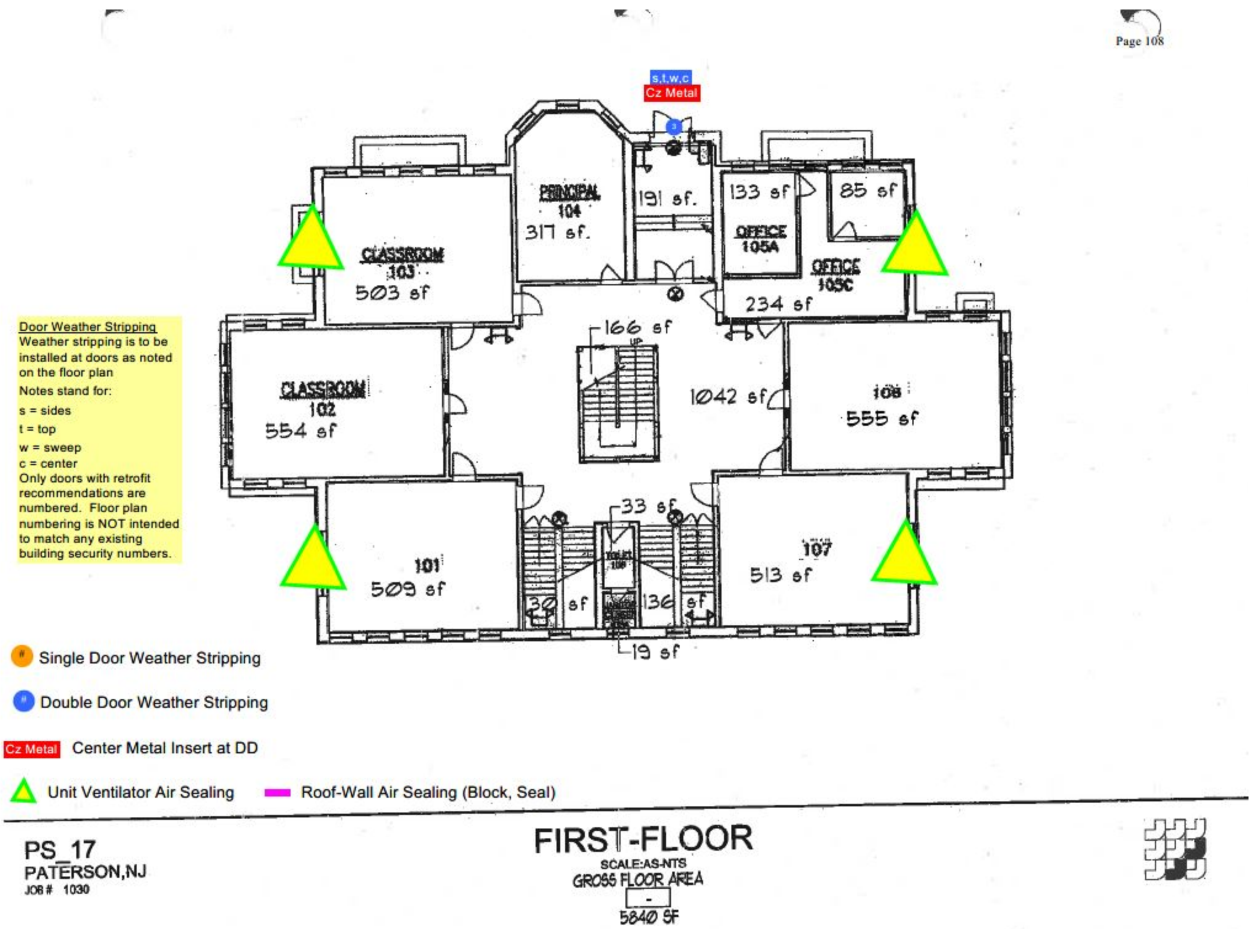
SCHOOL_PS#13
PATERSON,NJ
JOB# 1030

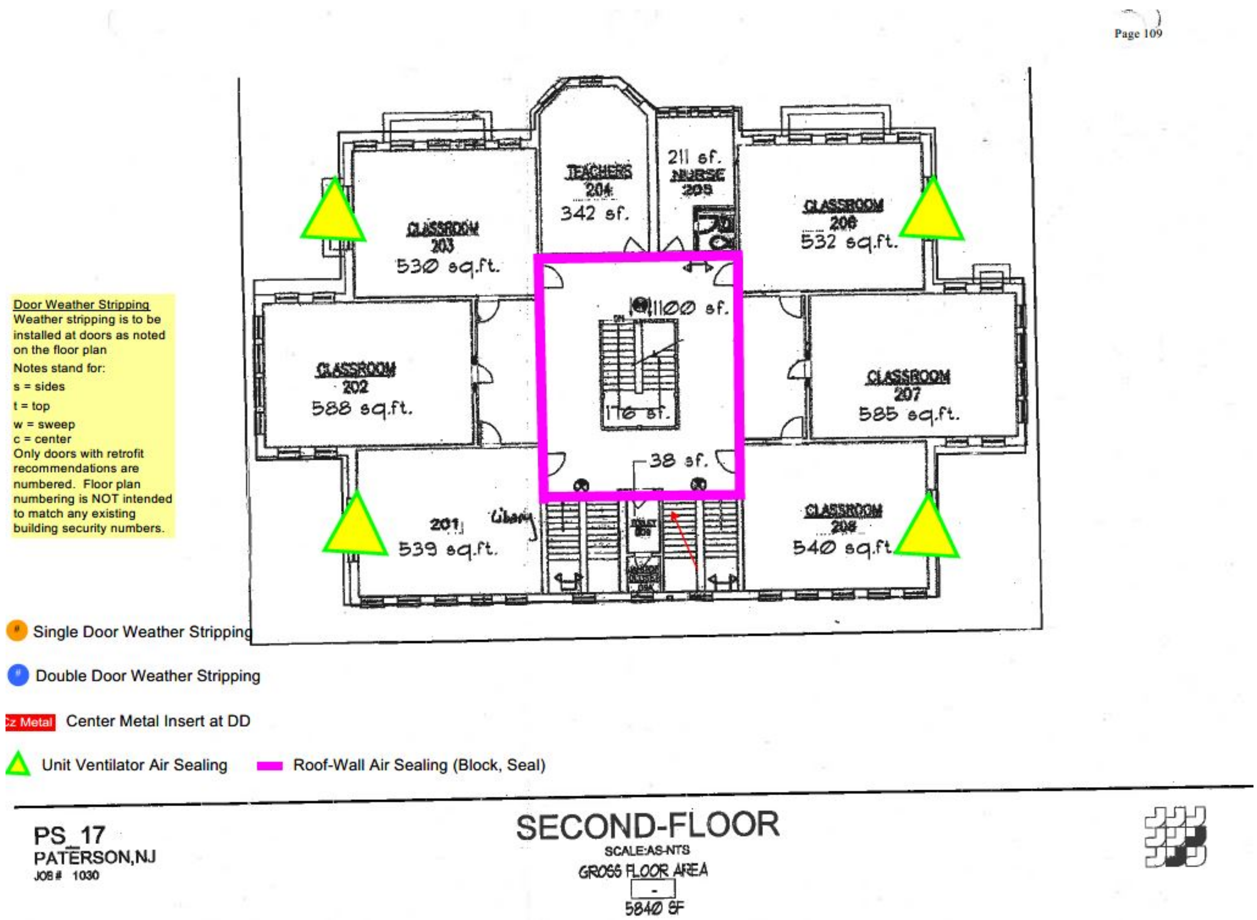
SECOND-FLOOR
SCALE:AS-NTS
GROSS FLOOR AREA
19604 SF


Page 105
NEW ADDITION
NEW ADDITION
Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.
Single Door Weather Stripping
Double Door Weather Stripping
Caulking
Roof-Wall Air Sealing (Seal)
SCHOOL_PS#13
PATERSON,NJ
JOB# 1030
THIRD-FLOOR
SCALE:AS-NTS
GROSS FLOOR AREA
19604 SF

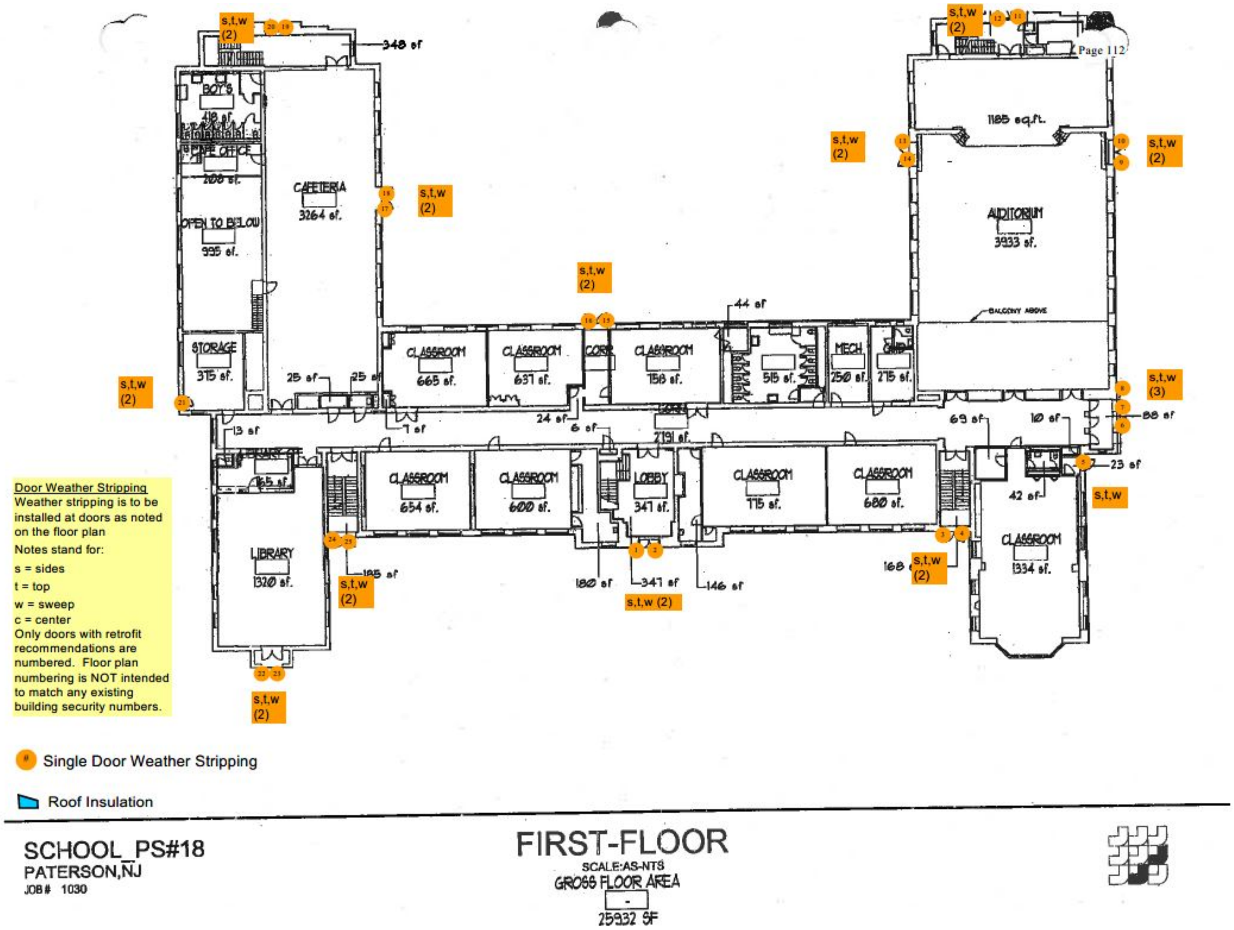
School 17

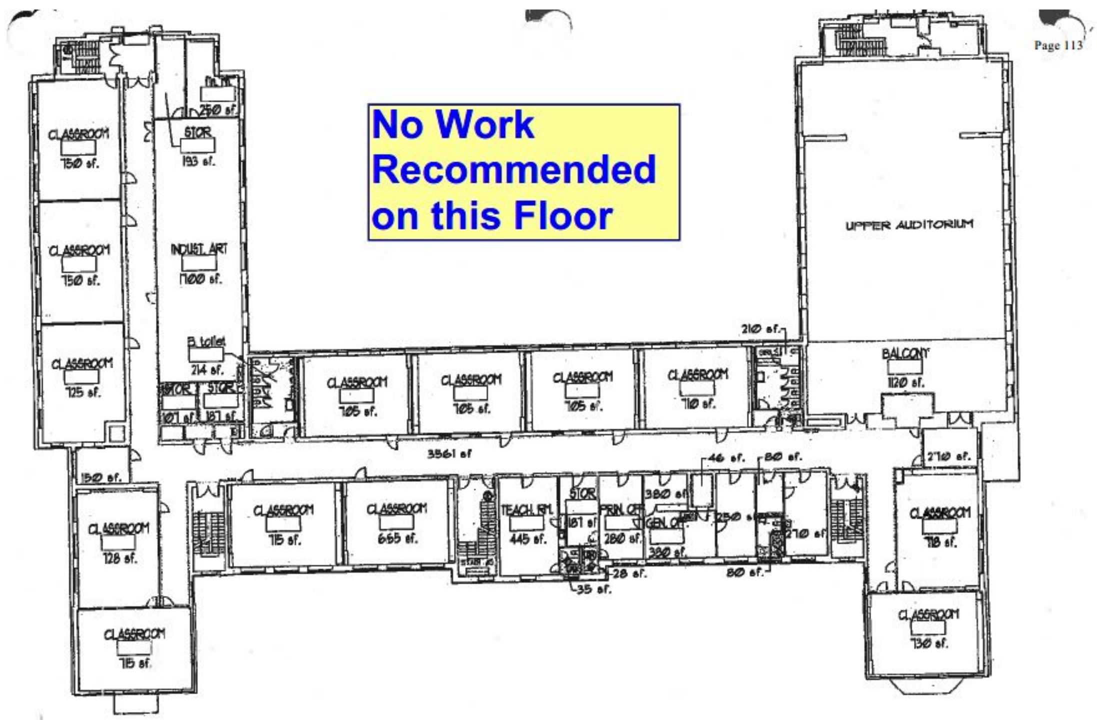

Page 107
Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.
CAFETERIA
08
1153 sq.ft.
206 sf.
STORAGE
KITCHEN
09
301 sf.
MECHANICAL ROOM
02
415 sf.
STORAGE
07
556 sq.ft.
STORAGE
114 sf.
664 sf.
MECHANICAL
04
80 sf
279 sq.ft.
BOY'S TOILET
06
176 sf.
229 sq.ft.
GIRL'S TOILET
05
s,t,w (2)
s,t,w,c (2)
Cz Metal (2)
Single Door Weather Stripping
Double Door Weather Stripping
Cz Metal
Center Metal Insert at DD
Penetration Air Sealing
Roof-Wall Air Sealing (Block, Seal)
PS_17
PATERSON,NJ
JOB # 1030
BASMENT-FLOOR
SCALE:AS-NTS
GROSS FLOOR AREA
5840 SF


Page 108
s,t,w,c
Cz Metal
PRINCIPAL 104
317 sf.
191 sf.
133 sf
85 sf
OFFICE 105A
OFFICE 105C
234 sf
CLASSROOM 103
503 sf
166 sf
CLASSROOM 102
554 sf
1042 sf
108
555 sf
33 sf
101
509 sf
107
513 sf
30 sf
136 sf
19 sf
Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.
Single Door Weather Stripping
Double Door Weather Stripping
Cz Metal
Center Metal Insert at DD
Unit Ventilator Air Sealing
Roof-Wall Air Sealing (Block, Seal)
PS_17
PATERSON,NJ
JOB # 1030
FIRST-FLOOR
SCALE:AS-NTS
GROSS FLOOR AREA
5840 SF


Page 109
TEACHERS
204
342 sf.
211 sf.
NURSE
205
CLASSROOM
203
530 sq.ft.
CLASSROOM
206
532 sq.ft.
1100 sf.
CLASSROOM
202
588 sq.ft.
176 sf.
CLASSROOM
207
585 sq.ft.
38 sf.
201
539 sq.ft.
Library
CLASSROOM
208
540 sq.ft.
Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.
Single Door Weather Stripping
Double Door Weather Stripping
Cz Metal
Center Metal Insert at DD
Unit Ventilator Air Sealing
Roof-Wall Air Sealing (Block, Seal)
PS_17
PATERSON,NJ
JOB # 1030
SECOND-FLOOR
SCALE:AS-NTS
GROSS FLOOR AREA
5840 SF

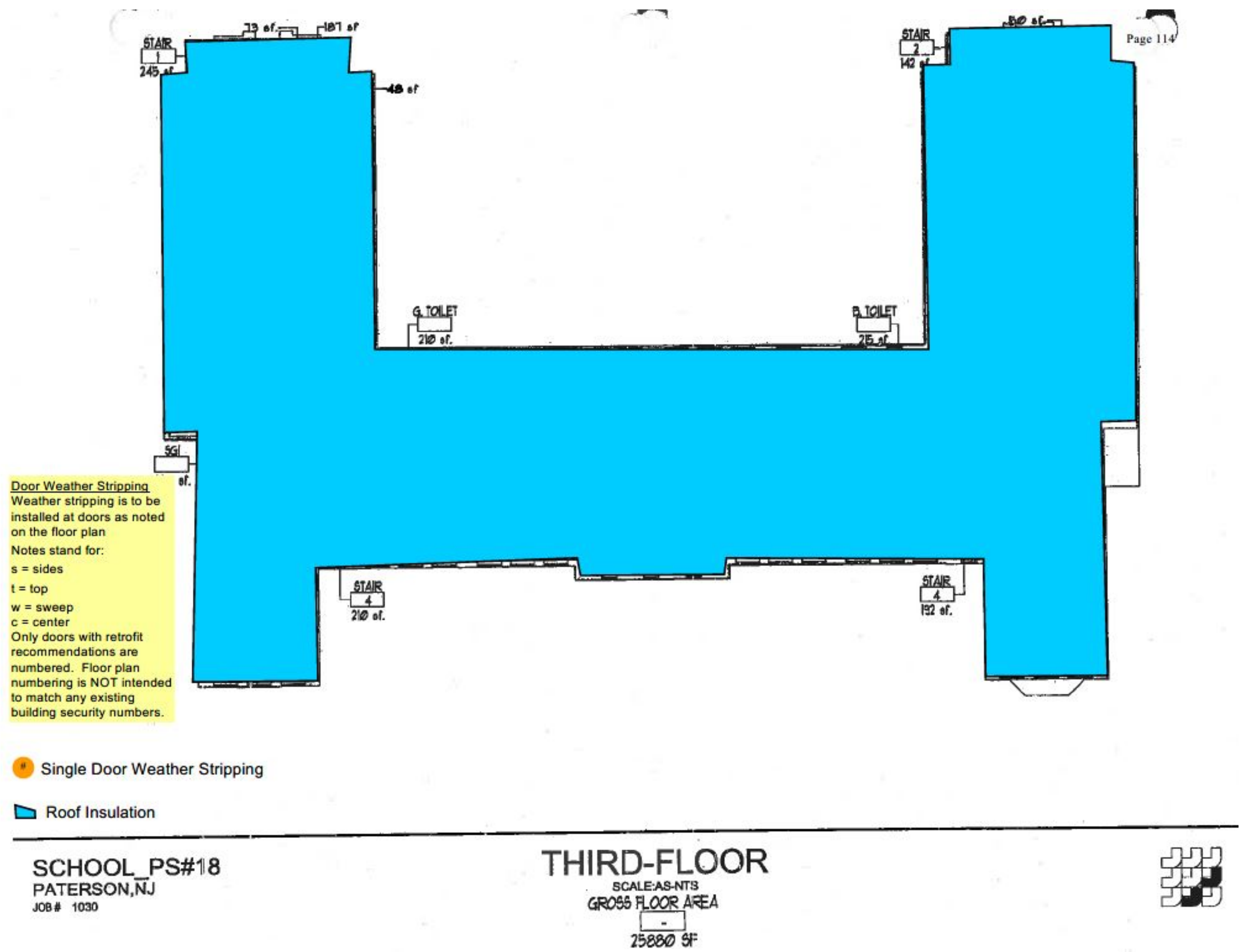
School 18


Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.
Single Door Weather Stripping
Roof Insulation
SCHOOL_PS#18
PATERSON,NJ
JOB# 1030
FIRST-FLOOR
SCALE:AS-NTS
GROSS FLOOR AREA
25932 SF
CAFETERIA
3264 sf.
AUDITORIUM
3933 sf.
LIBRARY
1320 sf.
LOBBY
341 sf.
STORAGE
315 sf.
MECH
s,t,w (2)
s,t,w (3)
s,t,w



SCHOOL_PS#18
PATERSON,NJ
JOB # 1030

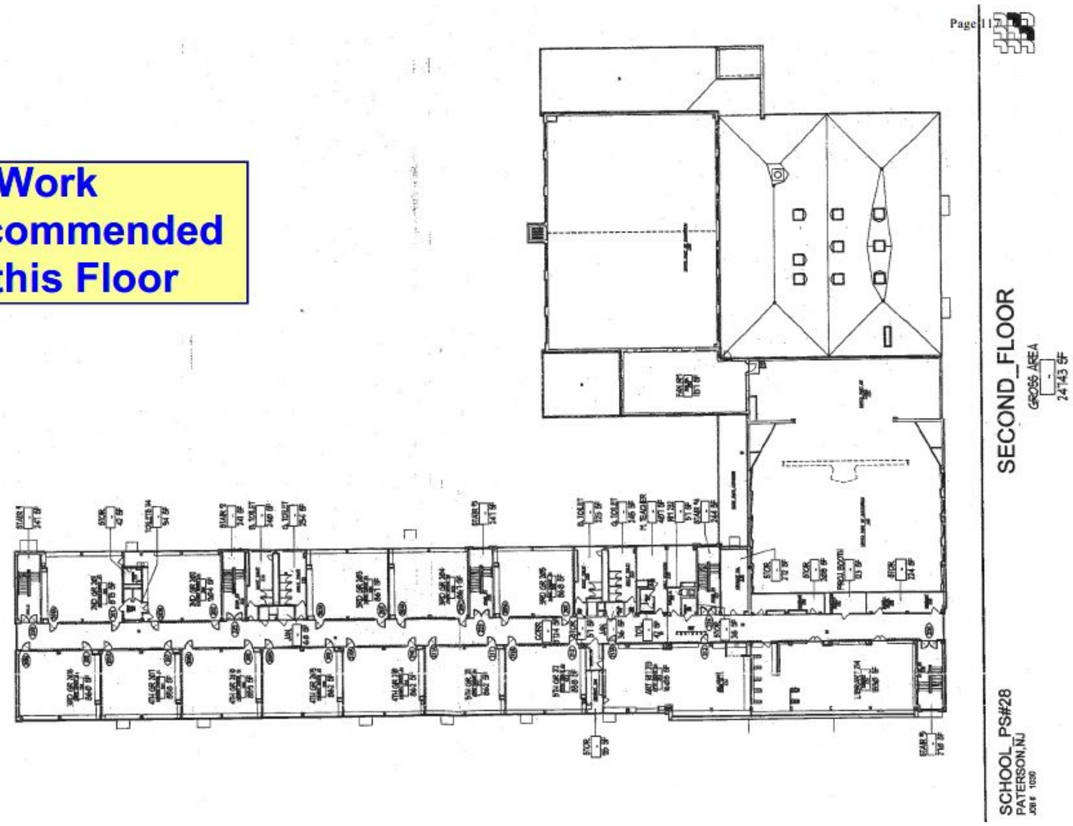
SECOND-FLOOR
SCALE:AS-NTS
GROSS FLOOR AREA
25815 SF


STAIR
1
245 sf
73 sf
187 sf
48 sf
STAIR
2
142 sf
180 sf
Page 114
G. TOILET
210 sf.
B. TOILET
215 sf
SGI
sf.
STAIR
4
210 sf.
STAIR
4
192 sf.
Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.
Single Door Weather Stripping
Roof Insulation
SCHOOL_PS#18
PATERSON,NJ
JOB # 1030
THIRD-FLOOR
SCALE:AS-NTS
GROSS FLOOR AREA
=
25880 SF

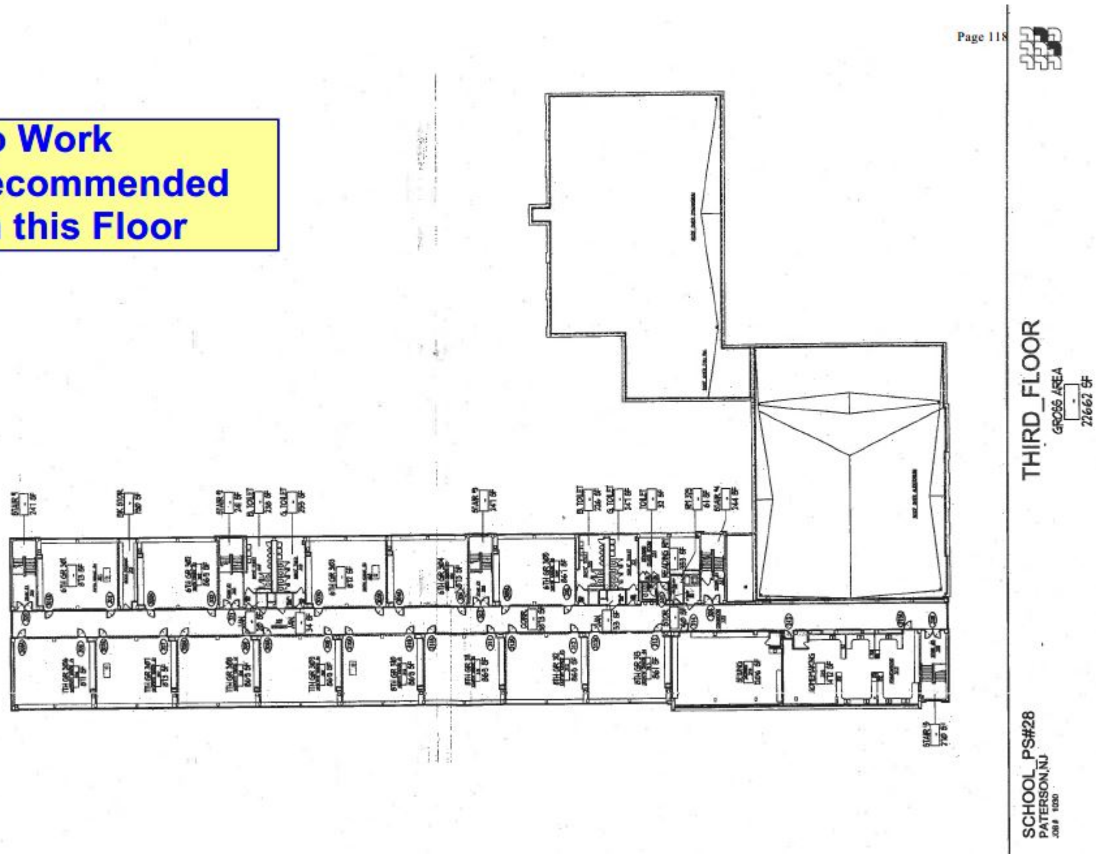
School 28


Roll Up Door Weather Stripping
Single Door Weather Stripping
Double Door Weather Stripping
Penetration Air Sealing
Buck Frame Sealing
Roof-Wall Air Sealing (Seal)
Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.
s,t,w (4)
s,t,w (2)
s,t,w (3)
s,t
s,t,w
FIRST_FLOOR
SCHOOL_PS#28
PATERSON,NJ
CAFETERIA
AUDITORIUM

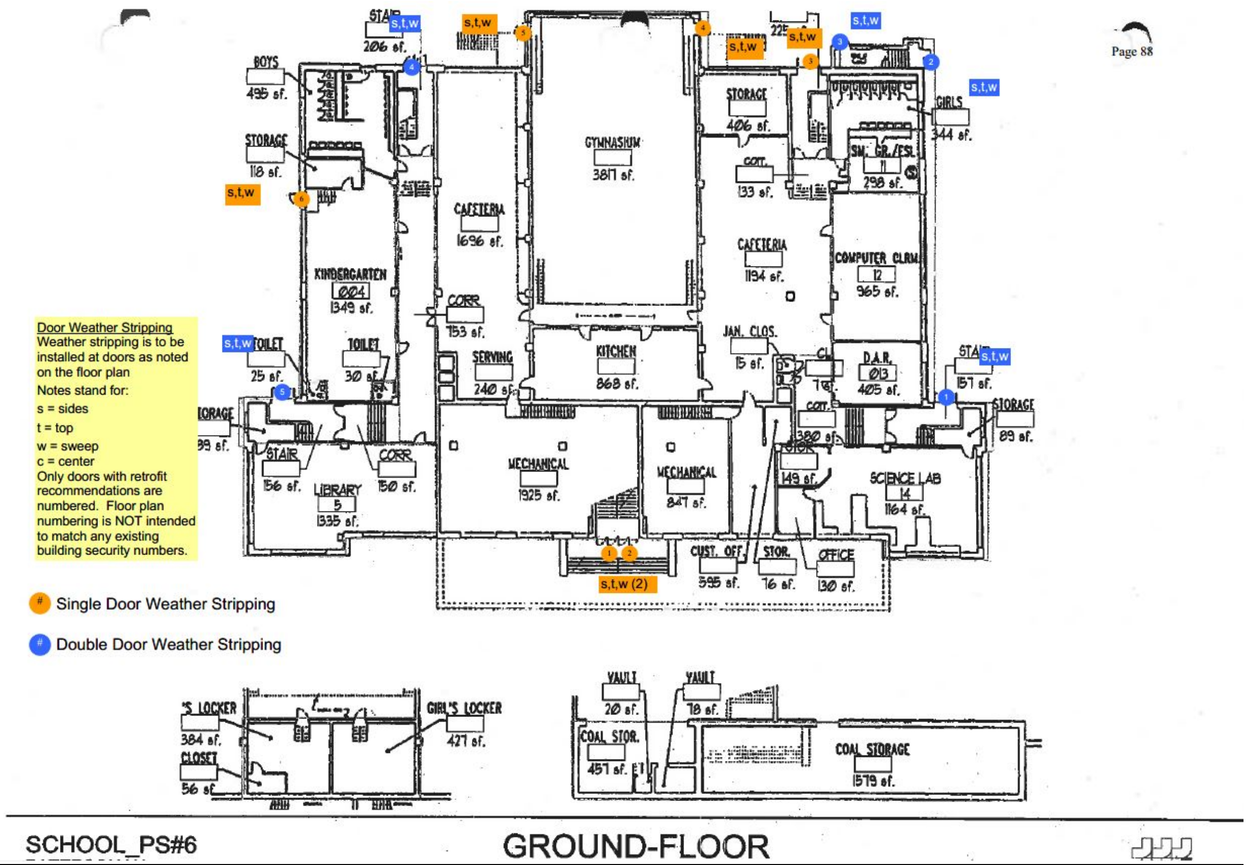
No Work Recommended on this Floor



No Work Recommended on this Floor



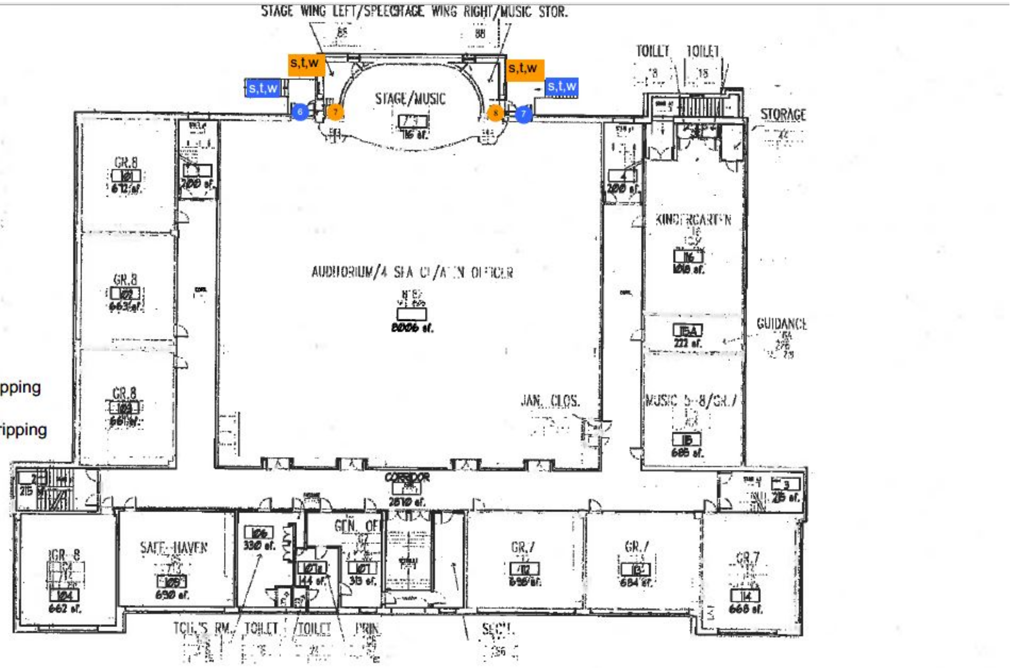
School 6


Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.
Single Door Weather Stripping
Double Door Weather Stripping
SCHOOL_PS#6
GROUND-FLOOR

Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.

Single Door Weather Stripping

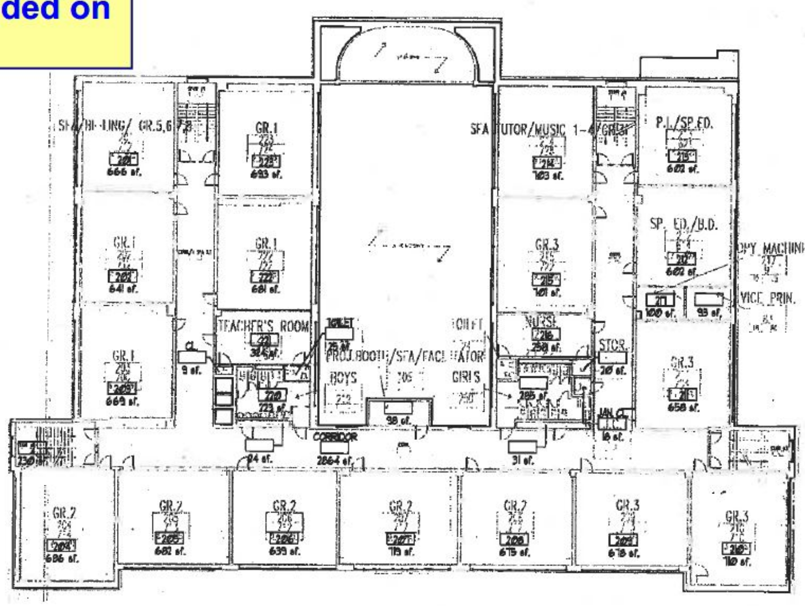
Double Door Weather Stripping



SCHOOL_PS#6 FIRST-FLOOR

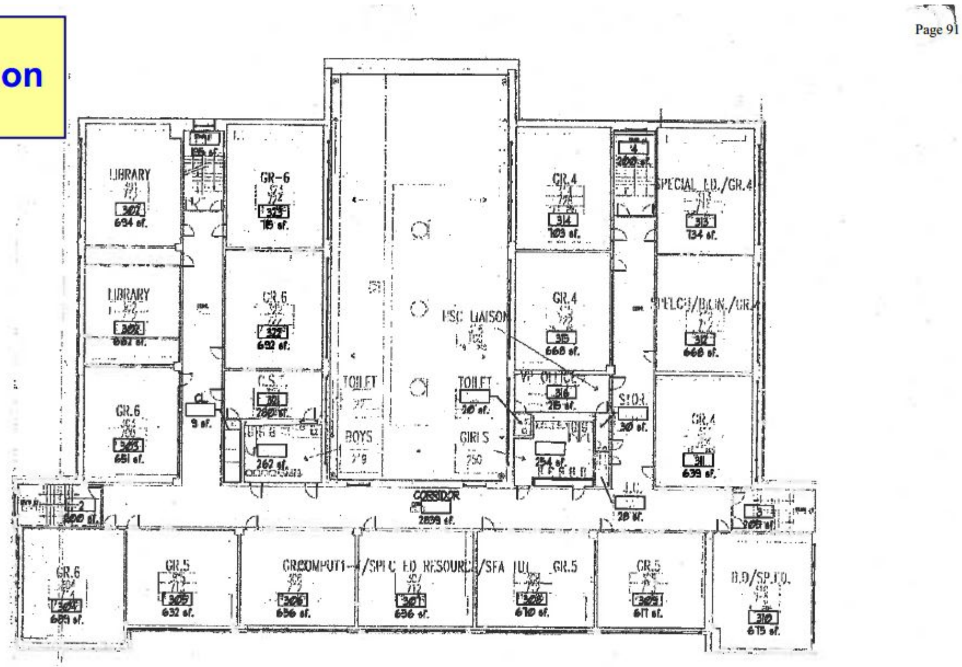
Page 90

No Work Recommended on this Floor



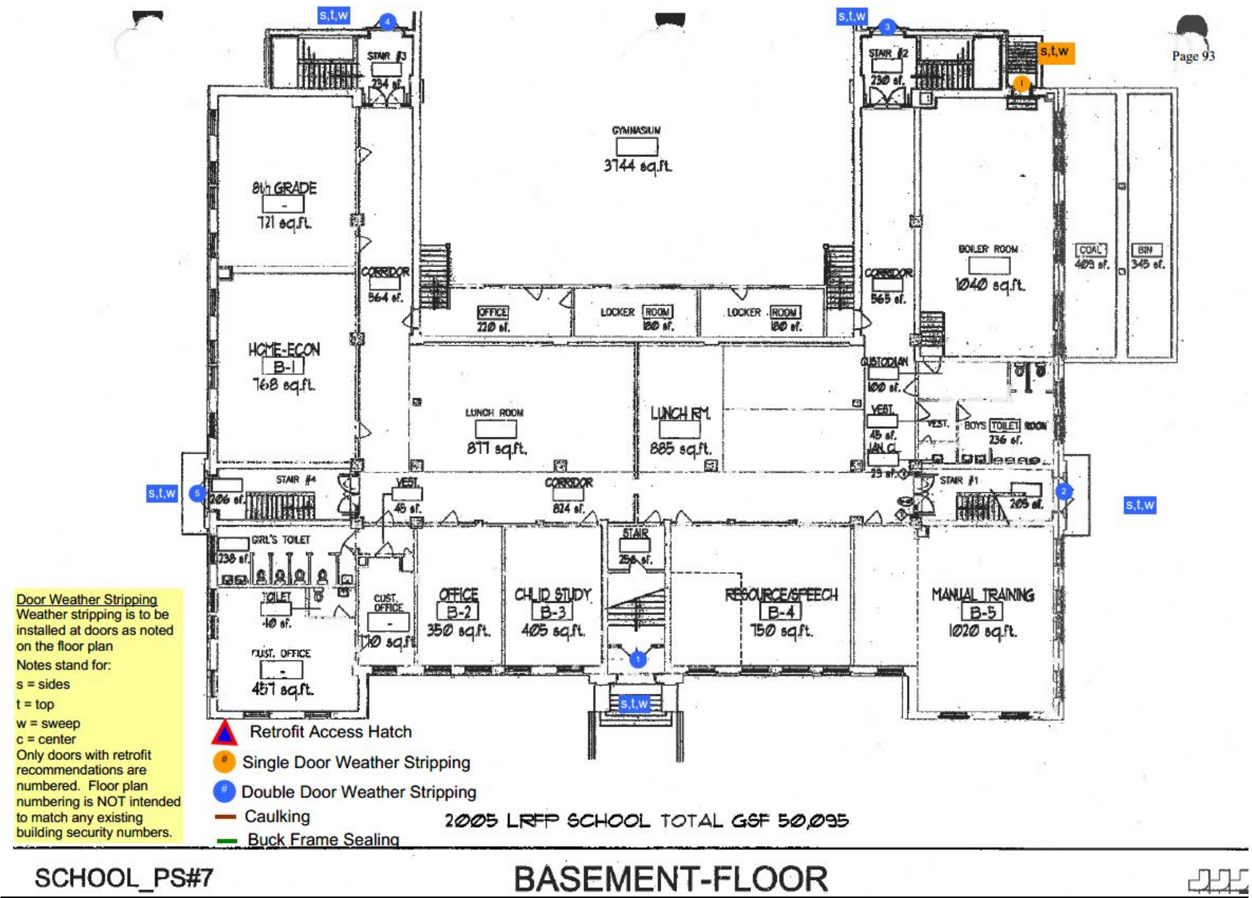
SCHOOL_PS#6 SECOND-FLOOR

No Work Recommended on this Floor

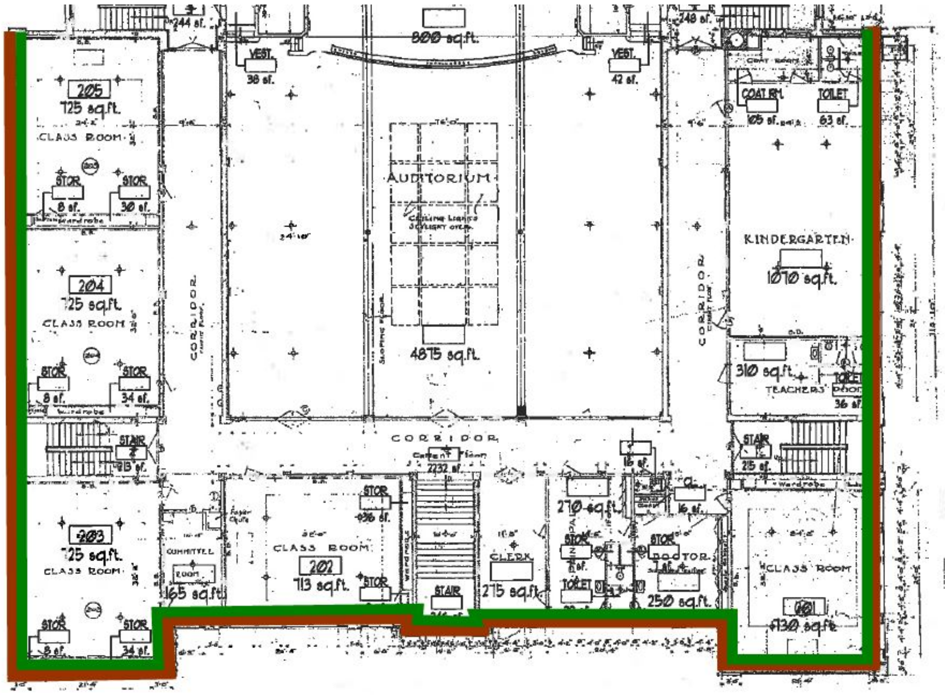


SCHOOL_PS#6 THIRD-FLOOR

School 7


Page 93
s,t,w
STAIR #3
234 sf.
GYMNASIUM
3744 sq.ft.
STAIR #2
230 sf.
8th GRADE
721 sq.ft.
CORRIDOR
564 sf.
OFFICE
220 sf.
LOCKER ROOM
180 sf.
LOCKER ROOM
180 sf.
CORRIDOR
565 sf.
BOILER ROOM
1040 sq.ft.
COAL
409 sf.
BIN
345 sf.
HOME-ECON
B-1
768 sq.ft.
LUNCH ROOM
877 sq.ft.
LUNCH RM.
885 sq.ft.
CUSTODIAN
100 sf.
VEST.
45 sf.
BOYS TOILET ROOM
236 sf.
STAIR #4
206 sf.
VEST.
45 sf.
CORRIDOR
824 sf.
STAIR #1
205 sf.
GIRL'S TOILET
238 sf.
STAIR
256 sf.
TOILET
40 sf.
CUST. OFFICE
110 sq.ft.
OFFICE
B-2
350 sq.ft.
CHILD STUDY
B-3
405 sq.ft.
RESOURCE/SPEECH
B-4
750 sq.ft.
MANUAL TRAINING
B-5
1020 sq.ft.
CUST. OFFICE
457 sq.ft.
Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.
Retrofit Access Hatch
Single Door Weather Stripping
Double Door Weather Stripping
Caulking
Buck Frame Sealing
2005 LRFP SCHOOL TOTAL GSF 50,095
SCHOOL_PS#7
BASEMENT-FLOOR

Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.



Retrofit Access Hatch
Single Door Weather Stripping
Double Door Weather Stripping
Caulking
Buck Frame Sealing

SCHOOL PS#7 FIRST-FLOOR

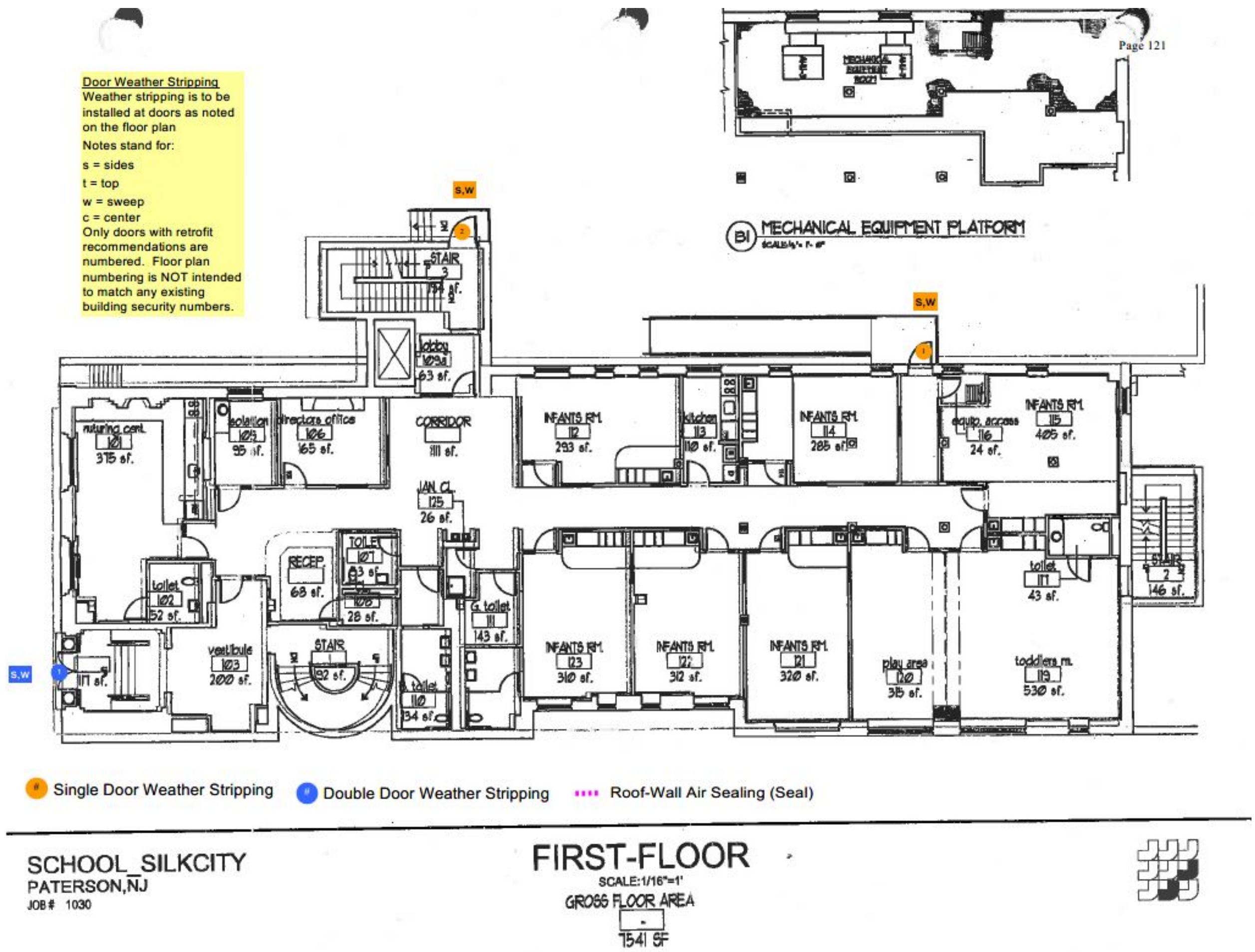
Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.

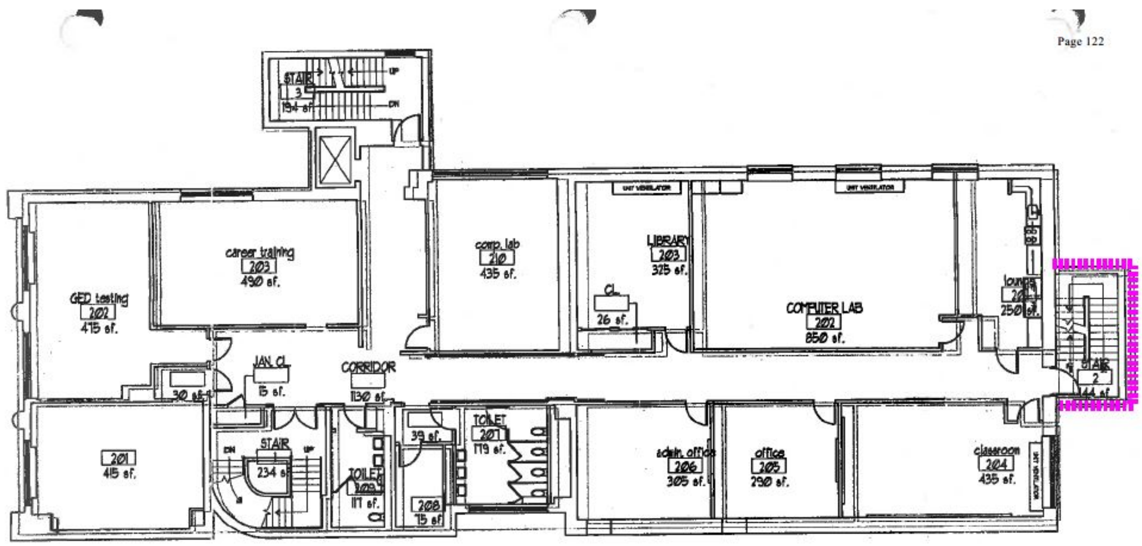
Retrofit Access Hatch | Single Door Weather Stripping | Double Door Weather Stripping
Caulking | Buck Frame Sealing

SCHOOL_PS#7

SECOND-FLOOR

Silk City 2000 Academy





Single Door Weather Stripping

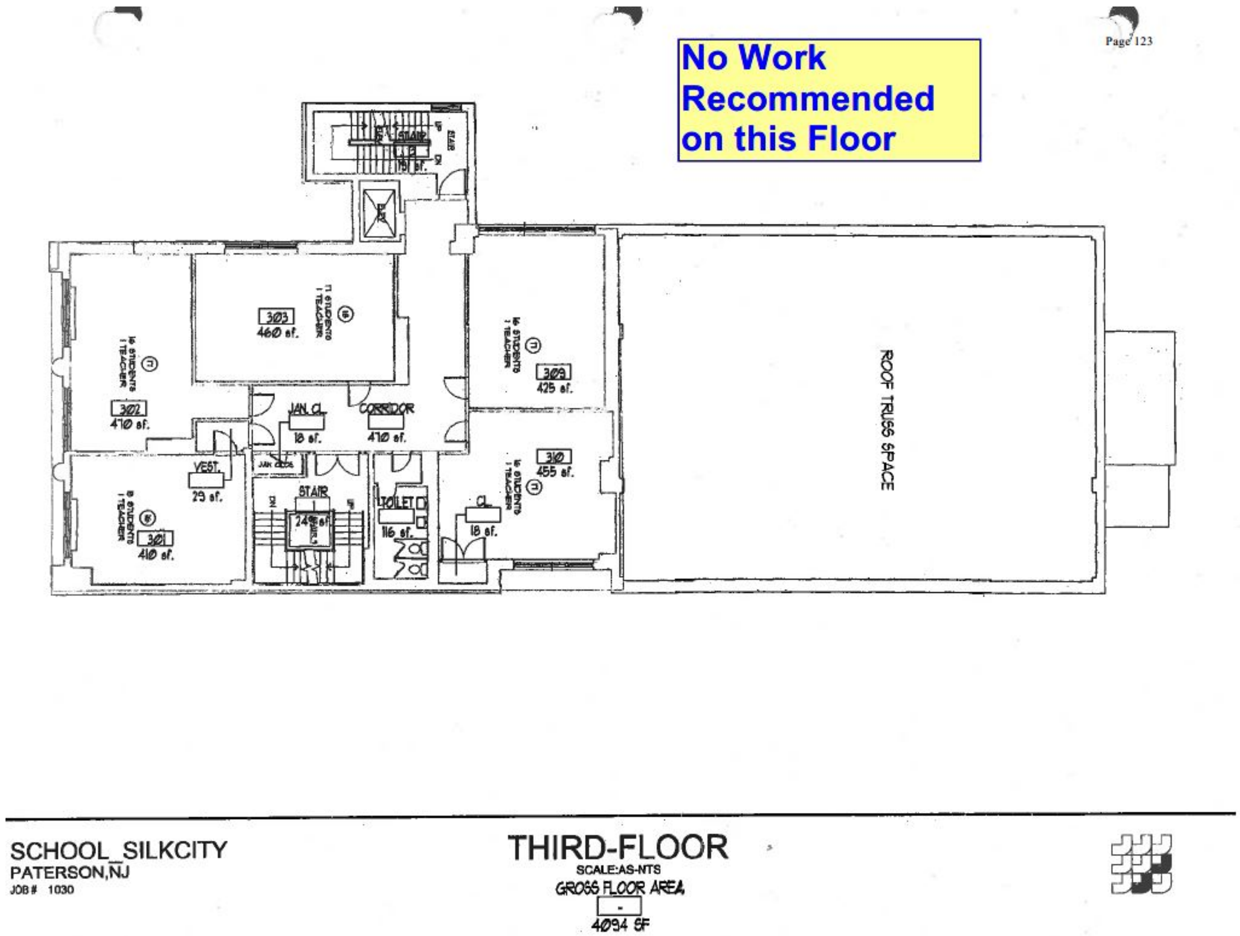
Double Door Weather Stripping

Roof-Wall Air Sealing (Seal)

Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.

SCHOOL_SILKCITY
PATERSON,NJ
JOB # 1030

SECOND-FLOOR
SCALE:1/16"=1'
GROSS FLOOR AREA
-
7541 SF


Page 123
No Work Recommended on this Floor
303
460 sf.
302
470 sf.
309
425 sf.
JAN. CL.
18 sf.
CORRIDOR
470 sf.
VEST.
29 sf.
301
410 sf.
STAIR
TOILET
116 sf.
310
455 sf.
CL
18 sf.
ROOF TRUSS SPACE
SCHOOL_SILKCITY
PATERSON,NJ
JOB # 1030
THIRD-FLOOR
SCALE:AS-NTS
GROSS FLOOR AREA
4094 SF

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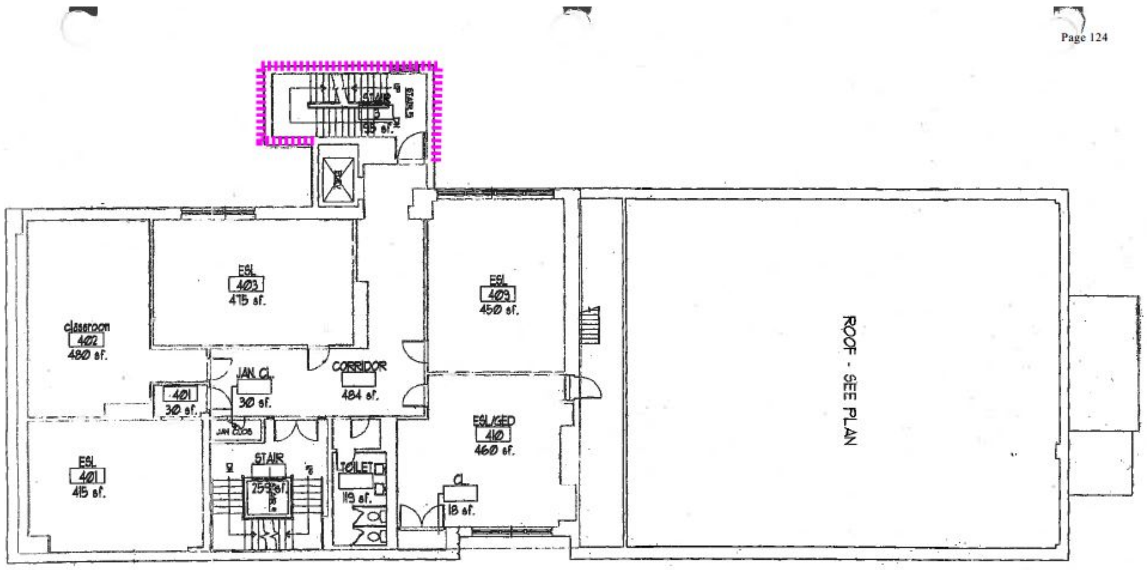


Single Door Weather Stripping

Double Door Weather Stripping

Roof-Wall Air Sealing (Seal)

Door Weather Stripping
Weather stripping is to be installed at doors as noted on the floor plan
Notes stand for:
s = sides
t = top
w = sweep
c = center
Only doors with retrofit recommendations are numbered. Floor plan numbering is NOT intended to match any existing building security numbers.

SCHOOL_SILKCITY
PATERSON,NJ
JOB # 1030

FOURTH-FLOOR
SCALE:AS-NTS
GROSS FLOOR AREA
-
4098 SF

APPENDIX 4. DETAILED SCOPE DESCRIPTIONS

Design Drawings will be available electronically.

Plug Loads (By School)

Academy of Earth and Space Sciences	
Device	Quantity:
Projector	6
Smartboard	0
Projector/Smartboard Combo	0
Amplifier	0
Charging Cart	5
Small Printer	0
Medium Printer	0
Large Printer/Copier (110 only)	2
TV/LCD/Smart TV	0
Snack Vending	0
Soda Vending	0
Lg Coffeemaker (Bunn)	0
H/C Water Dispenser	1
Water Fountain (plug on outside)	0
AC-110 (15A)	0
AC-110 (20A)	0
AC-220 (<=20A)	0
Other Device not listed above	0

Dale Avenue	
Device	Quantity:
Projector	9
Smartboard	0
Projector/Smartboard Combo	0
Amplifier	0
Charging Cart	0
Small Printer	0
Medium Printer	6
Large Printer/Copier (110 only)	1
TV/LCD/Smart TV	0
Snack Vending	0
Soda Vending	0
Lg Coffeemaker (Bunn)	1
H/C Water Dispenser	3
Water Fountain (plug on outside)	0
AC-110 (15A)	7
AC-110 (20A)	2
AC-220 (<=20A)	5
Other Device not listed above	0

Department of Facilities	
Device	Quantity:
Projector	1
Smartboard	0
Projector/Smartboard Combo	0
Amplifier	0
Charging Cart	0
Small Printer	0
Medium Printer	1
Large Printer/Copier (110 only)	0
TV/LCD/Smart TV	0
Snack Vending	0
Soda Vending	0
Lg Coffeemaker (Bunn)	0
H/C Water Dispenser	2
Water Fountain (plug on outside)	0
AC-110 (15A)	0
AC-110 (20A)	0

District Central Offices	
Device	Quantity:
Projector	8
Smartboard	0
Projector/Smartboard Combo	0
Amplifier	0
Charging Cart	0
Small Printer	0
Medium Printer	9
Large Printer/Copier (110 only)	4
TV/LCD/Smart TV	2
Snack Vending	1
Soda Vending	2
Lg Coffeemaker (Bunn)	0
H/C Water Dispenser	3
Water Fountain (plug on outside)	0
AC-110 (15A)	0
AC-110 (20A)	0

AC-220 (<=20A)	0
Other Device not listed above	0

AC-220 (<=20A)	0
Other Device not listed above	0

Early Learning Center	
Device	Quantity:
Projector	2
Smartboard	0
Projector/Smartboard Combo	1
Amplifier	0
Charging Cart	0
Small Printer	0
Medium Printer	2
Large Printer/Copier (110 only)	0
TV/LCD/Smart TV	0
Snack Vending	0
Soda Vending	0
Lg Coffeemaker (Bunn)	0
H/C Water Dispenser	8
Water Fountain (plug on outside)	0
AC-110 (15A)	5
AC-110 (20A)	0
AC-220 (<=20A)	0
Other Device not listed above	0

Eastside High School	
Device	Quantity:
Projector	4
Smartboard	0
Projector/Smartboard Combo	86
Amplifier	0
Charging Cart	49
Small Printer	0
Medium Printer	15
Large Printer/Copier (110 only)	4
TV/LCD/Smart TV	5
Snack Vending	2
Soda Vending	3
Lg Coffeemaker (Bunn)	0
H/C Water Dispenser	3
Water Fountain (plug on outside)	0
AC-110 (15A)	138
AC-110 (20A)	0
AC-220 (<=20A)	0
Other Device not listed above	0

Edward Kilpatrick	
Device	Quantity:
Projector	4
Smartboard	0
Projector/Smartboard Combo	0
Amplifier	0
Charging Cart	0
Small Printer	0
Medium Printer	4
Large Printer/Copier (110 only)	2
TV/LCD/Smart TV	0
Snack Vending	0
Soda Vending	1
Lg Coffeemaker (Bunn)	0
H/C Water Dispenser	5
Water Fountain (plug on outside)	0
AC-110 (15A)	3
AC-110 (20A)	1
AC-220 (<=20A)	2
Other Device not listed above	0

John F. Kennedy High School	
Device	Quantity:
Projector	45
Smartboard	0
Projector/Smartboard Combo	11
Amplifier	0
Charging Cart	30
Small Printer	0
Medium Printer	6
Large Printer/Copier (110 only)	4
TV/LCD/Smart TV	8
Snack Vending	2
Soda Vending	3
Lg Coffeemaker (Bunn)	0
H/C Water Dispenser	1
Water Fountain (plug on outside)	0
AC-110 (15A)	29
AC-110 (20A)	7
AC-220 (<=20A)	0
Other Device not listed above	0

New International High School	
Device	Quantity:
Projector	0
Smartboard	0
Projector/Smartboard Combo	32
Amplifier	0
Charging Cart	12
Small Printer	0
Medium Printer	6
Large Printer/Copier (110 only)	3
TV/LCD/Smart TV	2
Snack Vending	2
Soda Vending	2
Lg Coffeemaker (Bunn)	0
H/C Water Dispenser	1
Water Fountain (plug on outside)	0
AC-110 (15A)	0
AC-110 (20A)	0
AC-220 (<=20A)	0
Other Device not listed above	0

New Roberto Clemente School	
Device	Quantity:
Projector	21
Smartboard	0
Projector/Smartboard Combo	0
Amplifier	0
Charging Cart	6
Small Printer	0
Medium Printer	18
Large Printer/Copier (110 only)	2
TV/LCD/Smart TV	0
Snack Vending	0
Soda Vending	0
Lg Coffeemaker (Bunn)	0
H/C Water Dispenser	0
Water Fountain (plug on outside)	0
AC-110 (15A)	0
AC-110 (20A)	0
AC-220 (<=20A)	0
Other Device not listed above	0

Norman S. Weir	
Device	Quantity:
Projector	7
Smartboard	0
Projector/Smartboard Combo	0
Amplifier	0
Charging Cart	0
Small Printer	0
Medium Printer	1
Large Printer/Copier (110 only)	0
TV/LCD/Smart TV	0
Snack Vending	0
Soda Vending	0
Lg Coffeemaker (Bunn)	0
H/C Water Dispenser	0
Water Fountain (plug on outside)	0
AC-110 (15A)	0
AC-110 (20A)	0
AC-220 (<=20A)	0
Other Device not listed above	0

School 12	
Device	Quantity:
Projector	6
Smartboard	0
Projector/Smartboard Combo	0
Amplifier	0
Charging Cart	0
Small Printer	0
Medium Printer	6
Large Printer/Copier (110 only)	2
TV/LCD/Smart TV	0
Snack Vending	0
Soda Vending	1
Lg Coffeemaker (Bunn)	0
H/C Water Dispenser	0
Water Fountain (plug on outside)	0
AC-110 (15A)	2
AC-110 (20A)	0
AC-220 (<=20A)	0
Other Device not listed above	0

School 18	
Device	Quantity:
Projector	13
Smartboard	0
Projector/Smartboard Combo	0
Amplifier	0
Charging Cart	0
Small Printer	1
Medium Printer	6
Large Printer/Copier (110 only)	2
TV/LCD/Smart TV	0
Snack Vending	0
Soda Vending	1
Lg Coffeemaker (Bunn)	0
H/C Water Dispenser	0
Water Fountain (plug on outside)	0
AC-110 (15A)	13
AC-110 (20A)	3
AC-220 (<=20A)	0
Other Device not listed above	0

Rev. Dr. Martin Luther King Jr. School	
Device	Quantity:
Projector	9
Smartboard	0
Projector/Smartboard Combo	0
Amplifier	0
Charging Cart	1
Small Printer	0
Medium Printer	3
Large Printer/Copier (110 only)	0
TV/LCD/Smart TV	0
Snack Vending	0
Soda Vending	0
Lg Coffeemaker (Bunn)	0
H/C Water Dispenser	0
Water Fountain (plug on outside)	0
AC-110 (15A)	0
AC-110 (20A)	0
AC-220 (<=20A)	0
Other Device not listed above	0

Roberto Clemente Elementary	
Device	Quantity:
Projector	3
Smartboard	0
Projector/Smartboard Combo	0
Amplifier	0
Charging Cart	0
Small Printer	0
Medium Printer	4
Large Printer/Copier (110 only)	0
TV/LCD/Smart TV	0
Snack Vending	0
Soda Vending	0
Lg Coffeemaker (Bunn)	0
H/C Water Dispenser	0
Water Fountain (plug on outside)	0
AC-110 (15A)	0
AC-110 (20A)	0
AC-220 (<=20A)	0
Other Device not listed above	0

Rosa L. Parks School of Fine and Preforming Arts	
Device	Quantity:
Projector	17
Smartboard	0
Projector/Smartboard Combo	0
Amplifier	0
Charging Cart	15
Small Printer	0
Medium Printer	4
Large Printer/Copier (110 only)	2
TV/LCD/Smart TV	0
Snack Vending	2
Soda Vending	4
Lg Coffeemaker (Bunn)	0
H/C Water Dispenser	0
Water Fountain (plug on outside)	0
AC-110 (15A)	6
AC-110 (20A)	0
AC-220 (<=20A)	0
Other Device not listed above	0

School 13	
Device	Quantity:
Projector	14
Smartboard	0
Projector/Smartboard Combo	0
Amplifier	0
Charging Cart	1
Small Printer	1
Medium Printer	4
Large Printer/Copier (110 only)	1
TV/LCD/Smart TV	0
Snack Vending	1
Soda Vending	1
Lg Coffeemaker (Bunn)	0
H/C Water Dispenser	1
Water Fountain (plug on outside)	0
AC-110 (15A)	13
AC-110 (20A)	3
AC-220 (<=20A)	5
Other Device not listed above	0

School 17	
Device	Quantity:
Projector	0
Smartboard	0
Projector/Smartboard Combo	0
Amplifier	0
Charging Cart	0
Small Printer	0
Medium Printer	1
Large Printer/Copier (110 only)	0
TV/LCD/Smart TV	0
Snack Vending	0
Soda Vending	1
Lg Coffeemaker (Bunn)	0
H/C Water Dispenser	1
Water Fountain (plug on outside)	0
AC-110 (15A)	12
AC-110 (20A)	0
AC-220 (<=20A)	0
Other Device not listed above	0

School 7	
Device	Quantity:
Projector	0
Smartboard	0
Projector/Smartboard Combo	10
Amplifier	0
Charging Cart	1
Small Printer	11
Medium Printer	5
Large Printer/Copier (110 only)	0
TV/LCD/Smart TV	0
Snack Vending	1
Soda Vending	1
Lg Coffeemaker (Bunn)	0
H/C Water Dispenser	1
Water Fountain (plug on outside)	0
AC-110 (15A)	22
AC-110 (20A)	0
AC-220 (<=20A)	0
Other Device not listed above	0

HVAC PIPING INSULATION

Task	Academy of Earth and Space Sciences (PANTHER)	Dale Avenue	Early Learning Center	Eastside High School	Edward Kilpatrick	John F. Kennedy High School	New International High School	New Roberto Clemente School	Norman S. Weir
3-Way Valve Insulation (Units)				4					
Air Scoop Insulation (Units)			1						1
Bonnet Insulation (Units)		2		7					1
Butterfly Valve Insulation (Units)	2			29	2				
Check Valve Insulation (Units)		1		1	1	7			
Control Valve Insulation (Units)	4		3	4	2				4
End Cap Insulation (Units)				5		3		8	
Flange Insulation (Units)	7	4	2	65	17	50	4	10	1
Flex Fitting Insulation (UT)				16	8			8	
Gate Valve Insulation (Units)		7		7	8	14			5
Pipe Fitting Insulation (Units)		11	10	12	1	61	4		15
PRV Insulation (Units)									
Pump Insulation (Units)	2		3	6	2	2	2	2	3
Steam Trap Insulation (Units)		2				5			
Straight Pipe Insulation (LF)	7	104	26	157	35	351	11		60
Strainer Insulation (Units)		5		5	2	8		2	3
Suction Diffuser Insulation (Units)	2			4			2	2	
Tank Insulation (Units)	1	1		3		3	1	1	

Task	Rev. Dr. Martin Luther King Jr.	School 6	School 7	School 12	School 13	School 17	School 18	School 28	Silk City 2000 Academy	Total Quantity
3-Way Valve Insulation (Units)										4
Air Scoop Insulation (Units)										2
Bonnet Insulation (Units)			4				7			21
Butterfly Valve Insulation (Units)		3		8				2		46
Check Valve Insulation (Units)	4			3				1		18
Control Valve Insulation (Units)		3		2			1			23
End Cap Insulation (Units)	4		2	5	1	3			3	34
Flange Insulation (Units)	35	16	15	32	20	23	12	6	7	326
Flex Fitting Insulation (UT)	8	3					9			52
Gate Valve Insulation (Units)	15		1	11	6	4	4		1	83
Pipe Fitting Insulation (Units)	4	6	32	44	82	6	2	4	3	297
PRV Insulation (Units)				2						2
Pump Insulation (Units)	4	5		4			10	2		47
Steam Trap Insulation (Units)			4	10	3					24
Straight Pipe Insulation (LF)	8	7	159	223	441	21	7	19	35	1,671
Strainer Insulation (Units)	2		2	11	2		1	2		45
Suction Diffuser Insulation (Units)		3					2	2		17
Tank Insulation (Units)			2	4	1					17

Academy of Earth and Space Sciences (PANTHER)						
Fluid	**Pipe Dia (") or Tank Surface Area (SF)**	**Component**	**Insulation Thickness (in.)**	**Proposed Insulation Type**	**Qty. or Length**	**Total Eq Length (LF) or Total Area (SF)***
MTHW	1.25	Staright Pipe	1.5	Cellular Glass	1	1
MTHW	2	Butterfly Valve	2	Cellular Glass	2	8.2
MTHW	2	Control Valve	1.5	Removable Blanket	2	8.2
MTHW	2	Control Valve	2	Cellular Glass	2	8.2
MTHW	2	Flange	1.5	Removable Blanket	4	7.2
MTHW	2	Flange	2	Cellular Glass	3	5.4
MTHW	2	In-Line Pump	2	Cellular Glass	2	10
MTHW	2	Staright Pipe	2	Cellular Glass	2	2
MTHW	2	Staright Pipe	2	Cellular Glass	4	4
MTHW	2	Suction Diffuser	1.5	Removable Blanket	2	8.8
MTHW	21.6032	Air Seperator Tank	2	Cellular Glass	1	21.6032

Dale Avenue						
Fluid	**Pipe Dia (") or Tank Surface Area (SF)**	**Component**	**Insulation Thickness (in.)**	**Proposed Insulation Type**	**Qty. or Length**	**Total Eq Length (LF) or Total Area (SF)***
Cond	1.25	90 Degree Elbow	1	Cellular Glass	2	3.6
Cond	1.25	Gate Valve	1	Cellular Glass	4	16.4
Cond	1.25	Straight Pipe	1	Cellular Glass	48	48
Cond	1.25	Straight Pipe	1	Cellular Glass	46	16
Cond	1.25	Strainer	1.5	Removable Blanket	2	10
Cond	1.25	T Intersection	1	Cellular Glass	1	1.2
Cond	2	90 Degree Elbow	1.5	Cellular Glass	5	9
Cond	2	Flange	1.5	Removable Blanket	2	3.6
Cond	2	Gate Valve	1.5	Cellular Glass	1	4.1
Cond	2	Gate Valve	1.5	Removable Blanket	1	4.1
Cond	2	Steam Trap	1.5	Removable Blanket	2	8.8
Cond	2	Straight Pipe	1.5	Cellular Glass	11	11
Cond	2	Strainer	1.5	Removable Blanket	2	10
Cond	2	T Intersection	1.5	Cellular Glass	2	2.4
Cond	3	90 Degree Elbow	1.5	Cellular Glass	1	1.8
Cond	3	Straight Pipe	1.5	Cellular Glass	10	10
Cond	4	Flange	1.5	Removable Blanket	2	3.6
Cond	4	Straight Pipe	1.5	Cellular Glass	1	1
Cond	4	Strainer	1.5	Removable Blanket	1	5
Cond	90.6675	Condensate Tank	1.5	Cellular Glass	1	90.6675
LPS	4	Straight Pipe	3	Cellular Glass	18	18
LPS	10	Bonnet	1.5	Removable Blanket	2	3.6
LPS	10	Check Valve	1.5	Removable Blanket	1	5.3
LPS	10	Gate Valve	1.5	Removable Blanket	1	4.1

Early Learning Center						
Fluid	Pipe Dia (") or Tank Surface Area (SF)	Component	Insulation Thickness (in.)	Proposed Insulation Type	Qty. or Length	Total Eq Length (LF) or Total Area (SF)*
MTHW	1.5	90 Degree Elbow	2	Cellular Glass	1	1.8
MTHW	1.5	Straight Pipe	2	Cellular Glass	2	2
MTHW	2	90 Degree Elbow	2	Cellular Glass	2	3.6
MTHW	2	Control Valve	1.5	Removable Blanket	2	8.2
MTHW	2	Straight Pipe	1.5	Cellular Glass	4	4
MTHW	2	Straight Pipe	2	Cellular Glass	6	6
MTHW	3	Control Valve	1.5	Removable Blanket	1	4.1
MTHW	3	Straight Pipe	1.5	Cellular Glass	1	1
MTHW	3	Straight Pipe	2	Cellular Glass	1	1
MTHW	4	90 Degree Elbow	1.5	Cellular Glass	2	3.6
MTHW	4	90 Degree Elbow	2	Cellular Glass	3	5.4
MTHW	4	Air Scoop	2	Removable Blanket	1	4.4
MTHW	4	Flange	2	Removable Blanket	2	3.6
MTHW	4	In-Line Pump	2	Removable Blanket	3	15
MTHW	4	Straight Pipe	1.5	Cellular Glass	6	6
MTHW	4	Straight Pipe	2	Cellular Glass	6	6
MTHW	4	T Intersection	1.5	Cellular Glass	2	2.4

Eastside High School						
Fluid	Pipe Dia (") or Tank Surface Area (SF)	Component	Insulation Thickness (in.)	Proposed Insulation Type	Qty. or Length	Total Eq Length (LF) or Total Area (SF)*
MTHW	2	90 Degree Elbow	2	Cellular Glass	8	14.4
MTHW	2	90 Degree Elbow	2	Cellular Glass	1	1.8
MTHW	2	Bonnet	1.5	Removable Blanket	6	10.8
MTHW	2	Butterfly Valve	1.5	Removable Blanket	1	4.1
MTHW	2	Butterfly Valve	2	Cellular Glass	1	4.1
MTHW	2	Check Valve	1.5	Removable Blanket	1	5.3
MTHW	2	Control Valve	1.5	Removable Blanket	3	12.3
MTHW	2	Flange	1.5	Removable Blanket	4	7.2
MTHW	2	Gate Valve	1.5	Removable Blanket	1	4.1
MTHW	2	In-Line Pump	1.5	Removable Blanket	2	10
MTHW	2	Straight Pipe	2	Cellular Glass	2	2
MTHW	2	Straight Pipe	2	Cellular Glass	5	5
MTHW	2	Straight Pipe	2	Cellular Glass	50	50
MTHW	2	Strainer	1.5	Removable Blanket	1	5
MTHW	3	Control Valve	1.5	Removable Blanket	1	4.1
MTHW	3	Flange	2	Cellular Glass	3	5.4
MTHW	3	Gate Valve	1.5	Removable Blanket	1	4.1
MTHW	3	Straight Pipe	2	Cellular Glass	2	2
MTHW	3	Straight Pipe	2	Cellular Glass	10	10
MTHW	4	90 Degree Elbow	2	Cellular Glass	1	1.8
MTHW	4	Butterfly Valve	1.5	Cellular Glass	4	16.4
MTHW	4	Butterfly Valve	2	Cellular Glass	2	8.2
MTHW	4	Butterfly Valve	2	Cellular Glass	4	16.4
MTHW	4	End Cap	2	Cellular Glass	1	1.5
MTHW	4	Flange	1.5	Cellular Glass	4	7.2
MTHW	4	Flange	1.5	Removable Blanket	3	5.4
MTHW	4	Flange	2	Cellular Glass	2	3.6
MTHW	4	Flange	2	Cellular Glass		
MTHW	4	Flange	2	Cellular Glass	4	7.2
MTHW	4	Flange	2	Cellular Glass	8	14.4
MTHW	4	Flange	2	Cellular Glass	10	18
MTHW	4	Gate Valve	1.5	Removable Blanket	2	8.2
MTHW	4	Gate Valve	1.5	Removable Blanket	1	4.1
MTHW	4	Straight Pipe	1.5	Cellular Glass	12	12
MTHW	4	Straight Pipe	2	Cellular Glass	2	2
MTHW	4	Straight Pipe	2	Cellular Glass	8	8
MTHW	4	Straight Pipe	2	Cellular Glass	3	3
MTHW	4	Straight Pipe	2	Cellular Glass	6	6
MTHW	4	Straight Pipe	2	Cellular Glass	30	30
MTHW	4	T Intersection	2	Cellular Glass	2	2.4
MTHW	6	Butterfly Valve	1.5	Removable Blanket	4	16.4
MTHW	6	Centrifugal Pump	1.5	Removable Blanket	2	10
MTHW	6	Flange	1.5	Removable Blanket	8	14.4
MTHW	6	Flex Fitting	1.5	Removable Blanket	8	12
MTHW	6	Straight Pipe	2	Cellular Glass	6	6
MTHW	6	Strainer	1.5	Removable Blanket	2	10
MTHW	6	Suction Diffuser	1.5	Removable Blanket	2	8.8
MTHW	8	3-Way Valve	1.5	Removable Blanket	4	16.4
MTHW	8	Bonnet	1.5	Removable Blanket	1	1.8
MTHW	8	Butterfly Valve	2	Cellular Glass	2	8.2
MTHW	8	Butterfly Valve	2	Cellular Glass		
MTHW	8	Butterfly Valve	2	Cellular Glass	1	4.1
MTHW	8	Centrifugal Pump	1.5	Removable Blanket	2	10
MTHW	8	End Cap	2	Cellular Glass	1	1.5
MTHW	8	Flange	1.5	Removable Blanket	10	18
MTHW	8	Flange	2	Cellular Glass	3	5.4
MTHW	8	Flex Fitting	1.5	Removable Blanket	8	12
MTHW	8	Gate Valve	1.5	Removable Blanket	2	8.2
MTHW	8	Straight Pipe	2	Cellular Glass	4	4
MTHW	8	Straight Pipe	2	Cellular Glass		
MTHW	8	Strainer	1.5	Removable Blanket	2	10
MTHW	8	Suction Diffuser	2	Cellular Glass	2	8.8
MTHW	10	Butterfly Valve	2	Cellular Glass	2	8.2
MTHW	10	End Cap	2	Cellular Glass	2	3
MTHW	10	End Cap	2	Cellular Glass	1	1.5
MTHW	10	Flange	2	Cellular Glass	2	3.6
MTHW	10	Flange	2	Cellular Glass		
MTHW	10	Straight Pipe	2	Cellular Glass	2	2
MTHW	40.82	Air Seperator Tank	2	Cellular Glass	1	40.82
MTHW	90.6675	Air Seperator Tank	2	Cellular Glass	1	90.6675
MTHW	106.76	Air Seperator Tank	2	Cellular Glass	1	106.76

Edward Kilpatrick						
Fluid	Pipe Dia (") or Tank Surface Area (SF)	Component	Insulation Thickness (in.)	Proposed Insulation Type	Qty. or Length	Total Eq Length (LF) or Total Area (SF)*
MTHW	3	90 Degree Elbow	2	Cellular Glass	1	1.8
MTHW	3	Flange	1.5	Removable Blanket	4	7.2
MTHW	3	Flange	2	Cellular Glass	10	18
MTHW	3	Gate Valve	1.5	Removable Blanket	2	8.2
MTHW	3	Gate Valve	1.5	Removable Blanket	4	16.4
MTHW	3	Straight Pipe	2	Cellular Glass	4	4
MTHW	3	Straight Pipe	2	Cellular Glass	8	8
MTHW	3	Straight Pipe	2	Cellular Glass	3	3
MTHW	3	Straight Pipe	2	Cellular Glass	15	15
MTHW	3	Strainer	1.5	Removable Blanket	2	10
MTHW	4	Butterfly Valve	2	Cellular Glass	2	8.2
MTHW	4	Centrifugal Pump	1.5	Removable Blanket	2	10
MTHW	4	Check Valve	1.5	Removable Blanket	1	5.3
MTHW	4	Control Valve	1.5	Removable Blanket	2	8.2
MTHW	4	Flange	1.5	Removable Blanket	3	5.4
MTHW	4	Flex Fitting	1.5	Removable Blanket	8	12
MTHW	4	Gate Valve	1.5	Removable Blanket	2	8.2
MTHW	4	Straight Pipe	2	Cellular Glass	5	5

John F. Kennedy High School						
Fluid	Pipe Dia (") or Tank Surface Area (SF)	Component	Insulation Thickness (in.)	Proposed Insulation Type	Qty. or Length	Total Eq Length (LF) or Total Area (SF)*
MTHW	2	90 Degree Elbow	2	Cellular Glass	2	3.6
MTHW	2	Straight Pipe	2	Cellular Glass	5	5
MTHW	4	Centrifugal Pump	1.5	Removable Blanket	2	10
MTHW	4	Check Valve	1.5	Removable Blanket	2	10.3
MTHW	4	Flange	1.5	Removable Blanket	1	1.8
MTHW	4	Flange	1.5	Removable Blanket		
MTHW	4	Flange	1.5	Removable Blanket	16	28.8
MTHW	4	Gate Valve	1.5	Removable Blanket	4	16.4
MTHW	4	Straight Pipe	2	Cellular Glass	64	64
MTHW	4	Strainer	1.5	Removable Blanket	2	10
MTHW	4	T Intersection	2	Cellular Glass	1	1.2
MTHW	6	End Cap	2	Cellular Glass	1	1.5
MTHW	6	Straight Pipe	2	Cellular Glass	45	45
MTHW	15.3075	Heat Exchanger	2	Cellular Glass	1	15.3075
MTHW	21.195	Heat Exchanger	1.5	Removable Blanket	1	21.195
Cond	0.5	Steam Trap	1.5	Removable Blanket	1	4.4
Cond	0.5	Straight Pipe	1	Cellular Glass	2	2
Cond	1	45 Degree Elbow	1	Cellular Glass	2	2
Cond	1	90 Degree Elbow	1	Cellular Glass	3	5.4
Cond	1	Steam Trap	1.5	Removable Blanket	1	4.4
Cond	1	Straight Pipe	1	Cellular Glass	11	11
Cond	2	45 Degree Elbow	1.5	Cellular Glass	4	4
Cond	2	90 Degree Elbow	1.5	Cellular Glass	13	23.4
Cond	2	90 Degree Elbow	1.5	Cellular Glass	7	12.6
Cond	2	90 Degree Elbow	1.5	Cellular Glass	24	43.2
Cond	2	End Cap	1.5	Cellular Glass	1	1.5
Cond	2	End Cap	1.5	Cellular Glass		
Cond	2	Steam Trap	1.5	Removable Blanket	2	8.8
Cond	2	Steam Trap	1.5	Removable Blanket	1	4.4
Cond	2	Straight Pipe	1.5	Cellular Glass	12	12
Cond	2	Straight Pipe	1.5	Cellular Glass	49	49
Cond	2	Straight Pipe	1.5	Cellular Glass	156	156
Cond	2	Strainer	1.5	Removable Blanket	2	10
Cond	2	T Intersection	1.5	Cellular Glass	2	2.4
Cond	2	T Intersection	1.5	Cellular Glass	3	3.6
Cond	113.04	Condensate Tank	1.5	Cellular Glass	1	113.04
LPS	4	Check Valve	1.5	Removable Blanket	1	5.3
LPS	4	Flange	1.5	Removable Blanket	3	5.4
LPS	4	Strainer	1.5	Removable Blanket	1	5
LPS	6	Check Valve	1.5	Removable Blanket	1	5.3
LPS	6	Flange	1.5	Removable Blanket	2	3.6
LPS	6	Gate Valve	1.5	Removable Blanket	1	4.1
LPS	6	Straight Pipe	3	Cellular Glass	7	7
LPS	10	Check Valve	1.5	Removable Blanket	2	10.6
LPS	10	Check Valve	1.5	Removable Blanket	1	5.3
LPS	10	Flange	1.5	Removable Blanket	6	10.8
LPS	10	Flange	1.5	Removable Blanket	11	19.8
LPS	10	Flange	3	Cellular Glass	1	1.8
LPS	10	Flange	3	Cellular Glass		
LPS	10	Gate Valve	1.5	Removable Blanket	4	16.4
LPS	10	Gate Valve	1.5	Removable Blanket	3	12.3
LPS	10	Gate Valve	1.5	Removable Blanket	1	4.1
LPS	10	Strainer	1.5	Removable Blanket	3	15

New International High School						
Fluid	Pipe Dia (") or Tank Surface Area (SF)	Component	Insulation Thickness (in.)	Proposed Insulation Type	Qty. or Length	Total Eq Length (LF) or Total Area (SF)*
MTHW	4	Flange	1.5	Removable Blanket	2	3.6
MTHW	4	Flange	2	Cellular Glass	2	3.6
MTHW	4	Straight Pipe	2	Cellular Glass	1	1
MTHW	4	Straight Pipe	2	Cellular Glass	10	10
MTHW	4	Suction Diffuser	1.5	Removable Blanket	2	8.8
MTHW	4	T Intersection	2	Cellular Glass	4	4.8
MTHW	9.2	Centrifugal Pump	1.5	Removable Blanket	2	10
MTHW	61.23	Air Seperator Tank	2	Cellular Glass	1	61.23

New Roberto Clemente School						
Fluid	Pipe Dia (") or Tank Surface Area (SF)	Component	Insulation Thickness (in.)	Proposed Insulation Type	Qty. or Length	Total Eq Length (LF) or Total Area (SF)*
MTHW	6	Centrifugal Pump	1.5	Removable Blanket	2	10
MTHW	6	Flange	1.5	Removable Blanket	2	3.6
MTHW	6	Flange	1.5	Removable Blanket	6	10.8
MTHW	6	Flex Fitting	1.5	Removable Blanket	4	6
MTHW	6	Strainer	1.5	Removable Blanket	2	10
MTHW	6	Suction Diffiser	1.5	Removable Blanket	2	8.8
MTHW	8	End Cap	2	Cellular Glass	4	6
MTHW	8	End Cap	2	Cellular Glass		
MTHW	8	Flange	2	Cellular Glass	2	3.6
MTHW	96.1625	Air Seperator Tank	2	Cellular Glass	1	96.1625

Norman S. Weir						
Fluid	Pipe Dia (") or Tank Surface Area (SF)	Component	Insulation Thickness (in.)	Proposed Insulation Type	Qty. or Length	Total Eq Length (LF) or Total Area (SF)*
MTHW	1.5	90 Degree Elbow	2	Cellular Glass	3	5.4
MTHW	1.5	Control Valve	2	Cellular Glass	3	123
MTHW	1.5	Gate Valve	1.5	Removable Blanket	4	16.4
MTHW	1.5	Straight Pipe	2	Cellular Glass	6	6
MTHW	2	90 Degree Elbow	2	Cellular Glass	2	3.6
MTHW	2	90 Degree Elbow	2	Cellular Glass	3	5.4
MTHW	2	90 Degree Elbow	2	Cellular Glass	1	1.8
MTHW	2	Gate Valve	1.5	Removable Blanket	1	4.1
MTHW	2	In-Line Pump	1.5	Removable Blanket	3	15
MTHW	2	Straight Pipe	2	Cellular Glass	8	8
MTHW	2	Straight Pipe	2	Cellular Glass	5	5
MTHW	2	Straight Pipe	2	Cellular Glass	34	34
MTHW	2	Strainer	1.5	Removable Blanket	3	15
MTHW	2	T Intersection	2	Cellular Glass	2	2.4
MTHW	2	T Intersection	2	Cellular Glass	4	4.8
MTHW	2.5	Flange	2	Cellular Glass	1	1.8
MTHW	2.5	Straight Pipe	2	Cellular Glass	1	1
MTHW	3	Air Scoop	1.5	Removable Blanket	1	4.4
MTHW	3	Bonnet	1.5	Removable Blanket	1	1.8
MTHW	3	Control Valve	1.5	Removable Blanket	1	4.1
MTHW	3.5	Straight Pipe	2	Cellular Glass	6	6

Rev. Dr. Martin Luther King Jr.						
Fluid	**Pipe Dia (") or Tank Surface Area (SF)**	**Component**	**Insulation Thickness (in.)**	**Proposed Insulation Type**	**Qty. or Length**	**Total Eq Length (LF) or Total Area (SF)***
MTHW	2.5	45 Degree Elbow	2	Cellular Glass	4	4
MTHW	2.5	Check Valve	1.5	Removable Blanket	2	10.6
MTHW	2.5	Flange	1.5	Removable Blanket	4	7.2
MTHW	2.5	Gate Valve	1.5	Removable Blanket	4	16.4
MTHW	2.5	In-Line Pump	1.5	Removable Blanket	2	10
MTHW	2.5	Straight Pipe	2	Cellular Glass	4	4
MTHW	6	Centrifugal Pump	1.5	Removable Blanket	2	10
MTHW	6	Check Valve	1.5	Removable Blanket	1	5.3
MTHW	6	End Cap	2	Cellular Glass	2	3
MTHW	6	Flange	1.5	Removable Blanket	2	3.6
MTHW	6	Flange	1.5	Removable Blanket	4	7.2
MTHW	6	Flange	1.5	Removable Blanket	3	5.4
MTHW	6	Flange	1.5	Removable Blanket	1	1.8
MTHW	6	Flange	1.5	Removable Blanket	5	9
MTHW	6	Flange	2	Cellular Glass	4	7.2
MTHW	6	Flange	2	Cellular Glass	12	21.6
MTHW	6	Flex Fitting	1.5	Removable Blanket	8	12
MTHW	6	Gate Valve	1.5	Removable Blanket	4	16.4
MTHW	6	Gate Valve	1.5	Removable Blanket	3	12.3
MTHW	6	Straight Pipe	2	Cellular Glass	2	2
MTHW	6	Strainer	1.5	Removable Blanket	2	10

School 12						
Fluid	Pipe Dia (") or Tank Surface Area (SF)	Component	Insulation Thickness (in.)	Proposed Insulation Type	Qty. or Length	Total Eq Length (LF) or Total Area (SF)*
MTHW	2	Butterfly Valve	1.5	Removable Blanket	1	4.1
MTHW	2	Check Valve	1.5	Removable Blanket	1	5.3
MTHW	2	Flange	1.5	Removable Blanket	2	3.6
MTHW	4	90 Degree Elbow	2	Cellular Glass	2	3.6
MTHW	4	Butterfly Valve	1.5	Removable Blanket	2	8.2
MTHW	4	Butterfly Valve	1.5	Removable Blanket	1	4.1
MTHW	4	Centrifugal Pump	1.5	Removable Blanket	2	10
MTHW	4	Control Valve	1.5	Removable Blanket	2	8.2
MTHW	4	End Cap	2	Cellular Glass	1	1.5
MTHW	4	Flange	1.5	Removable Blanket	2	3.6
MTHW	4	Flange	2	Cellular Glass	2	3.6
MTHW	4	Flange	2	Cellular Glass		
MTHW	4	Straight Pipe	2	Cellular Glass	3	3
MTHW	4	Straight Pipe	2	Cellular Glass	26	26
MTHW	4	Strainer	1.5	Removable Blanket	2	10
MTHW	4	T Intersection	2	Cellular Glass	2	2.4
MTHW	6	Check Valve	1.5	Removable Blanket	2	10.6
MTHW	6	Flange	1.5	Removable Blanket	8	14.4
MTHW	6	Gate Valve	1.5	Removable Blanket	4	16.4
MTHW	6	PRV	1.5	Removable Blanket	2	8.8
MTHW	6	Straight Pipe	2	Cellular Glass	4	4
MTHW	6	Strainer	1.5	Removable Blanket	2	10
MTHW	8	Butterfly Valve	1.5	Removable Blanket	4	16.4
MTHW	8	Flange	1.5	Removable Blanket	4	7.2
MTHW	8	Flange	1.5	Removable Blanket	8	14.4
MTHW	8	Flange	2	Cellular Glass	2	3.6
MTHW	8	Gate Valve	1.5	Removable Blanket	2	8.2
MTHW	8	Gate Valve	1.5	Removable Blanket	4	16.4
MTHW	12	End Cap	2	Cellular Glass	2	3
MTHW	12	Straight Pipe	2	Cellular Glass	3	3
MTHW	31.4	Air Seperator Tank	2	Cellular Glass	1	31.4
MTHW	50.24	Heat Exchanger	1.5	Removable Blanket	2	50.24
Cond	0.5	90 Degree Elbow	1	Cellular Glass	1	1.8
Cond	0.5	Steam Trap	1.5	Removable Blanket	2	8.8
Cond	0.5	Straight Pipe	1	Removable Blanket	3	3
Cond	1	End Cap	1	Removable Blanket	2	3
Cond	1	Straight Pipe	1	Removable Blanket	2	2
Cond	138.16	Condensate Tank	1.5	Removable Blanket	1	138.16
LPS	1.5	45 Degree Below	2.5	Cellular Glass	1	1
LPS	1.5	90 Degree Below	2.5	Cellular Glass	4	7.2
LPS	1.5	90 Degree Below	2.5	Cellular Glass	14	25.2
LPS	1.5	Steam Trap	1.5	Removable Blanket	3	13.2
LPS	1.5	Steam Trap	2	Removable Blanket	1	4.4
LPS	1.5	Straight Pipe	2.5	Cellular Glass	26	26
LPS	1.5	Straight Pipe	2.5	Cellular Glass	49	49
LPS	1.5	Strainer	1.5	Removable Blanket	1	5
LPS	1.5	Strainer	1.5	Cellular Glass	1	5
LPS	1.5	T Intersection	2.5	Cellular Glass	1	1.2
LPS	2	90 Degree Below	2.5	Cellular Glass	3	5.4
LPS	2	90 Degree Below	2.5	Cellular Glass	1	1.8
LPS	2	90 Degree Below	2.5	Cellular Glass	14	25.2
LPS	2	In-Line Pump	2.5	Cellular Glass	2	10
LPS	2	Steam Trap	1.5	Removable Blanket	4	17.6
LPS	2	Straight Pipe	2.5	Cellular Glass	6	6
LPS	2	Straight Pipe	2.5	Cellular Glass	12	12
LPS	2	Straight Pipe	2.5	Cellular Glass	70	70
LPS	2	Strainer	1.5	Removable Blanket	2	10
LPS	2	Strainer	1.5	Removable Blanket	1	5
LPS	2	Strainer	1.5	Removable Blanket		
LPS	2	Strainer	2.5	Cellular Glass	1	5
LPS	2	T Intersection	2.5	Cellular Glass	1	1.2
LPS	3	Straight Pipe	2.5	Cellular Glass	4	4
LPS	4	Flange	1.5	Removable Blanket	2	3.6
LPS	4	Gate Valve	1.5	Removable Blanket	1	41
LPS	6	Straight Pipe	3	Cellular Glass	15	15

School 13						
Fluid	Pipe Dia (") or Tank Surface Area (SF)	Component	Insulation Thickness (in.)	Proposed Insulation Type	Qty. or Length	Total Eq Length (LF) or Total Area (SF)*
Cond	0.75	90 Degree Below	1	Cellular Glass	2	3.6
Cond	0.75	Straight Pipe	1	Cellular Glass	19	19
Cond	1	45 Degree Below	1	Cellular Glass	2	2
Cond	1	45 Degree Below	1	Cellular Glass	4	4
Cond	1	45 Degree Below	1	Cellular Glass	3	3
Cond	1	45 Degree Below	1	Cellular Glass	1	1
Cond	1	90 Degree Below	1	Cellular Glass	5	9
Cond	1	90 Degree Below	1	Cellular Glass	7	12.6
Cond	1	90 Degree Below	1	Cellular Glass		
Cond	1	Steam Trap	1.5	Removable Blanket	2	8.8
Cond	1	Straight Pipe	1	Cellular Glass	49	49
Cond	1	Straight Pipe	1	Cellular Glass	32	32
Cond	1	Straight Pipe	1	Cellular Glass	37	37
Cond	1	Strainer	1	Cellular Glass	1	5
Cond	1	T Intersection	1	Cellular Glass	2	2.4
Cond	1.25	90 Degree Below	1	Cellular Glass	4	7.2
Cond	1.25	Straight Pipe	1	Cellular Glass	64	64
Cond	1.25	T Intersection	1	Cellular Glass	1	1.2
Cond	1.5	45 Degree Below	1.5	Cellular Glass	2	2
Cond	1.5	90 Degree Below	1.5	Cellular Glass	5	9
Cond	1.5	Straight Pipe	1.5	Cellular Glass	51	51
Cond	1.5	T Intersection	1.5	Cellular Glass	2	2.4
Cond	2	90 Degree Below	1.5	Cellular Glass	5	9
Cond	2	90 Degree Below	1.5	Cellular Glass	10	18
Cond	2	Gate Valve	1.5	Cellular Glass	1	4.1
Cond	2	Steam Trap	1.5	Cellular Glass	1	4.4
Cond	2	Straight Pipe	1.5	Cellular Glass	13	13
Cond	2	Straight Pipe	1.5	Cellular Glass	66	66
Cond	2	Strainer	1.5	Removable Blanket	1	5
Cond	56.9125	Condensate Tank	1.5	Cellular Glass	1	56.9125
LPS	1	90 Degree Below	2.5	Cellular Glass	1	1.8
LPS	1	Straight Pipe	2.5	Cellular Glass	3	3
LPS	2	45 Degree Below	2.5	Cellular Glass	2	2
LPS	2	90 Degree Below	2.5	Cellular Glass	8	14.4
LPS	2	Straight Pipe	2.5	Cellular Glass	25	25
LPS	2	Straight Pipe	2.5	Cellular Glass	28	28
LPS	2	T Intersection	2.5	Cellular Glass	4	4.8
LPS	6	90 Degree Below	3	Cellular Glass	2	3.6
LPS	6	End Cap	3	Cellular Glass	1	1.5
LPS	6	Flange	1.5	Removable Blanket	5	9
LPS	6	Gate Valve	1.5	Removable Blanket	2	8.2
LPS	6	Straight Pipe	3	Cellular Glass	2	2
LPS	6	Straight Pipe	3	Cellular Glass	5	5
LPS	8	90 Degree Below	3	Cellular Glass	3	5.4
LPS	8	Flange	1.5	Removable Blanket	2	3.6
LPS	8	Flange	1.5	Removable Blanket	8	14.4
LPS	8	Gate Valve	1.5	Removable Blanket	2	8.2
LPS	8	Gate Valve	1.5	Removable Blanket	1	4.1
LPS	8	Straight Pipe	3	Cellular Glass	2	2
LPS	8	Straight Pipe	3	Cellular Glass	5	5
LPS	12	Flange	3	Cellular Glass	5	9
LPS	12	Straight Pipe	3	Cellular Glass	8	8

School 17						
Fluid	Pipe Dia (") or Tank Surface Area (SF)	Component	Insulation Thickness (in.)	Proposed Insulation Type	Qty. or Length	Total Eq Length (LF) or Total Area (SF)*
MTHW	3	90 Degree Elbow	2	Cellular Glass	2	3.6
MTHW	3	End Cap	2	Cellular Glass	3	4.5
MTHW	3	Flange	1.5	Removable Blanket	7	12.6
MTHW	3	Flange	2	Cellular Glass	4	7.2
MTHW	3	Gate Valve	1.5	Removable Blanket	2	8.2
MTHW	3	Straight Pipe	2	Cellular Glass	21	21
MTHW	3	T Intersection	2	Cellular Glass	4	4.8
MTHW	6	Flange	1.5	Removable Blanket	8	14.4
MTHW	6	Flange	2	Cellular Glass	4	7.2
MTHW	6	Gate Valve	1.5	Removable Blanket	2	8.2

School 18						
Fluid	Pipe Dia (") or Tank Surface Area (SF)	Component	Insulation Thickness (in.)	Proposed Insulation Type	Qty. or Length	Total Eq Length (LF) or Total Area (SF)*
MTHW	3	Bonnet	1.5	Removable Blanket	4	7.2
MTHW	3	Flex Fitting	1.5	Removable Blanket	4	6
MTHW	3	Flex Fitting	1.5	Removable Blanket	3	4.5
MTHW	3	Gate Valve	1.5	Removable Blanket	1	4.1
MTHW	3	In-Line Pump	2	Cellular Glass	3	15
MTHW	3	In-Line Pump	2	Cellular Glass	5	25
MTHW	3	Straight Pipe	2	Cellular Glass	5	5
MTHW	3	Strainer	1.5	Removable Blanket	1	5
MTHW	4	45 Degree Elbow	2	Cellular Glass	1	1
MTHW	4	Bonnet	1.5	Removable Blanket	2	3.6
MTHW	4	Centrifugal Pump	1.5	Removable Blanket	2	10
MTHW	4	Control Valve	1.5	Removable Blanket	1	4.1
MTHW	4	Flange	1.5	Removable Blanket	6	10.8
MTHW	4	Flange	2	Cellular Glass	5	9
MTHW	4	Flex Fitting	1.5	Removable Blanket	2	3
MTHW	4	Gate Valve	1.5	Removable Blanket	2	8.2
MTHW	4	Suction Diffuser	1.5	Removable Blanket	2	8.8
MTHW	4	T Intersection	2	Cellular Glass	1	1.2
MTHW	6	Straight Pipe	2	Cellular Glass	2	2
MTHW	8	Bonnet	1.5	Removable Blanket	1	1.8
MTHW	8	Flange	1.5	Removable Blanket	1	1.8
MTHW	8	Gate Valve	1.5	Removable Blanket	1	4.1

School 28						
Fluid	Pipe Dia (") or Tank Surface Area (SF)	Component	Insulation Thickness (in.)	Proposed Insulation Type	Qty. or Length	Total Eq Length (LF) or Total Area (SF)*
MTHW	4	Straight Pipe	2	Cellular Glass	6	6
MTHW	4	T Intersection	2	Cellular Glass	4	4.8
MTHW	5	Butterfly Valve	1.5	Removable Blanket	1	4.1
MTHW	5	Butterfly Valve	2	Cellular Glass	1	4.1
MTHW	5	Centrifugal Pump	1.5	Removable Blanket	2	10
MTHW	5	Check Valve	1.5	Removable Blanket	1	5.3
MTHW	5	Flange	1.5	Removable Blanket	2	3.6
MTHW	5	Flange	1.5	Removable Blanket	4	7.2
MTHW	5	Straight Pipe	2	Cellular Glass	2	2
MTHW	5	Straight Pipe	2	Cellular Glass	11	11
MTHW	5	Strainer	1.5	Removable Blanket	2	10
MTHW	5	Suction Diffuser	1.5	Removable Blanket	2	8.8

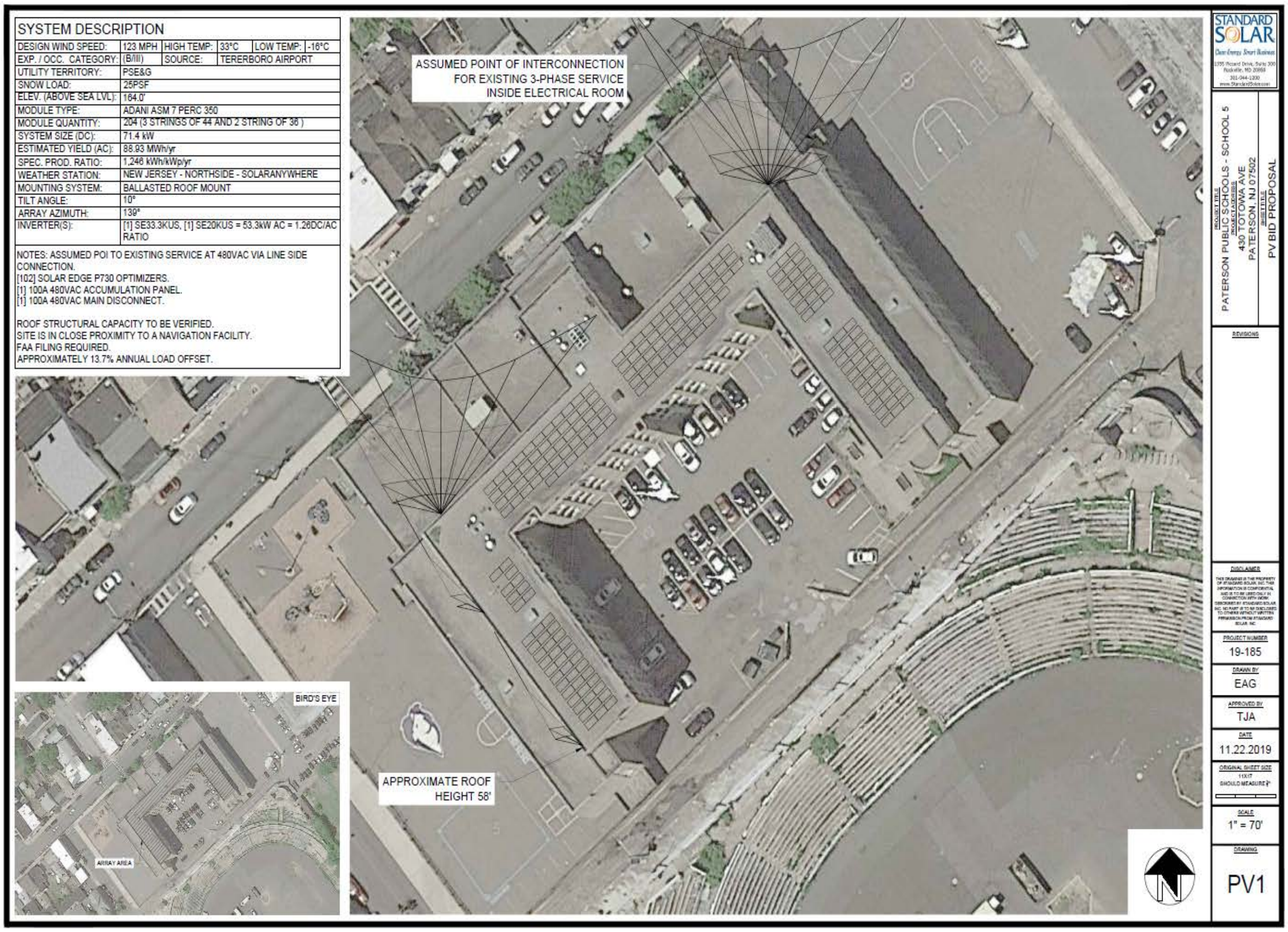
School 6						
Fluid	Pipe Dia (") or Tank Surface Area (SF)	Component	Insulation Thickness (in.)	Proposed Insulation Type	Qty. or Length	Total Eq Length (LF) or Total Area (SF)*
MTHW	4.5	Centrifugal Pump	1.5	Removable Blanket	3	15
MTHW	4.5	Flange	1.5	Removable Blanket	3	5.4
MTHW	4.5	Straight Pipe	2	Cellular Glass	3	3
MTHW	4.5	Suction Diffuser	1.5	Removable Blanket	3	13.2
MTHW	6	Flange	2	Cellular Glass	4	7.2
MTHW	6	In-Line Pump	1.5	Removable Blanket	2	10
MTHW	6	Straight Pipe	2	Cellular Glass	4	4
MTHW	7	90 Degree Elbow	2	Cellular Glass	6	10.8
MTHW	7	Butterfly Valve	1.5	Removable Blanket	3	12.3
MTHW	7	Control Valve	1.5	Removable Blanket	3	12.3
MTHW	7	Flange	1.5	Removable Blanket	9	16.2
MTHW	7	Flex Fitting	1.5	Removable Blanket	3	4.5

School 7						
Fluid	**Pipe Dia (") or Tank Surface Area (SF)**	**Component**	**Insulation Thickness (in.)**	**Proposed Insulation Type**	**Qty. or Length**	**Total Eq Length (LF) or Total Area (SF)***
Cond	1	90 Degree Elbow	1	Cellular Glass	5	9
Cond	1	Steam Trap	1.5	Removable Blanket	1	4.4
Cond	1	Straight Pipe	1	Cellular Glass	26	26
Cond	1	Strainer	1	Cellular Glass	1	5
Cond	1.25	90 Degree Elbow	1	Cellular Glass	6	10.8
Cond	1.25	End Cap	1	Cellular Glass	1	1.5
Cond	1.25	Stream Trap	1.5	Removable Blanket	1	4.4
Cond	1.25	Straight Pipe	1	Cellular Glass	1	1
Cond	1.25	Straight Pipe	1	Cellular Glass	6	6
Cond	1.25	Straight Pipe	1	Cellular Glass	36	36
Cond	1.25	T Intersection	1	Cellular Glass	5	6
Cond	2	90 Degree Elbow	1.5	Cellular Glass	3	5.4
Cond	2	90 Degree Elbow	1.5	Cellular Glass	1	1.8
Cond	2	Stream Trap	1.5	Removable Blanket	1	4.4
Cond	2	Straight Pipe	1.5	Cellular Glass	8	8
Cond	2	Straight Pipe	1.5	Cellular Glass	37	37
Cond	2	Strainer	1.5	Removable Blanket	1	5
Cond	2.5	Flange	1.5	Removable Blanket	3	5.4
Cond	2.5	Gate Valve	1.5	Removable Blanket	1	4.1
Cond	2.5	Straight Pipe	1.5	Cellular Glass	10	10
Cond	3	90 Degree Elbow	1.5	Cellular Glass	2	3.6
Cond	3	90 Degree Elbow	1.5	Cellular Glass	3	5.4
Cond	3	Stream Trap	1.5	Removable Blanket	1	4.4
Cond	3	Straight Pipe	1.5	Cellular Glass	14	14
Cond	3	T Intersection	1.5	Cellular Glass	1	1.2
Cond	4	Flange	1.5	Cellular Glass	4	7.2
Cond	4	Straight Pipe	1.5	Cellular Glass	16	16
Cond	24	Condensate Tank	1.5	Cellular Glass	1	24
Cond	118.1425	Condensate Tank	1.5	Cellular Glass	1	118.1425
LPS	5	Flange	3	Cellular Glass	6	10.8
LPS	5	Straight Pipe	3	Cellular Glass	2	2
LPS	10	Bonnet	1.5	Removable Blanket	2	3.6
LPS	10	Bonnet	1.5	Removable Blanket	1	1.8
LPS	10	End Cap	3	Cellular Glass	1	1.5
LPS	10	Flange	3	Cellular Glass	2	3.6
LPS	10	Straight Pipe	3	Cellular Glass	3	3

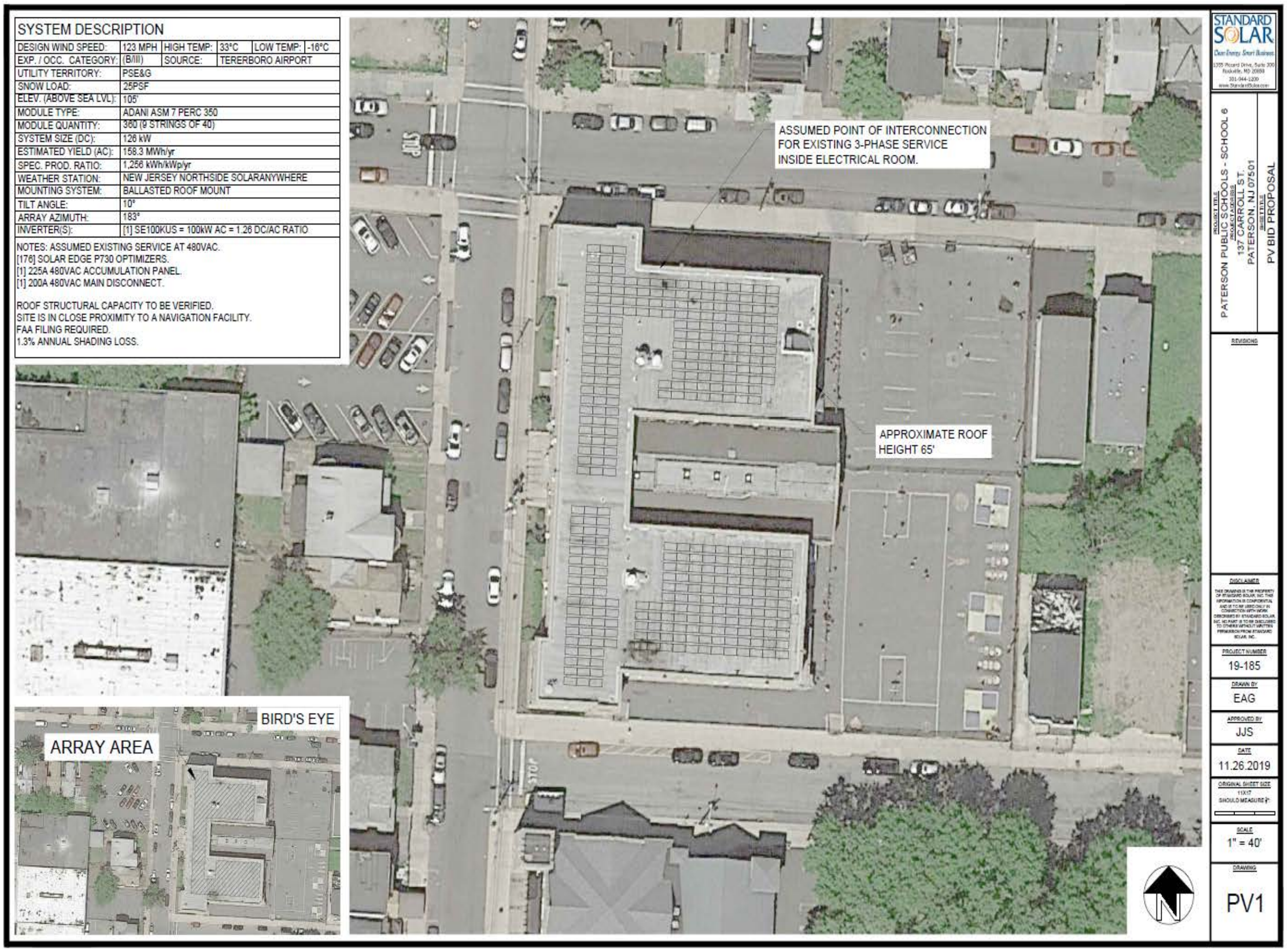
Silk City 2000 Academy						
Fluid	Pipe Dia (") or Tank Surface Area (SF)	Component	Insulation Thickness (in.)	Proposed Insulation Type	Qty. or Length	Total Eq Length (LF) or Total Area (SF)*
MTHW	2.5	90 Degree Elbow	2	Cellular Glass	1	1.8
MTHW	2.5	End Cap	2	Cellular Glass	1	1.5
MTHW	2.5	Flange	2	Cellular Glass	1	1.8
MTHW	2.5	Straight Pipe	2	Cellular Glass	8	8
MTHW	3	45 Degree Elbow	2	Cellular Glass	1	1
MTHW	3	Straight Pipe	2	Cellular Glass	3	3
MTHW	6	90 Degree Elbow	2	Cellular Glass	1	1.8
MTHW	6	End Cap	2	Cellular Glass	2	3
MTHW	6	Flange	2	Cellular Glass	2	3.6
MTHW	6	Flange	2	Cellular Glass	4	7.2
MTHW	6	Gate Valve	2	Cellular Glass	1	4.1
MTHW	6	Straight Pipe	2	Cellular Glass	24	24

SOLAR LAYOUTS

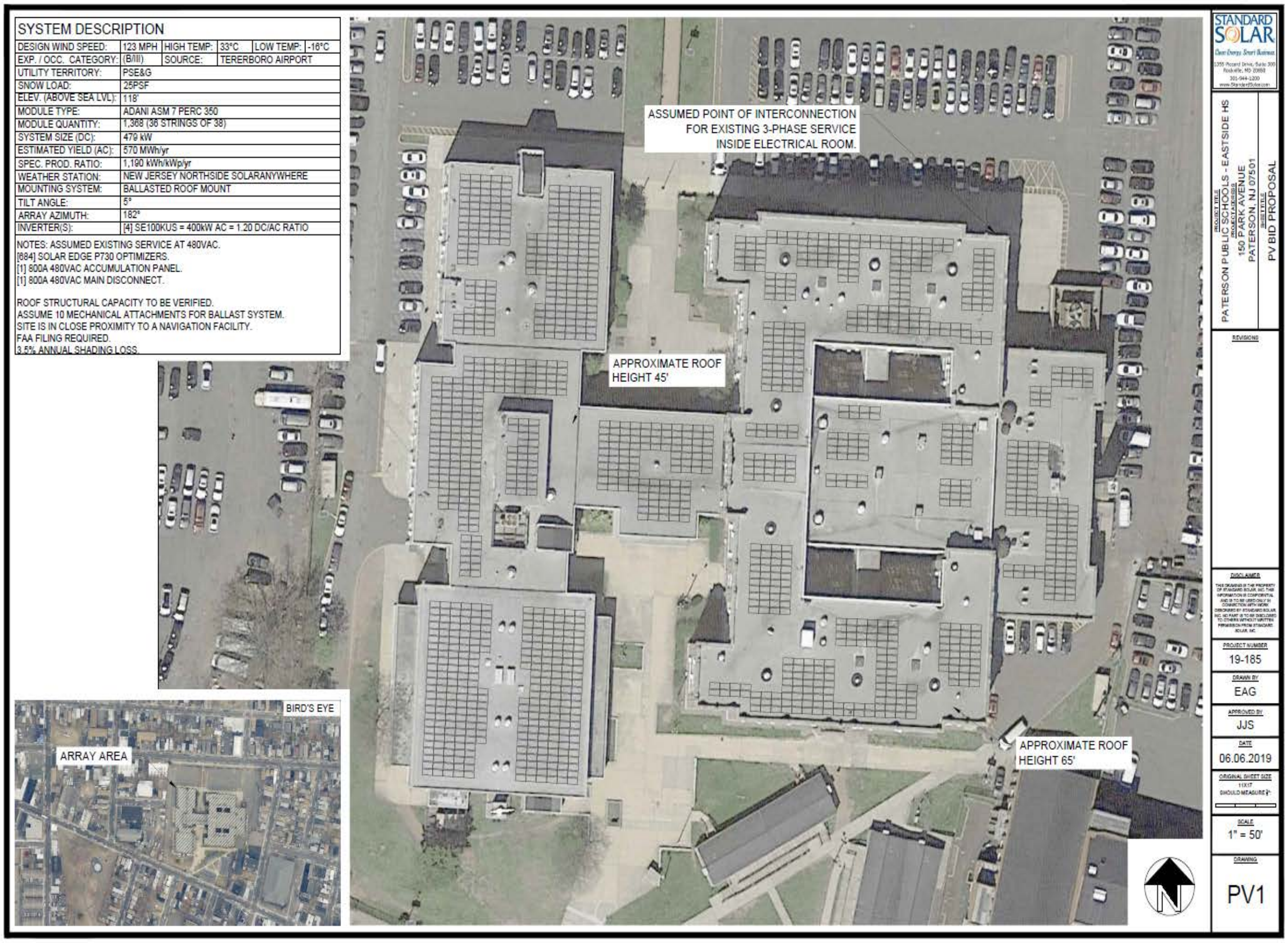
SCHOOL 5 – 71.4 KW (DC)



SCHOOL 6 – 126 KW (DC)



SCHOOL EASTSIDE HS – 479 KW (DC)

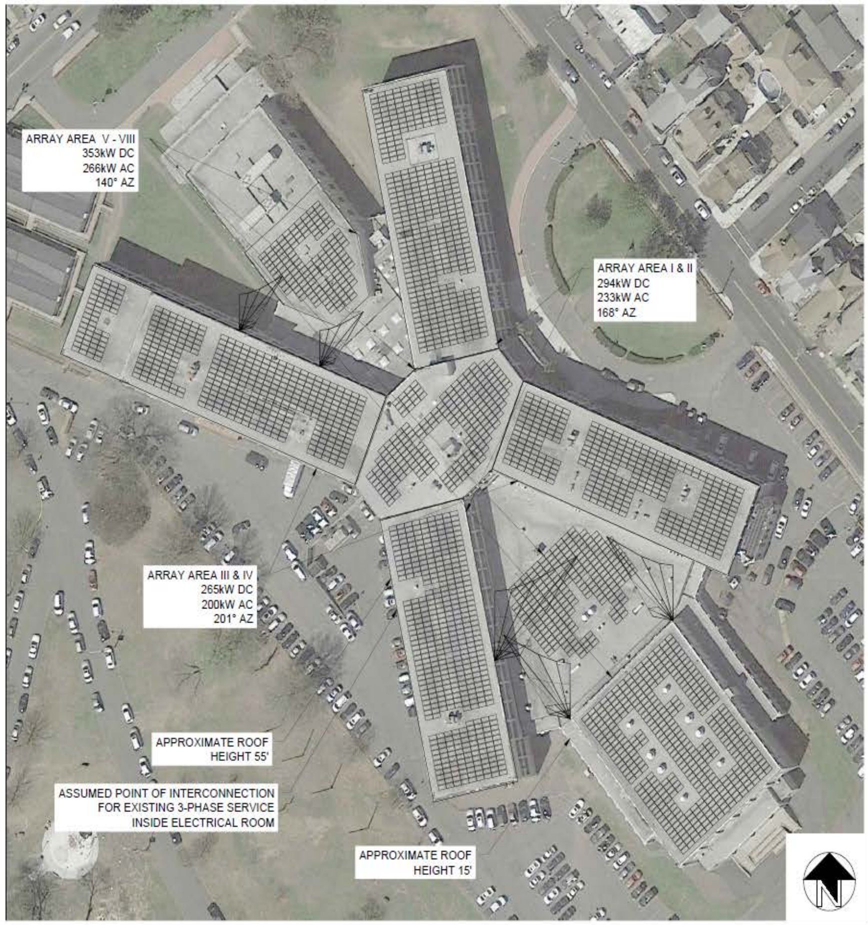


SCHOOL JFK HS – 911 KW (DC)

SYSTEM DESCRIPTION					
DESIGN WIND SPEED:	123 MPH	HIGH TEMP:	33°C	LOW TEMP:	-16°C
EXP. / OCC. CATEGORY:	(B/III)	SOURCE:	TERERBORO AIRPORT		
UTILITY TERRITORY:	PSE&G				
SNOW LOAD:	25PSF				
ELEV. (ABOVE SEA LVL):	150.9'				
MODULE TYPE:	ADANI ASM 7 PERC 350				
MODULE QUANTITY:	2,604 (21 STRINGS OF 40; 42 STRINGS OF 42)				
SYSTEM SIZE (DC):	911 kW				
ESTIMATED YIELD (AC):	1,091 MWh/yr				
SPEC. PROD. RATIO:	1,197 kWh/kWp/yr				
WEATHER STATION:	NEW JERSEY NORTHSIDE SOLARANYWHERE				
MOUNTING SYSTEM:	BALLASTED ROOF MOUNT				
TILT ANGLE:	5°				
ARRAY AZIMUTH:	SEE NOTES				
INVERTER(S):	[6] SE100KUS, [1] SE66.6KUS, [1] SE33.3KUS = 700kW AC = 1.30 DC/AC RATIO				

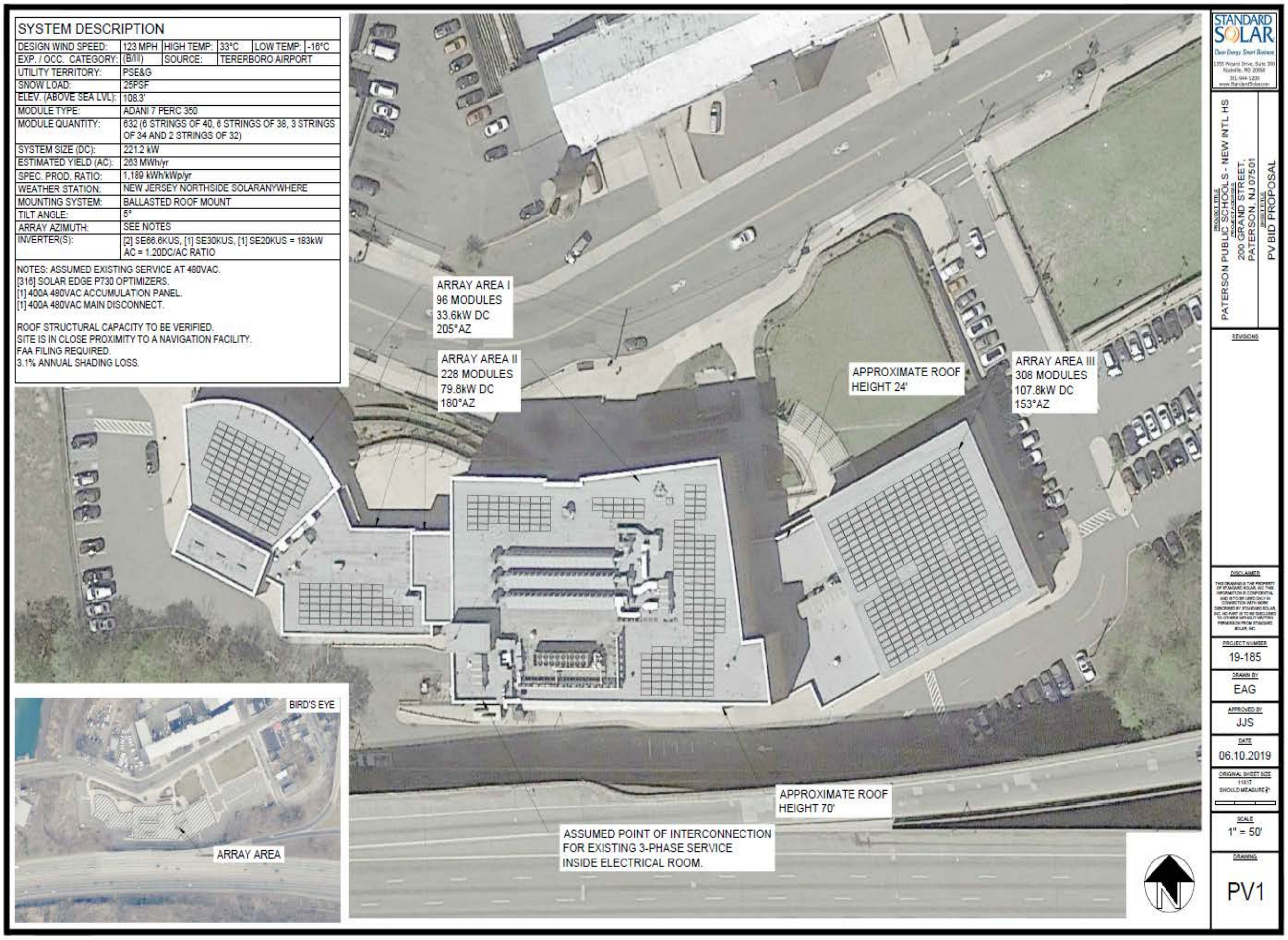
NOTES: ASSUMED EXISTING SERVICE AT 480VAC VIA LINE SIDE CONNECTION.
[1,032] SOLAR EDGE P730 OPTIMIZERS.
[1] 1200A 480VAC ACCUMULATION PANEL.
[1] 1200A 480VAC MAIN DISCONNECT.

ROOF STRUCTURAL CAPACITY TO BE VERIFIED.
SITE IS IN CLOSE PROXIMITY TO A NAVIGATION FACILITY.
FAA FILING REQUIRED.
2.0% ANNUAL SHADING LOSS.

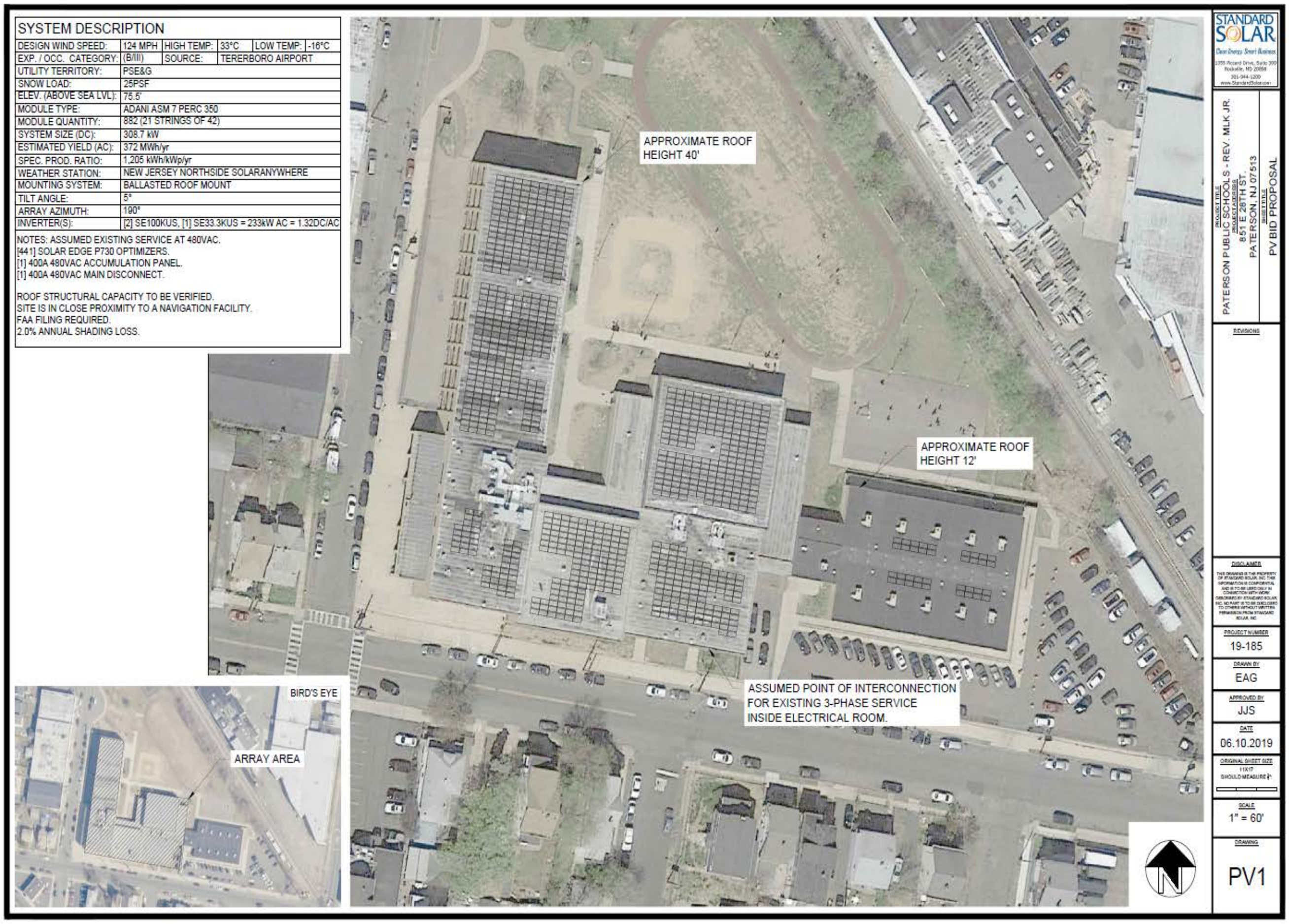


STANDARD SOLAR
PROJECT TITLE
PATERSON PUBLIC SCHOOLS - JFK HS
PROJECT ADDRESS
61-127 PREAKNESS AVE
PATERSON, NJ 07522
SHEET TITLE
PV BID PROPOSAL
REVISIONS
DISCLAIMER
PROJECT NUMBER
19-185
DRAWN BY
EAG
APPROVED BY
JJS
DATE
06.18.2019
SCALE
1" = 50'
DRAWING
PV1

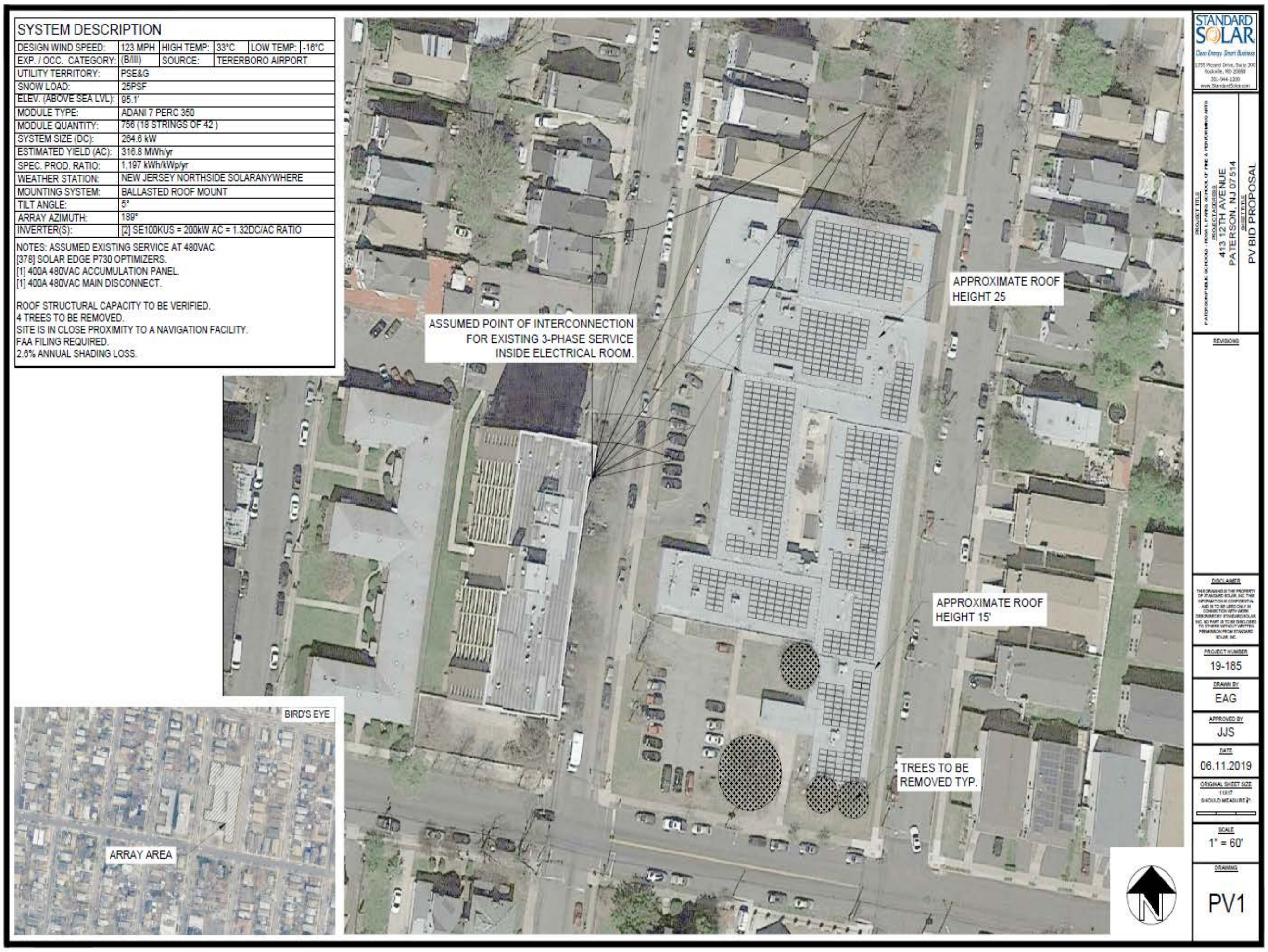
SCHOOL NEW INTERNATIONAL HS – 221.2 KW (DC)



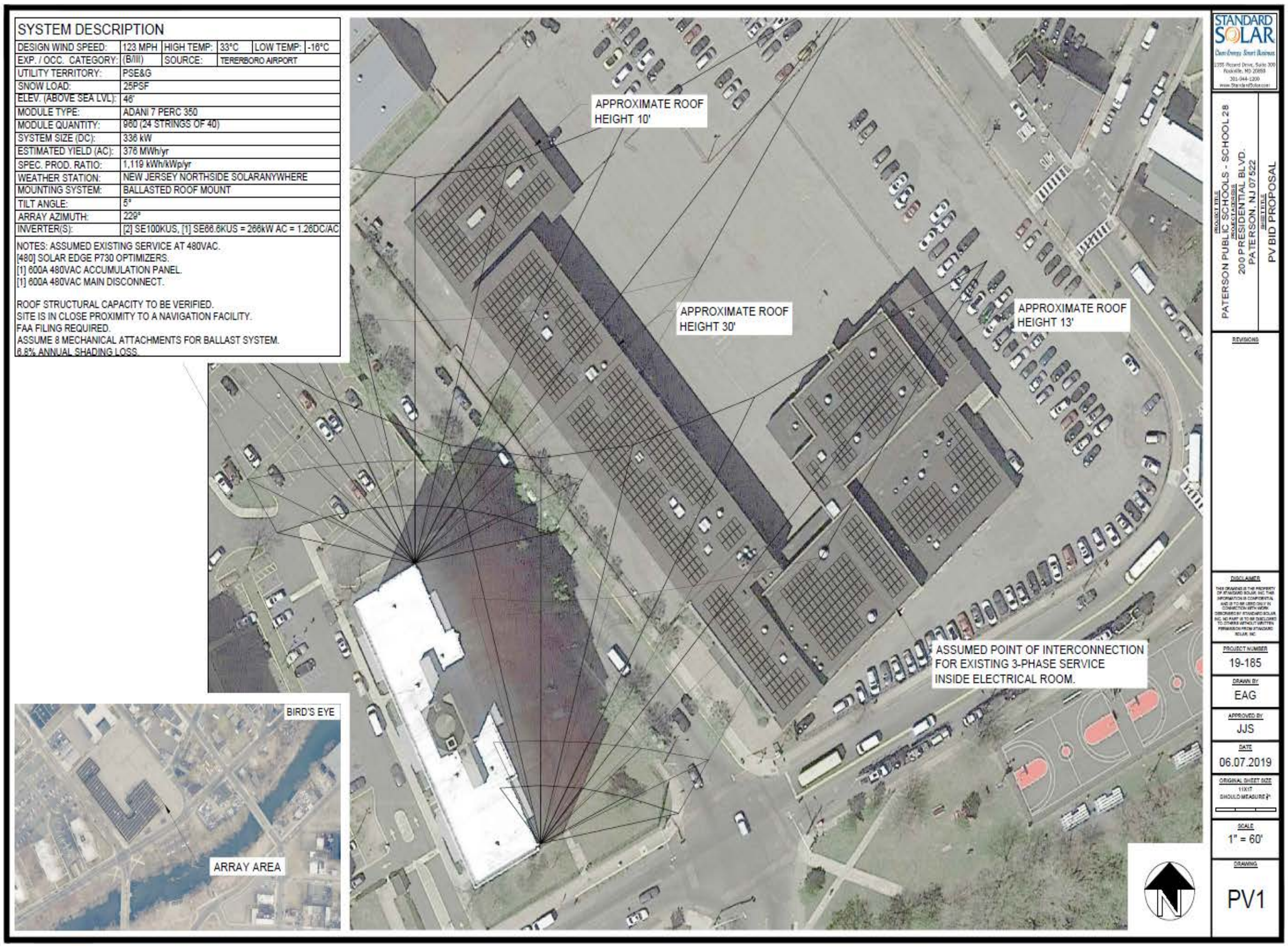
SCHOOL REV. MLK JR. – 308.7 KW (DC)



SCHOOL ROSA PARKS HS – 264.6 KW (DC)



SCHOOL 28 – 336 KW (DC)



APPENDIX 5. RECOMMENDED PROJECT – ESP

ECM ID	ECMs	School	Estimated Installed Hard Costs ($)	Estimated Annual Savings ($)	Estimated Simple Payback (years)	Installation Plan
1	Lighting Upgrades - LED	Dale Avenue	$125,388	$13,665	9.2	Public Bidding
2	Lighting Upgrades - LED	Department of Facilities	$65,237	$7,253	9.0	Public Bidding
3	Lighting Upgrades - LED	District Central Offices	$347,156	$38,886	8.9	Public Bidding
4	Lighting Upgrades - LED	Eastside High School	$657,039	$39,668	16.6	Public Bidding
5	Lighting Upgrades - LED	Edward Kilpatrick	$174,844	$15,958	11.0	Public Bidding
6	Lighting Upgrades - LED	John F. Kennedy High School	$622,504	$47,873	13.0	Public Bidding
7	Lighting Upgrades - LED	New International High School	$297,680	$29,046	10.2	Public Bidding
8	Lighting Upgrades - LED	New Roberto Clemente School	$316,056	$16,221	19.5	Public Bidding
9	Lighting Upgrades - LED	New Roberto K Center	$17,030	$1,865	9.1	Public Bidding
10	Lighting Upgrades - LED	Norman S. Weir	$133,406	$10,341	12.9	Public Bidding
11	Lighting Upgrades - LED	Rev. Dr. Martin Luther King Jr.	$315,215	$42,402	7.4	Public Bidding
12	Lighting Upgrades - LED	Roberto Clemente Elementary	$91,342	$3,343	27.3	Public Bidding
13	Lighting Upgrades - LED	Rosa L. Parks School of Fine and Performing Arts	$131,599	$9,327	14.1	Public Bidding
14	Lighting Upgrades - LED	School 12	$125,805	$8,692	14.5	Public Bidding
15	Lighting Upgrades - LED	School 13	$195,397	$16,798	11.6	Public Bidding
16	Lighting Upgrades - LED	School 18	$181,621	$13,710	13.2	Public Bidding
17	Lighting Upgrades - LED	School 28	$250,936	$16,455	15.3	Public Bidding
18	Lighting Upgrades - LED	School 6	$214,825	$17,366	12.4	Public Bidding
19	Lighting Upgrades - LED	School 7	$101,288	$12,408	8.2	Public Bidding
20	Lighting Upgrades - LED	Silk City 2000 Academy	$92,123	$9,967	9.2	Public Bidding
21	Lighting Upgrades - LED, Direct Install	Academy of Earth and Space Sciences (PANTHER)	$111,121	$13,315	8.3	Direct Install
22	Lighting Upgrades - LED, Direct Install	Early Learning Center	$35,353	$4,617	7.7	Direct Install
23	Lighting Upgrades - LED, Direct Install	Rutland Early childhood Learning Center	$40,444	$5,363	7.5	Direct Install
24	Lighting Upgrades - LED, Direct Install	School 17	$33,835	$2,672	12.7	Direct Install
25	Exhuast Fan Motor Replacement	New International High School	$37,039	$329	112.5	Public Bidding
26	Exhuast Fan Motor Replacement	New Roberto Clemente School	$16,006	$350	45.8	Public Bidding
27	Exhuast Fan Motor Replacement	Norman S. Weir	$4,642	$230	20.2	Public Bidding
28	Exhuast Fan Motor Replacement	Rev. Dr. Martin Luther King Jr.	$36,560	$1,034	35.3	Public Bidding
29	Exhuast Fan Motor Replacement	Rosa L. Parks School of Fine and Performing Arts	$11,836	$165	71.8	Public Bidding
30	Exhuast Fan Motor Replacement	Rutland Early childhood Learning Center	$3,353	$148	22.6	Public Bidding

ECM ID	ECMs	School	Estimated Installed Hard Costs ($)	Estimated Annual Savings ($)	Estimated Simple Payback (years)	Installation Plan
31	Exhuast Fan Motor Replacement	School 18	$11,786	$441	26.7	Public Bidding
32	Exhuast Fan Motor Replacement	School 7	$3,353	$62	53.9	Public Bidding
33	VFDs on HW Pumps	Eastside High School	$34,434	$8,504	4.0	Public Bidding
34	VFDs on HW Pumps	New International High School	$28,975	$4,189	6.9	Public Bidding
35	VFDs on HW Pumps	School 12	$29,100	$4,031	7.2	Public Bidding
36	VFDs on HW Pumps	School 28	$24,210	$2,744	8.8	Public Bidding
37	VFDs on HW Pumps	School 6	$40,114	$5,273	7.6	Public Bidding
38	Destratification Fans	Eastside High School	$21,609	$2,482	8.7	Public Bidding
39	Destratification Fans	John F. Kennedy High School	$32,755	$3,721	8.8	Public Bidding
40	Destratification Fans	New International High School	$21,609	$2,485	8.7	Public Bidding
41	Destratification Fans	New Roberto Clemente School	$16,377	$1,758	9.3	Public Bidding
42	Destratification Fans	Rosa L. Parks School of Fine and Performing Arts	$6,867	$633	10.8	Public Bidding
43	Destratification Fans	School 28	$13,380	$1,180	11.3	Public Bidding
44	Auditorium Air Conditioning (2) 20 Ton	Eastside High School	$210,187	-$5,090		Public Bidding
45	Chiller Refurbishment	Dale Avenue	$7,412	$1,418	5.2	Public Bidding
46	Gymnasium Air Conditioning (2) 20 Ton	Eastside High School	$356,345	-$5,090		Public Bidding
47	Steam Boiler Replacement	Dale Avenue	$530,495	$834	636.3	Public Bidding
48	Boiler Controls / Intellidyne	John F. Kennedy High School	$13,047	$4,438	2.9	Public Bidding
49	Boiler Controls / Intellidyne	New International High School	$13,047	$1,639	8.0	Public Bidding
50	Boiler Controls / Intellidyne	New Roberto Clemente School	$13,047	$5,570	2.3	Public Bidding
51	Boiler Controls / Intellidyne	School 12	$13,047	$1,207	10.8	Public Bidding
52	Boiler Controls / Intellidyne	School 13	$13,047	$1,739	7.5	Public Bidding
53	Boiler Controls / Intellidyne	School 17	$13,047	$618	21.1	Public Bidding
54	Boiler Controls / Intellidyne	School 18	$13,047	$1,481	8.8	Public Bidding
55	Boiler Controls / Intellidyne	School 28	$13,047	$3,559	3.7	Public Bidding
56	Boiler Controls / Intellidyne	School 6	$13,047	$1,432	9.1	Public Bidding
57	Boiler Controls / Intellidyne	Silk City 2000 Academy	$13,047	$1,124	11.6	Public Bidding
58	RTU Replacement	Rosa L. Parks School of Fine and Performing Arts	$132,025	$515	256.3	Public Bidding
59	DI HVAC Controls - Direct Install	Academy of Earth and Space Sciences (PANTHER)	$573	$1,592	0.4	Direct Install
60	DI HVAC Controls - Direct Install	Early Learning Center	$3,443	$2,141	1.6	Direct Install

ECM ID	ECMs	School	Estimated Installed Hard Costs ($)	Estimated Annual Savings ($)	Estimated Simple Payback (years)	Installation Plan
61	DI HVAC Controls - Direct Install	Rutland Early childhood Learning Center	$2,948	$1,103	2.7	Direct Install
62	DI HVAC Controls - Direct Install	School 17	$5,377	$1,138	4.7	Direct Install
63	Building Controls - Central Plant	Academy of Earth and Space Sciences (PANTHER)	$48,615	$1,033	47.1	Public Bidding
64	Building Controls - Central Plant	All Sites	$100,393	$0		Public Bidding
65	Building Controls - Central Plant	Dale Avenue	$66,374	$6,348	10.5	Public Bidding
66	Building Controls - Central Plant	Early Learning Center	$19,105	$1,510	12.7	Public Bidding
67	Building Controls - Central Plant	Eastside High School	$92,057	$18,401	5.0	Public Bidding
68	Building Controls - Central Plant	Edward Kilpatrick	$32,978	$2,180	15.1	Public Bidding
69	Building Controls - Central Plant	John F. Kennedy High School	$82,664	$17,029	4.9	Public Bidding
70	Building Controls - Central Plant	New International High School	$61,993	$4,136	15.0	Public Bidding
71	Building Controls - Central Plant	New Roberto Clemente School	$54,691	$6,841	8.0	Public Bidding
72	Building Controls - Central Plant	New Roberto K Center	$16,611	$1,084	15.3	Public Bidding
73	Building Controls - Central Plant	Norman S. Weir	$38,523	$851	45.3	Public Bidding
74	Building Controls - Central Plant	Rev. Dr. Martin Luther King Jr.	$71,629	$8,997	8.0	Public Bidding
75	Building Controls - Central Plant	Roberto Clemente Elementary	$29,091	$729	39.9	Public Bidding
76	Building Controls - Central Plant	Rosa L. Parks School of Fine and Performing Arts	$23,661	$1,826	13.0	Public Bidding
77	Building Controls - Central Plant	Rutland Early childhood Learning Center	$13,690	$1,010	13.6	Public Bidding
78	Building Controls - Central Plant	School 12	$36,598	$2,065	17.7	Public Bidding
79	Building Controls - Central Plant	School 13	$34,590	$2,741	12.6	Public Bidding
80	Building Controls - Central Plant	School 17	$42,530	$980	43.4	Public Bidding
81	Building Controls - Central Plant	School 18	$54,075	$4,948	10.9	Public Bidding
82	Building Controls - Central Plant	School 28	$38,393	$4,322	8.9	Public Bidding
83	Building Controls - Central Plant	School 6	$33,191	$6,316	5.3	Public Bidding
84	Building Controls - Central Plant	School 7	$27,258	$1,368	19.9	Public Bidding
85	Building Controls - Central Plant	Silk City 2000 Academy	$37,024	$2,045	18.1	Public Bidding
86	Building Controls - Distributions (AHU/RTU)	Academy of Earth and Space Sciences (PANTHER)	$6,389	$0		Public Bidding
87	Building Controls - Distributions (AHU/RTU)	Dale Avenue	$31,956	$982	32.5	Public Bidding
88	Building Controls - Distributions (AHU/RTU)	Edward Kilpatrick	$24,034	$0		Public Bidding
89	Building Controls - Distributions (AHU/RTU)	John F. Kennedy High School	$63,418	$3,819	16.6	Public Bidding

ECM ID	ECMs	School	Estimated Installed Hard Costs ($)	Estimated Annual Savings ($)	Estimated Simple Payback (years)	Installation Plan
90	Building Controls - Distributions (AHU/RTU)	New International High School	$92,532	$1,394	66.4	Public Bidding
91	Building Controls - Distributions (AHU/RTU)	New Roberto Clemente School	$84,501	$1,065	79.4	Public Bidding
92	Building Controls - Distributions (AHU/RTU)	New Roberto K Center	$13,179	$0		Public Bidding
93	Building Controls - Distributions (AHU/RTU)	Norman S. Weir	$32,321	$689	46.9	Public Bidding
94	Building Controls - Distributions (AHU/RTU)	Rev. Dr. Martin Luther King Jr.	$96,134	$2,009	47.9	Public Bidding
95	Building Controls - Distributions (AHU/RTU)	Rosa L. Parks School of Fine and Performing Arts	$87,202	$1,190	73.3	Public Bidding
96	Building Controls - Distributions (AHU/RTU)	Rutland Early childhood Learning Center	$35,229	$0		Public Bidding
97	Building Controls - Distributions (AHU/RTU)	School 12	$20,383	$0		Public Bidding
98	Building Controls - Distributions (AHU/RTU)	School 13	$109,484	$1,262	86.8	Public Bidding
99	Building Controls - Distributions (AHU/RTU)	School 18	$23,705	$1,626	14.6	Public Bidding
100	Building Controls - Distributions (AHU/RTU)	School 28	$55,003	$946	58.2	Public Bidding
101	Building Controls - Distributions (AHU/RTU)	School 6	$43,686	$1,556	28.1	Public Bidding
102	Building Controls - Distributions (AHU/RTU)	School 7	$4,259	$0		Public Bidding
103	Building Controls - Distributions (AHU/RTU)	Silk City 2000 Academy	$33,404	$0		Public Bidding
104	Data Analytics	All Sites	$316,100	$35,108	9.0	Public Bidding
105	Building Envelope Upgrades	Academy of Earth and Space Sciences (PANTHER)	$15,734	$887	17.7	Public Bidding
106	Building Envelope Upgrades	Dale Avenue	$6,524	$443	14.7	Public Bidding
107	Building Envelope Upgrades	Early Learning Center	$12,693	$550	23.1	Public Bidding
108	Building Envelope Upgrades	Eastside High School	$46,722	$3,543	13.2	Public Bidding
109	Building Envelope Upgrades	Edward Kilpatrick	$9,379	$2,030	4.6	Public Bidding
110	Building Envelope Upgrades	John F. Kennedy High School	$37,752	$5,202	7.3	Public Bidding
111	Building Envelope Upgrades	New International High School	$76,389	$3,271	23.4	Public Bidding
112	Building Envelope Upgrades	New Roberto Clemente School	$12,873	$1,244	10.3	Public Bidding
113	Building Envelope Upgrades	New Roberto K Center	$7,006	$531	13.2	Public Bidding
114	Building Envelope Upgrades	Norman S. Weir	$12,613	$866	14.6	Public Bidding
115	Building Envelope Upgrades	Rev. Dr. Martin Luther King Jr.	$44,251	$3,789	11.7	Public Bidding
116	Building Envelope Upgrades	Roberto Clemente Elementary	$11,984	$132	90.7	Public Bidding
117	Building Envelope Upgrades	Rosa L. Parks School of Fine and Performing Arts	$34,886	$2,620	13.3	Public Bidding
118	Building Envelope Upgrades	School 12	$21,495	$6,168	3.5	Public Bidding

ECM ID	ECMs	School	Estimated Installed Hard Costs ($)	Estimated Annual Savings ($)	Estimated Simple Payback (years)	Installation Plan
119	Building Envelope Upgrades	School 13	$24,824	$2,617	9.5	Public Bidding
120	Building Envelope Upgrades	School 17	$32,812	$1,725	19.0	Public Bidding
121	Building Envelope Upgrades	School 18	$150,220	$6,643	22.6	Public Bidding
122	Building Envelope Upgrades	School 28	$23,343	$2,122	11.0	Public Bidding
123	Building Envelope Upgrades	School 6	$5,726	$511	11.2	Public Bidding
124	Building Envelope Upgrades	School 7	$10,035	$1,306	7.7	Public Bidding
125	Building Envelope Upgrades	Silk City 2000 Academy	$5,452	$226	24.1	Public Bidding
126	Domestic Fixtures (Sink Faucets)	Academy of Earth and Space Sciences (PANTHER)	$511	$135	3.8	Public Bidding
127	Domestic Fixtures (Sink Faucets)	Dale Avenue	$2,137	$808	2.6	Public Bidding
128	Domestic Fixtures (Sink Faucets)	Early Learning Center	$511	$58	8.8	Public Bidding
129	Domestic Fixtures (Sink Faucets)	Eastside High School	$2,462	$528	4.7	Public Bidding
130	Domestic Fixtures (Sink Faucets)	Edward Kilpatrick	$2,091	$297	7.0	Public Bidding
131	Domestic Fixtures (Sink Faucets)	John F. Kennedy High School	$4,879	$1,419	3.4	Public Bidding
132	Domestic Fixtures (Sink Faucets)	New International High School	$2,741	$325	8.4	Public Bidding
133	Domestic Fixtures (Sink Faucets)	New Roberto Clemente School	$2,324	$361	6.4	Public Bidding
134	Domestic Fixtures (Sink Faucets)	New Roberto K Center	$186	$38	5.0	Public Bidding
135	Domestic Fixtures (Sink Faucets)	Norman S. Weir	$1,115	$210	5.3	Public Bidding
136	Domestic Fixtures (Sink Faucets)	Rev. Dr. Martin Luther King Jr.	$1,858	$510	3.6	Public Bidding
137	Domestic Fixtures (Sink Faucets)	Roberto Clemente Elementary	$1,255	$501	2.5	Public Bidding
138	Domestic Fixtures (Sink Faucets)	Rosa L. Parks School of Fine and Performing Arts	$697	$205	3.4	Public Bidding
139	Domestic Fixtures (Sink Faucets)	Rutland Early childhood Learning Center	$325	$47	6.9	Public Bidding
140	Domestic Fixtures (Sink Faucets)	School 12	$836	$368	2.3	Public Bidding
141	Domestic Fixtures (Sink Faucets)	School 13	$1,906	$395	4.8	Public Bidding
142	Domestic Fixtures (Sink Faucets)	School 17	$511	$77	6.6	Public Bidding
143	Domestic Fixtures (Sink Faucets)	School 18	$1,487	$729	2.0	Public Bidding
144	Domestic Fixtures (Sink Faucets)	School 28	$2,742	$235	11.7	Public Bidding
145	Domestic Fixtures (Sink Faucets)	School 6	$1,487	$352	4.2	Public Bidding
146	Domestic Fixtures (Sink Faucets)	School 7	$604	$180	3.4	Public Bidding
147	Domestic Fixtures (Sink Faucets)	Silk City 2000 Academy	$977	$143	6.8	Public Bidding

ECM ID	ECMs	School	Estimated Installed Hard Costs ($)	Estimated Annual Savings ($)	Estimated Simple Payback (years)	Installation Plan
148	PPA Rate Savings	Eastside High School	$0	$0	N/A	Solar PPA
149	PPA Rate Savings	John F. Kennedy High School	$0	$0	N/A	Solar PPA
150	PPA Rate Savings	New International High School	$0	$0	N/A	Solar PPA
151	PPA Rate Savings	Rev. Dr. Martin Luther King Jr.	$0	$0	N/A	Solar PPA
152	PPA Rate Savings	Rosa L. Parks School of Fine and Performing Arts	$0	$0	N/A	Solar PPA
153	PPA Rate Savings	School 28	$0	$0	N/A	Solar PPA
154	PPA Rate Savings	School 6	$0	$0	N/A	Solar PPA
155	PPA Rate Savings	School 5	$0	$0	N/A	Solar PPA
156	Liquid Pool Cover	Norman S. Weir	$9,297	$2,046	4.5	Public Bidding
157	Pool System Upgrades	Norman S. Weir	$69,490	$2,871	24.2	Public Bidding
158	Cogeneration 35kw	Eastside High School	$257,890	$15,545	16.6	Public Bidding
159	DHW Heater Replacement	John F. Kennedy High School	$44,752	$0		Public Bidding
160	Steam Trap Replacements	Dale Avenue	$45,723	$3,897	11.7	Public Bidding
161	Steam Trap Replacements	John F. Kennedy High School	$155,851	$16,649	9.4	Public Bidding
162	Steam Trap Replacements	School 12	$12,098	$4,932	2.5	Public Bidding
163	Steam Trap Replacements	School 13	$60,905	$10,875	5.6	Public Bidding
164	Steam Trap Replacements	School 17	$31,624	$313	100.9	Public Bidding
165	Steam Trap Replacements	School 7	$65,644	$833	78.8	Public Bidding
166	Steam Trap Replacements	Silk City 2000 Academy	$15,209	$1,293	11.8	Public Bidding
167	Roof Restoration	Eastside High School	$816,546	$0		Public Bidding
168	Roof Restoration	John F. Kennedy High School	$1,298,190	$0		Public Bidding
169	Roof Restoration	School 28	$376,214	$0		Public Bidding
170	HVAC Piping Insulation	Academy of Earth and Space Sciences (PANTHER)	$5,024	$279	18.0	Public Bidding
171	HVAC Piping Insulation	Dale Avenue	$16,991	$885	19.2	Public Bidding
172	HVAC Piping Insulation	Early Learning Center	$6,044	$350	17.3	Public Bidding
173	HVAC Piping Insulation	Eastside High School	$62,401	$6,551	9.5	Public Bidding
174	HVAC Piping Insulation	Edward Kilpatrick	$7,831	$661	11.8	Public Bidding
175	HVAC Piping Insulation	John F. Kennedy High School	$63,678	$6,606	9.6	Public Bidding
176	HVAC Piping Insulation	New International High School	$7,295	$492	14.8	Public Bidding
177	HVAC Piping Insulation	New Roberto Clemente School	$14,717	$965	15.3	Public Bidding
178	HVAC Piping Insulation	Norman S. Weir	$5,927	$461	12.9	Public Bidding
179	HVAC Piping Insulation	Rev. Dr. Martin Luther King Jr.	$14,475	$1,873	7.7	Public Bidding

ECM ID	ECMs	School	Estimated Installed Hard Costs ($)	Estimated Annual Savings ($)	Estimated Simple Payback (years)	Installation Plan
180	HVAC Piping Insulation	School 12	$64,453	$2,455	26.3	Public Bidding
181	HVAC Piping Insulation	School 13	$35,513	$1,903	18.7	Public Bidding
182	HVAC Piping Insulation	School 17	$7,738	$592	13.1	Public Bidding
183	HVAC Piping Insulation	School 18	$7,288	$696	10.5	Public Bidding
184	HVAC Piping Insulation	School 28	$7,003	$704	9.9	Public Bidding
185	HVAC Piping Insulation	School 6	$9,680	$605	16.0	Public Bidding
186	HVAC Piping Insulation	School 7	$26,582	$1,408	18.9	Public Bidding
187	HVAC Piping Insulation	Silk City 2000 Academy	$4,960	$421	11.8	Public Bidding
188	Educational Program	All Sites	$0	$0		Public Bidding
189	Refrigeration Controls (E-Temp)	Dale Avenue	$9,853	$2,282	4.3	Public Bidding
190	Refrigeration Controls (E-Temp)	Early Learning Center	$2,956	$1,052	2.8	Public Bidding
191	Refrigeration Controls (E-Temp)	Eastside High School	$17,735	$5,556	3.2	Public Bidding
192	Refrigeration Controls (E-Temp)	Edward Kilpatrick	$5,912	$1,261	4.7	Public Bidding
193	Refrigeration Controls (E-Temp)	John F. Kennedy High School	$15,764	$4,153	3.8	Public Bidding
194	Refrigeration Controls (E-Temp)	New International High School	$3,941	$1,487	2.6	Public Bidding
195	Refrigeration Controls (E-Temp)	New Roberto Clemente School	$7,882	$1,878	4.2	Public Bidding
196	Refrigeration Controls (E-Temp)	Norman S. Weir	$3,941	$861	4.6	Public Bidding
197	Refrigeration Controls (E-Temp)	Rev. Dr. Martin Luther King Jr.	$1,971	$1,153	1.7	Public Bidding
198	Refrigeration Controls (E-Temp)	Roberto Clemente Elementary	$3,941	$680	5.8	Public Bidding
199	Refrigeration Controls (E-Temp)	Rosa L. Parks School of Fine and Performing Arts	$2,956	$1,273	2.3	Public Bidding
200	Refrigeration Controls (E-Temp)	School 12	$4,926	$1,002	4.9	Public Bidding
201	Refrigeration Controls (E-Temp)	School 13	$5,912	$1,480	4.0	Public Bidding
202	Refrigeration Controls (E-Temp)	School 17	$3,941	$1,107	3.6	Public Bidding
203	Refrigeration Controls (E-Temp)	School 18	$3,941	$857	4.6	Public Bidding
204	Refrigeration Controls (E-Temp)	School 28	$8,868	$1,718	5.2	Public Bidding
205	Refrigeration Controls (E-Temp)	School 6	$1,971	$896	2.2	Public Bidding
206	Refrigeration Controls (E-Temp)	School 7	$5,912	$1,869	3.2	Public Bidding
207	Refrigeration Controls (E-Temp)	Silk City 2000 Academy	$1,971	$570	3.5	Public Bidding
208	Legend Power	New Roberto Clemente School	$25,070	$9,445	2.7	Test Installation by Manufacturer
			$13,081,933	$788,829	16.6	

Operational Savings

Operational Savings for Financial Model	
ECM Description	**Annual Savings**
LED Lighting Upgrades & Occupancy Sensors – District Wide (24 Schools)	$ 215,092
Direct Digital Controls (DDC) Upgrade – District Wide, Boiler Replacement – Steam Boilers – Dale Avenue	$ 387,782
Totals	**$ 602,874**

NJ Clean Energy Rebates

Building	Energy Conservation Measure	Energy Rebate/ Incentives
Academy of Earth and Space Sciences (PANTHER)	Lighting Upgrades - LED, Direct Install	$15,355.08
Dale Avenue	Lighting Upgrades - LED	$6,195.96
Department of Facilities	Lighting Upgrades - LED	$3,954.20
District Central Offices	Lighting Upgrades - LED	$20,890.34
Early Learning Center	Lighting Upgrades - LED, Direct Install	$11,583.72
Eastside High School	Lighting Upgrades - LED	$24,620.98
Edward Kilpatrick	Lighting Upgrades - LED	$7,182.40
John F. Kennedy High School	Lighting Upgrades - LED	$32,648.46
New International High School	Lighting Upgrades - LED	$13,073.36
New Roberto Clemente School	Lighting Upgrades - LED	$13,303.84
New Roberto K Center	Lighting Upgrades - LED	$1,079.40
Norman S. Weir	Lighting Upgrades - LED	$5,476.11
Rev. Dr. Martin Luther King Jr.	Lighting Upgrades - LED	$18,226.81
Roberto Clemente Elementary	Lighting Upgrades - LED	$3,781.34
Rosa L. Parks School of Fine and Performing Arts	Lighting Upgrades - LED	$7,293.03
Rutland Early childhood Learning Center	Lighting Upgrades - LED, Direct Install	$13,556.60
School 12	Lighting Upgrades - LED	$5,628.99
School 13	Lighting Upgrades - LED	$8,897.14
School 17	Lighting Upgrades - LED, Direct Install	$10,308.42
School 18	Lighting Upgrades - LED	$7,897.64
School 28	Lighting Upgrades - LED	$10,968.35
School 6	Lighting Upgrades - LED	$11,822.65
School 7	Lighting Upgrades - LED	$5,202.61
Silk City 2000 Academy	Lighting Upgrades - LED	$4,458.17
Early Learning Center	DI HVAC Controls - Direct Install	$1,941.38
Academy of Earth and Space Sciences (PANTHER)	DI HVAC Controls - Direct Install	$323.43
Rutland Early childhood Learning Center	DI HVAC Controls - Direct Install	$1,662.50
School 17	DI HVAC Controls - Direct Install	$3,031.53

Demand Response Energy – Emergency Capacity Credit		
PJM Payment Year	**Approved Load (kW)**	**Annual Customer Capacity Benefit**
2020/2021	612.2 kW	$16,460
2021/2022	612.2 kW	$11,758
2022/2023	612.2 kW	$11,758
2023/2024	612.2 kW	$11,758
Totals		**$51,734**

Incentive Breakout for Recommended Project

Year	DR EE Credit	NJ Clean Energy Rebates	Total
1	$16,460	$270,364	$ 286,824
2	$11,758	$0	$ 11,758
3	$11,758	$0	$ 11,758
4	$11,758	$0	$ 11,758
TOTAL	**$51,734**	**$270,364**	**$ 322,099**

Business Case for Recommended Project

FORM VI - ENERGY SAVINGS PLAN

ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP):
ESCO's PRELIMINARY ANNUAL CASH FLOW ANALYSIS FORM
Paterson Phase 2
ENERGY SAVINGS IMPROVEMENT PROGRAM

ESCO Name: ENERGY SYSTEMS GROUP **Project Scenario 3**

Note: Respondents must use the following assumptions in all financial calculations:

(a) The cost of all types of energy should be assumed to inflate at 2.4% gas, 2.2% electric per year; and

1. Term of Agreement: 20 years — **Design/Consultant Fee** $ 1,415,603
2. Construction period[2] (months): 18 — **Costs of Issuance** $ 200,000
3. Cash Flow Analysis Format:

Total Financed Amount[4] $ 18,909,103
Total ESG Project Cost [1] $ 17,293,500

Interest Rate to be used for Proposal Purposes: 2.35%

	Annual Energy Savings	Annual Operational Savings	Energy Rebates/ Incentives	Solar PPA	Total Annual Savings	Annual Project Costs	Board Costs	Annual Service Costs	Net Cash-Flow to client	Cumulative Cash Flow
Installation[3]	$ 198,605	$ -	$ -	$ 38,671	$ 237,276	$ -	$ -	$ -	$ 237,276	$ 237,276
1	$ 806,641	$ 602,874	$ 286,825	$ 79,043	$ 1,775,383	$ 1,712,314	$ 1,772,983	$ 60,669	$ 2,400	$ 239,676
2	$ 824,855	$ 602,874	$ 11,758	$ 80,782	$ 1,520,269	$ 1,517,869	$ 1,517,869	$ -	$ 2,400	$ 242,076
3	$ 843,482	$ 215,092	$ 11,758	$ 82,559	$ 1,152,891	$ 1,150,491	$ 1,150,491	$ -	$ 2,400	$ 244,476
4	$ 862,529	$ 215,092	$ 11,758	$ 84,375	$ 1,173,754	$ 1,171,354	$ 1,171,354	$ -	$ 2,400	$ 246,876
5	$ 882,007	$ 215,092	$ -	$ 86,231	$ 1,183,331	$ 1,180,931	$ 1,180,931	$ -	$ 2,400	$ 249,276
6	$ 901,926	$ -	$ -	$ 88,129	$ 990,055	$ 987,655	$ 987,655	$ -	$ 2,400	$ 251,676
7	$ 922,296	$ -	$ -	$ 90,067	$ 1,012,363	$ 1,009,963	$ 1,009,963	$ -	$ 2,400	$ 254,076
8	$ 943,126	$ -	$ -	$ 92,049	$ 1,035,175	$ 1,032,775	$ 1,032,775	$ -	$ 2,400	$ 256,476
9	$ 964,427	$ -	$ -	$ 94,074	$ 1,058,501	$ 1,056,101	$ 1,056,101	$ -	$ 2,400	$ 258,876
10	$ 986,211	$ -	$ -	$ 96,144	$ 1,082,354	$ 1,079,954	$ 1,079,954	$ -	$ 2,400	$ 261,276
11	$ 1,008,487	$ -	$ -	$ 98,259	$ 1,106,746	$ 1,104,346	$ 1,104,346	$ -	$ 2,400	$ 263,676
12	$ 1,031,267	$ -	$ -	$ 100,420	$ 1,131,688	$ 1,129,288	$ 1,129,288	$ -	$ 2,400	$ 266,076
13	$ 1,054,563	$ -	$ -	$ 102,630	$ 1,157,192	$ 1,154,792	$ 1,154,792	$ -	$ 2,400	$ 268,476
14	$ 1,078,385	$ -	$ -	$ 104,888	$ 1,183,273	$ 1,180,873	$ 1,180,873	$ -	$ 2,400	$ 270,876
15	$ 1,102,747	$ -	$ -	$ 107,195	$ 1,209,942	$ 1,207,542	$ 1,207,542	$ -	$ 2,400	$ 273,276
16	$ 1,127,660	$ -	$ -	$ -	$ 1,127,660	$ 1,125,260	$ 1,125,260	$ -	$ 2,400	$ 275,676
17	$ 1,153,137	$ -	$ -	$ -	$ 1,153,137	$ 1,150,737	$ 1,150,737	$ -	$ 2,400	$ 278,076
18	$ 1,179,190	$ -	$ -	$ -	$ 1,179,190	$ 1,176,790	$ 1,176,790	$ -	$ 2,400	$ 280,476
19	$ 1,205,833	$ -	$ -	$ -	$ 1,205,833	$ 1,203,433	$ 1,203,433	$ -	$ 2,400	$ 282,876
20	$ 1,233,078	$ -	$ -	$ -	$ 1,233,078	$ 1,096,397	$ 1,096,397	$ -	$ 136,681	$ 419,557
Totals	**$ 20,310,452**	**$ 1,851,024**	**$ 322,099**	**$ 1,425,515**	**$ 23,909,090**	**$ 23,428,864**	**$ 23,489,533**	**$ 60,669**	**$ 419,557**	**$ -**

NOTES:

1 **Includes: Hard costs and project service fees defined in ESCO's PROPOSED 'FORM V"**
2 **No payments are made by the Board during the construction period.**
3 **Installation period savings for Energy Savings and Operational Savings are guarenteed. These savings will be used in addition to the first loan payment.**
4 **Total Financed Cost includes all Fees and project costs.**

APPENDIX 6. LIGHTING UPGRADES

Lighting Scope of Work			
Building	**Post Code**	**Post Fixture Qty.**	**DESCRIPTION**
East Side High School	10A19DIM/840	284	LED A19 10 Watt, Fully Omni E26 Base, 120V, 4000K, Dimmable-Enclosed - EnergySt
	128011-303	3	HIGH BAY, G2 ECO LINEAR, 1X2, 81W, 4000K, 120-277VAC, DIMMABLE, MEDIUM OPTIC
	151051-103	10	INTERIOR LUMINAIRES, G2 THIN PANEL, 2X2, 20W, 4000K, 120-277VAC, DIMMABLE - DLC LISTED
	151053-103	32	INTERIOR LUMINAIRES, G2 THIN PANEL, 2X2, 30W, 4000K, 120-277VAC, DIMMABLE - DLC LISTED
	151053-103-BB	9	INTERIOR LUMINAIRES, G2 THIN PANEL, 2X2, 30W, 4000K, 120-277VAC, DIMMABLE, BB - DLC LISTED
	153051-103	7	INTERIOR LUMINAIRES, G2 THIN PANEL, 2X4, 36W, 4000K, 120-277VAC, DIMMABLE - DLC LISTED
	153054-103	24	INTERIOR LUMINAIRES, G2 THIN PANEL, 2X4, 50W, 4000K, 120-277VAC, DIMMABLE - DLC LISTED
	157053-103	17	INTERIOR LUMINAIRES, G2 THIN PANEL, 1X4, 30W, 4000K, 120-277VAC, DIMMABLE - DLC LISTED
	157053-103-BB	1	INTERIOR LUMINAIRES, G2 THIN PANEL, 1X4, 30W, 4000K, 120-277VAC, DIMMABLE, BB - DLC LISTED
	16.5A21/840/277V	3	16.5 WATT, A21, 4000K, 277 V, A LAMP
	17PAR38G4DIM/940FL40	16	PAR38, E26 Base, 17 Watt, High CRI, 120V 40°, 4000K, Dimmable - Energy Star
	202000-413	127	G4 SP 2 Foot 8W 4000K 140LPW Nano Lens SEP LED Tube - DLC Listed
	203002-513	34	TUBE LIGHT, G5 SEP, T8, 12W, 3FT, 4000K, SINGLE-END POWER, FROSTED PLASTIC LENS - DLC LISTED
	204001-433	5,510	Tube Light, T8, G4, 10.5W, 4Ft, SEP, Nano, 4000K, High Efficacy - DLC Listed
	204002-413	152	G4 SP 4 Foot 15W 4000K 140LPW Nano Lens SEP LED Tube - DLC Listed
	22C 3 W10 BL11	75	Retrofit Kit for 2' U-Tube (Includes (3) Sockets)
	22C 4 W10 BL11	4	Retrofit Kit for 2' U-Tube (Includes (4) Sockets)
	27CDLA8/840/277V	14	8" Retrofit 12/19/27W Innofit Series 4000K 120-277V Non-Dimmable - Energy Star
	300-WR-240-T-LED-TS	1	Wrap Fixture 8' Tandem Wired For LED
	400-PV-240-LED-TS	2	4ft 2 lamp strip
	6G25DIM/827	7	G25, E26 Base, 6 Watt, 120V, 2700K, Dimmable - Energy Star
	8.5MR16DIM/930SP35	3	MR16, GU5.3 Base 8.5 Watt, 12V, 35°, 3000K, Dimmable - Energy Star
	8PAR20DIM/940FL40	15	Refine PAR20, E26, 8W, 4000K, 40°, High CRI, 120V Dim - Energy Star
	900-PV-240-LED-TS	12	4FT 2 LAMP INDUSTRIAL HOOD
	AL	12	**** ALREADY LED ****
	CL16	14	Cree 16" Clear Prismatic Conical Lens for Prismatic & Acrylic Reflectors
	CXBC16	14	Clear Polycarbonate Reflector
	FL200N	6,000	Non-Shunted Socket, 600v, 660w
	FM11WR40R	1	Metalux AP Series-Round Flush Mount-11" 13.5W 4000K 1100 LUMEN
	KBL-A-UV-M-40K-7-UL-10V	14	KBL Highbay, 20,900 Lumens, Universal Mount, 70CRI, 4000K, 120-277V, 0-10V Dim
	LC	58	Lens Cover -- Place Holder
	PLL-17-835-BYP	4	LED PLL Lamp 2G11 4 Pin, 17W, 3500K, Bypass, Non-Dimmable - DLC Listed
	XTS-RT-1-TS-T8	2,100	1 Lamp Universal Tombstone Kit with Ballast Disconnect T8

Building	Post Code	Post Fixture Qty.	DESCRIPTION
	XTS-RT-2-TS-T8	1,570	2 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-3-TS-T8	26	3 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-4-TS-T8	100	4 Lamp Universal Tombstone Kit with Ballast Disconnect T8
Edward Kilpatrick	153051-103	13	INTERIOR LUMINAIRES, G2 THIN PANEL, 2X4, 36W, 4000K, 120-277VAC, DIMMABLE - DLC LISTED
	202000-413	3	G4 SP 2 Foot 8W 4000K 140LPW Nano Lens SEP LED Tube - DLC Listed
	204001-433	1,665	Tube Light, T8, G4, 10.5W, 4Ft, SEP, Nano, 4000K, High Efficacy - DLC Listed
	22C 3 W10 BL11	1	Retrofit Kit for 2' U-Tube (Includes (3) Sockets)
	900-PV-240-LED-TS	1	4FT 2 LAMP INDUSTRIAL HOOD
	9A19G4/840/277V	217	LED A19 9 Watt, Fully Omni, E26 Base, 120-277V, 4000K, Non-Dimmable (Energy Star)
	AL	4	**** ALREADY LED ****
	FL200N	1,670	Non-Shunted Socket, 600v, 660w
	FM15WR40R	2	Metalux AP Series-Round Flush Mount-15"-21.3W 4000K 1700 LUMEN
	LF-4836U-40	1	MAXLITE - LINEAR L-FORM 48" 36W 120-277V 4000K
	XTS-RT-1-TS-T8	40	1 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-2-TS-T8	800	2 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-4-TS-T8	10	4 Lamp Universal Tombstone Kit with Ballast Disconnect T8
New International High School	12353	60	GX23 2 PIN MALE TO E27 FEMALE CONVERTER
	151051-103	8	INTERIOR LUMINAIRES, G2 THIN PANEL, 2X2, 20W, 4000K, 120-277VAC, DIMMABLE - DLC LISTED
	153054-103	21	INTERIOR LUMINAIRES, G2 THIN PANEL, 2X4, 50W, 4000K, 120-277VAC, DIMMABLE - DLC LISTED
	17PAR38G4/940FL40/277V	38	PAR38, E26 Base, 17 Watt, 120-277V 40°, 4000K, High CRI, Non-Dimmable
	19PAR38HO/840FL40/277V	46	PAR38, 19 Watt, 120-277V 40°, 4000K, High Output, Non-Dimmable - Energy Star
	203000-413	8	G4 SP 3 Foot 12W 4000K 120LPW Nano Lens SEP LED Tube
	204001-433	3,048	Tube Light, T8, G4, 10.5W, 4Ft, SEP, Nano, 4000K, High Efficacy - DLC Listed
	400-PV-140-T-LED-TS	6	8ft 1 lamp strip tandem
	400-PV-240-LED-TS	7	4ft 2 lamp strip
	400-PV-240-T-LED-TS	34	8ft 2 lamp strip tandem
	850-CI-240-LED-TS	4	4FT VAPORTIGHT 2 LIGHT
	8PAR20DIM/940FL40	6	Refine PAR20, E26, 8W, 4000K, 40°, High CRI, 120V Dim - Energy Star
	900-PV-240-T-LED-TS	9	8FT 2 LAMP TANDEM INDUSTRIAL HOOD
	9A19G4/840/277V	56	LED A19 9 Watt, Fully Omni, E26 Base, 120-277V, 4000K, Non-Dimmable (Energy Star)
	AL	2	**** ALREADY LED ****
	FL200N	2,950	Non-Shunted Socket, 600v, 660w
	ICN 2TT P40 SC	14	1&2L Biax 40w Ballast
	ICN 3TT P40 SC	53	3L Biax 40w Ballast

Building	Post Code	Post Fixture Qty.	DESCRIPTION
	LB8R/41K/WH	213	Economy 18W LED 8" Round 4100K White 110° 1260lm Type IC Damp ES CRI 80 - Energy Star
	LLL-LD2050HB	213	Lotus LED Lights Adder for 277-347V driver for Model LB8R
	PLL-17-835-BYP	173	LED PLL Lamp 2G11 4 Pin, 17W, 3500K, Bypass, Non-Dimmable - DLC Listed
	XTS-RT-1-TS-T8	30	1 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-2-TS-T8	990	2 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-3-TS-T8	155	3 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-4-TS-T8	100	4 Lamp Universal Tombstone Kit with Ballast Disconnect T8
Rev. Dr. Martin Luther King Jr.	12800W-304	4	ACCESSORY, HIGH BAY, G2 ECO LINEAR, WIRE GUARD KIT, COMPATIBLE WITH 128XX8-3XX (281W) AND 128XX9-3XX (321W)
	128018-303	32	HIGH BAY, G2 ECO LINEAR, 2X4, 281W, 4000K, 120-277VAC, DIMMABLE, MEDIUM OPTIC
	14A21DIM/840	5	LED A21 14 Watt, Fully Omni E26 Base, 120V, 4000K, Dimmable, Enclosed - Energy Star
	14BR40DIM/827	144	BR40, E26 Base, 14 Watt, 120V, 2700K, Dimmable - Energy Star
	151051-103	238	INTERIOR LUMINAIRES, G2 THIN PANEL, 2X2, 20W, 4000K, 120-277VAC, DIMMABLE - DLC LISTED
	153051-103	13	INTERIOR LUMINAIRES, G2 THIN PANEL, 2X4, 36W, 4000K, 120-277VAC, DIMMABLE - DLC LISTED
	153054-103	91	INTERIOR LUMINAIRES, G2 THIN PANEL, 2X4, 50W, 4000K, 120-277VAC, DIMMABLE - DLC LISTED
	202000-413	56	G4 SP 2 Foot 8W 4000K 140LPW Nano Lens SEP LED Tube - DLC Listed
	204001-433	2,469	Tube Light, T8, G4, 10.5W, 4Ft, SEP, Nano, 4000K, High Efficacy - DLC Listed
	204002-413	2	G4 SP 4 Foot 15W 4000K 140LPW Nano Lens SEP LED Tube - DLC Listed
	22C 3 W10 BL11	16	Retrofit Kit for 2' U-Tube (Includes (3) Sockets)
	400-PV-240-LED-TS	1	4ft 2 lamp strip
	9A19G4/840/277V	67	LED A19 9 Watt, Fully Omni, E26 Base, 120-277V, 4000K, Non-Dimmable (Energy Star)
	AL	2	**** ALREADY LED ****
	FHSKITT04LNC	6	Fulham HotSpot Linear kit: battery/driver/linear array
	FL200N	2,500	Non-Shunted Socket, 600v, 660w
	FM15WR40R	1	Metalux AP Series-Round Flush Mount-15"-21.3W 4000K 1700 LUMEN
	VT-V4840-U-40	4	TriMax Vapor Tight, Vandal Resistant, 4', 40W, 120-277V, 4000K - DLC Listed
	XTS-RT-1-TS-T8	115	1 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-2-TS-T8	815	2 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-2-TS-T8-16	10	16 INCH- 2 LAMP HARNESS
	XTS-RT-3-TS-T8	180	3 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-4-TS-T8	50	4 Lamp Universal Tombstone Kit with Ballast Disconnect T8
School 12	16.5A21/840/277V	1	16.5 WATT, A21, 4000K, 277 V, A LAMP
	202000-413	5	G4 SP 2 Foot 8W 4000K 140LPW Nano Lens SEP LED Tube - DLC Listed
	203000-413	1	G4 SP 3 Foot 12W 4000K 120LPW Nano Lens SEP LED Tube
	204001-433	1,377	Tube Light, T8, G4, 10.5W, 4Ft, SEP, Nano, 4000K, High Efficacy - DLC Listed

Building	Post Code	Post Fixture Qty.	DESCRIPTION
	204003-303	72	G4 HO 4 Foot 18W 4000K Frosted Lens SEP LED Tube - DLC Listed
	22C 3 W10 BL11	1	Retrofit Kit for 2' U-Tube (Includes (3) Sockets)
	400-PV-240-T-LED-TS	7	8ft 2 lamp strip tandem
	900-PV-240-LED-TS	9	4FT 2 LAMP INDUSTRIAL HOOD
	9A19G4/840/277V	39	LED A19 9 Watt, Fully Omni, E26 Base, 120-277V, 4000K, Non-Dimmable (Energy Star)
	FHSKITT04LNC	3	Fulham HotSpot Linear kit: battery/driver/linear array
	FL200N	1,500	Non-Shunted Socket, 600v, 660w
	FM15WR40R	2	Metalux AP Series-Round Flush Mount-15"-21.3W 4000K 1700 LUMEN
	LEV-OPP20-D2	1	Low Voltage Power Pack
	LEV-OSC20-RMW	1	Ceiling Sensor
	LEV-OSSMT-MDW	65	Multi-Technology Wall Switch Sensor - MDW
	XTS-RT-1-TS-T8	76	1 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-2-TS-T8	627	2 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-3-TS-T8	1	3 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-4-TS-T8	20	4 Lamp Universal Tombstone Kit with Ballast Disconnect T8
School 13	12800W-302	16	ACCESSORY, HIGH BAY, G2 ECO LINEAR, WIRE GUARD KIT, COMPATIBLE WITH 128XX3-3XX (141W), 128XX5-3XX (161W), AND 128XX6-3XX (201W 2FT)
	128015-303	16	HIGH BAY, G2 ECO LINEAR, 2x2, 161W, 4000K, 120-277VAC, DIMMABLE, MEDIUM OPTIC
	151051-103	49	INTERIOR LUMINAIRES, G2 THIN PANEL, 2X2, 20W, 4000K, 120-277VAC, DIMMABLE - DLC LISTED
	202000-413	36	G4 SP 2 Foot 8W 4000K 140LPW Nano Lens SEP LED Tube - DLC Listed
	204001-433	1,797	Tube Light, T8, G4, 10.5W, 4Ft, SEP, Nano, 4000K, High Efficacy - DLC Listed
	204002-413	79	G4 SP 4 Foot 15W 4000K 140LPW Nano Lens SEP LED Tube - DLC Listed
	22C 3 W10 BL11	12	Retrofit Kit for 2' U-Tube (Includes (3) Sockets)
	300-WR-240-LED-TS	2	4ft Wrap around 2 lamp
	5.5B11DIM/827	6	5.5B11DIM/827-LED CANDLE,5.5 WATT,OMNI,B11,E12,120V,2700K,DIMMABLE-
	9A19G4/840/277V	60	LED A19 9 Watt, Fully Omni, E26 Base, 120-277V, 4000K, Non-Dimmable (Energy Star)
	AL	7	**** ALREADY LED ****
	FL200N	1,900	Non-Shunted Socket, 600v, 660w
	FM11WR40R	4	Metalux AP Series-Round Flush Mount-11" 13.5W 4000K 1100 LUMEN
	FM15WR30R	4	Metalux AP Series-Round Flush Mount-15"-21.3W 3000K 1600 LUMEN - ENERGY STAR
	PRIS 2X4	11	2x4 PRISMATIC LENS
	XTS-RT-1-TS-T8	250	1 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-2-TS-T8	750	2 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-3-TS-T8	2	3 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-4-TS-T8	40	4 Lamp Universal Tombstone Kit with Ballast Disconnect T8
School 18	202000-413	5	G4 SP 2 Foot 8W 4000K 140LPW Nano Lens SEP LED Tube - DLC Listed
	204001-433	1,753	Tube Light, T8, G4, 10.5W, 4Ft, SEP, Nano, 4000K, High Efficacy - DLC Listed
	22C 3 W10 BL11	1	Retrofit Kit for 2' U-Tube (Includes (3) Sockets)

Building	Post Code	Post Fixture Qty.	DESCRIPTION
	45HID/840/277V/EX39/R	10	HID LED EX39 45W 120-277V 4000K Non-Dimmable
	5150002301	24	Lens, Prismatic Acrylic, 4', Custom Lens, F904 Series, LRHBT6
	5150002401	6	Lens, Clear Acrylic, 4’, Custom Lens, F904 Series, LRHBT6
	9A19G4/840/277V	51	LED A19 9 Watt, Fully Omni, E26 Base, 120-277V, 4000K, Non-Dimmable (Energy Star)
	AL	11	**** ALREADY LED ****
	CXBA16N	11	Cree 16" Matte Spun Aluminium Reflector / Single Pkg
	FL200N	1,745	Non-Shunted Socket, 600v, 660w
	FM11WR40R	8	Metalux AP Series-Round Flush Mount-11" 13.5W 4000K 1100 LUMEN
	FM15WR40R	9	Metalux AP Series-Round Flush Mount-15"-21.3W 4000K 1700 LUMEN
	KBL-A-UV-H-40K-8-UL-10V	11	KBL Highbay, 27,500 Lumens, Universal Mount, 80+ CRI, 4000K, 120-277V, 0-10V Dim - DLC Listed
	WG-A	11	Cree 16" Wire Guard for Aluminum Reflectors
	XTS-RT-1-TS-T8	410	1 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-2-TS-T8	500	2 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-3-TS-T8	35	3 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-4-TS-T8	60	4 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-6-TS-T8	4	6 Lamp Universal Tombstone Kit with Ballast Disconnect T8
School 28	12800W-302	12	ACCESSORY, HIGH BAY, G2 ECO LINEAR, WIRE GUARD KIT, COMPATIBLE WITH 128XX3-3XX (141W), 128XX5-3XX (161W), AND 128XX6-3XX (201W 2FT)
	128015-303	12	HIGH BAY, G2 ECO LINEAR, 2x2, 161W, 4000K, 120-277VAC, DIMMABLE, MEDIUM OPTIC
	14A21DIM/840	12	LED A21 14 Watt, Fully Omni E26 Base, 120V, 4000K, Dimmable, Enclosed - Energy Star
	151051-103	153	INTERIOR LUMINAIRES, G2 THIN PANEL, 2X2, 20W, 4000K, 120-277VAC, DIMMABLE - DLC LISTED
	17PAR38G4DIM/940FL40	8	PAR38, E26 Base, 17 Watt, High CRI, 120V 40°, 4000K, Dimmable - Energy Star
	202000-413	6	G4 SP 2 Foot 8W 4000K 140LPW Nano Lens SEP LED Tube - DLC Listed
	203000-413	9	G4 SP 3 Foot 12W 4000K 120LPW Nano Lens SEP LED Tube
	204001-433	2,148	Tube Light, T8, G4, 10.5W, 4Ft, SEP, Nano, 4000K, High Efficacy - DLC Listed
	400-PV-440-T-LED-TS	1	8ft 4 lamp strip tandem
	900-PV-240-T-LED-TS	1	8FT 2 LAMP TANDEM INDUSTRIAL HOOD
	9A19G4/840/277V	82	LED A19 9 Watt, Fully Omni, E26 Base, 120-277V, 4000K, Non-Dimmable (Energy Star)
	AL	121	**** ALREADY LED ****
	FL200N	2,170	Non-Shunted Socket, 600v, 660w
	FM15WR40R	14	Metalux AP Series-Round Flush Mount-15"-21.3W 4000K 1700 LUMEN
	LC	97	Lens Cover -- Place Holder
	LF-4836U-40	2	MAXLITE - LINEAR L-FORM 48" 36W 120-277V 4000K
	PC	12	*---- Placeholder ----*
	XTS-RT-1-TS-T8	173	1 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-2-TS-T8	990	2 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-4-TS-T8	10	4 Lamp Universal Tombstone Kit with Ballast Disconnect T8

Building	Post Code	Post Fixture Qty.	DESCRIPTION
Dale Avenue	10A19DIM/840	1	LED A19 10 Watt, Fully Omni E26 Base, 120V, 4000K, Dimmable-Enclosed - EnergySt
	12800W-301	15	ACCESSORY, HIGH BAY, G2 ECO LINEAR, WIRE GUARD KIT, COMPATIBLE WITH 128XX0-3XX (55W), 128XX1-3XX (81W), AND 128XX2-3XX (101W)
	128011-303	15	HIGH BAY, G2 ECO LINEAR, 1X2, 81W, 4000K, 120-277VAC, DIMMABLE, MEDIUM OPTIC
	17PAR38G4DIM/930FL40	12	PAR38, E26 Base, 17 Watt, High CRI, 120V 40°, 3000K, Dimmable - Energy Star
	202000-413	222	G4 SP 2 Foot 8W 4000K 140LPW Nano Lens SEP LED Tube - DLC Listed
	204001-433	1,021	Tube Light, T8, G4, 10.5W, 4Ft, SEP, Nano, 4000K, High Efficacy - DLC Listed
	22C 3 W10 BL11	70	Retrofit Kit for 2' U-Tube (Includes (3) Sockets)
	4-OSL-LED-3000L-DIM10-MVOLT-40K-85-FSM	35	Stairwell Linear 4' LED 3000L DIM10 MVOLT 4000K 85CRI with sensor included
	FHSKITT04LNC	48	Fulham HotSpot Linear kit: battery/driver/linear array
	FL200N	1,033	Non-Shunted Socket, 600v, 660w
	LB8R/41K/WH	21	Economy 18W LED 8" Round 4100K White 110° 1260lm Type IC Damp ES CRI 80 - Energy Star
	LC	2	Lens Cover -- Place Holder
	XTS-RT-2-TS-T8	506	2 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-3-TS-T8	3	3 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-4-TS-T8	3	4 Lamp Universal Tombstone Kit with Ballast Disconnect T8
Department of Facilities	202000-413	89	G4 SP 2 Foot 8W 4000K 140LPW Nano Lens SEP LED Tube - DLC Listed
	204001-433	993	Tube Light, T8, G4, 10.5W, 4Ft, SEP, Nano, 4000K, High Efficacy - DLC Listed
	22C 3 W10 BL11	29	Retrofit Kit for 2' U-Tube (Includes (3) Sockets)
	FL200N	1,100	Non-Shunted Socket, 600v, 660w
	FM11WR40R	2	Metalux AP Series-Round Flush Mount-11" 13.5W 4000K 1100 LUMEN
	XTS-RT-1-TS-T8	9	1 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-2-TS-T8	179	2 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-4-TS-T8	154	4 Lamp Universal Tombstone Kit with Ballast Disconnect T8
District Central Offices	151053-103	6	INTERIOR LUMINAIRES, G2 THIN PANEL, 2X2, 30W, 4000K, 120-277VAC, DIMMABLE - DLC LISTED
	153051-103	1	INTERIOR LUMINAIRES, G2 THIN PANEL, 2X4, 36W, 4000K, 120-277VAC, DIMMABLE - DLC LISTED
	202000-413	190	G4 SP 2 Foot 8W 4000K 140LPW Nano Lens SEP LED Tube - DLC Listed
	203000-413	2	G4 SP 3 Foot 12W 4000K 120LPW Nano Lens SEP LED Tube
	204001-433	5,040	Tube Light, T8, G4, 10.5W, 4Ft, SEP, Nano, 4000K, High Efficacy - DLC Listed
	22C 3 W10 BL11	43	Retrofit Kit for 2' U-Tube (Includes (3) Sockets)
	400-PV-240-LED-TS	52	4ft 2 lamp strip
	5.5PLS/840/HYB/GX23	52	GX23 (2 Pin CFL) Hybrid 5.5 Watt 4000K Magnetic Ballast Compatible
	8BR30DIM/840	3	LED BR30 8 WATT CLOUD DESIGN, E26 BASE, 120V, 4000K, DIMMABLE (ENERGY STAR)
	9A19G4/840/277V	6	LED A19 9 Watt, Fully Omni, E26 Base, 120-277V, 4000K, Non-Dimmable (Energy Star)
	AL	17	**** ALREADY LED ****
	APC7R	27	Cooper Surelite LED Exit/Emergency Combo (Red Letters)

Building	Post Code	Post Fixture Qty.	DESCRIPTION
	FHSKITT04LNC	100	Fulham HotSpot Linear kit: battery/driver/linear array
	FL200n	5,059	T8 non shunted socket - common
	LF-4836U-40-EM	30	MAXLITE - LINEAR L-FORM LED LUMINAIRE 48" 36W 120-277V 4000K, EMERGENCY BATTERY BACK-UP
	XTS-RT-1-TS-T8	14	1 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-2-TS-T8	128	2 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-2-TS-T8-16	12	16 INCH- 2 LAMP HARNESS
	XTS-RT-3-TS-T8	1,331	3 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-4-TS-T8	193	4 Lamp Universal Tombstone Kit with Ballast Disconnect T8
John F. Kennedy High School	17PAR38G4DIM/940FL40	16	PAR38, E26 Base, 17 Watt, High CRI, 120V 40°, 4000K, Dimmable - Energy Star
	202000-413	325	G4 SP 2 Foot 8W 4000K 140LPW Nano Lens SEP LED Tube - DLC Listed
	203000-413	2	G4 SP 3 Foot 12W 4000K 120LPW Nano Lens SEP LED Tube
	204001-433	7,249	Tube Light, T8, G4, 10.5W, 4Ft, SEP, Nano, 4000K, High Efficacy - DLC Listed
	204002-413	136	G4 SP 4 Foot 15W 4000K 140LPW Nano Lens SEP LED Tube - DLC Listed
	300-WR-240-LED-TS	38	4ft Wrap around 2 lamp
	4-OSL-LED-3000L-DIM10-MVOLT-40K-85-FSM	121	Stairwell Linear 4' LED 3000L DIM10 MVOLT 4000K 85CRI with sensor included
	8BR30DIM/840	33	LED BR30 8 WATT CLOUD DESIGN, E26 BASE, 120V, 4000K, DIMMABLE (ENERGY STAR)
	8PAR20DIM/940FL40	3	Refine PAR20, E26, 8W, 4000K, 40°, High CRI, 120V Dim - Energy Star
	9A19G4/840/277V	35	LED A19 9 Watt, Fully Omni, E26 Base, 120-277V, 4000K, Non-Dimmable (Energy Star)
	AL	2	**** ALREADY LED ****
	APC7R	2	Cooper Surelite LED Exit/Emergency Combo (Red Letters)
	APEL	1	Cooper Surelite LED Emergency Light With Battery Backup
	FHSKITT04LNC	1	Fulham HotSpot Linear kit: battery/driver/linear array
	FL200N	7,297	Non-Shunted Socket, 600v, 660w
	LC	38	Lens Cover -- Place Holder
	n/a	2	No Retrofit
	PRIS 2X2	6	2x2 PRISMATIC LENS
	PRIS 2X4	10	2x4 PRISMATIC LENS
	XTS-RT-1-TS-T8	655	1 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-2-TS-T8	1,522	2 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-3-TS-T8	91	3 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-4-TS-T8	836	4 Lamp Universal Tombstone Kit with Ballast Disconnect T8
New Roberto Clemente	202000-413	4	G4 SP 2 Foot 8W 4000K 140LPW Nano Lens SEP LED Tube - DLC Listed
	203000-413	23	G4 SP 3 Foot 12W 4000K 120LPW Nano Lens SEP LED Tube
	204001-433	2,616	Tube Light, T8, G4, 10.5W, 4Ft, SEP, Nano, 4000K, High Efficacy - DLC Listed
	204620-113	44	TUBE LIGHT, T8, 4FT, 10W, 4000K, G1 ECO-FIT, BALLAST-READY, FROSTED NANO LENS - DLC Listed

Building	Post Code	Post Fixture Qty.	DESCRIPTION
	400-PV-240-LED-TS	59	4ft 2 lamp strip
	AL	36	**** ALREADY LED ****
	APC7R	1	Cooper Surelite LED Exit/Emergency Combo (Red Letters)
	FHS2-AR-4W-C	28	Fulham HotSpot Circular LED array
	FHSKITT04LNC	71	Fulham HotSpot Linear kit: battery/driver/linear array
	FL200n	2,687	T8 non shunted socket - common
	LB8R/41K/WH	9	Economy 18W LED 8" Round 4100K White 110° 1260lm Type IC Damp ES CRI 80 - Energy Star
	LC	8	Lens Cover -- Place Holder
	LLL-LD2050HB	518	Lotus LED Lights Adder for 277-347V driver for Model LB8R
	LY6RCS/41K/WH	509	Super Thin 12W LED 6" Round 4100K White 110° 800lm Type IC Damp ES CRI 80 - Energy Star
	PC	4	*---- Placeholder ----*
	PLL-17-835-BYP	18	LED PLL Lamp 2G11 4 Pin, 17W, 3500K, Bypass, Non-Dimmable - DLC Listed
	SLIM26NW	13	SLIM 26W NEUTRAL LED 120V TO 277V WALLMOUNT WHITE - DLC Listed
	XTS-RT-1-TS-T8	21	1 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-2-TS-T8	1,234	2 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-3-TS-T8	66	3 Lamp Universal Tombstone Kit with Ballast Disconnect T8
New Roberto K Center	204001-433	281	Tube Light, T8, G4, 10.5W, 4Ft, SEP, Nano, 4000K, High Efficacy - DLC Listed
	204620-113	20	TUBE LIGHT, T8, 4FT, 10W, 4000K, G1 ECO-FIT, BALLAST-READY, FROSTED NANO LENS - DLC Listed
	5.5PLS/840/HYB/GX23	2	GX23 (2 Pin CFL) Hybrid 5.5 Watt 4000K Magnetic Ballast Compatible
	APC7R	4	Cooper Surelite LED Exit/Emergency Combo (Red Letters)
	APEL	4	Cooper Surelite LED Emergency Light With Battery Backup
	FHSKITT04LNC	7	Fulham HotSpot Linear kit: battery/driver/linear array
	FL200N	281	Non-Shunted Socket, 600v, 660w
	XTS-RT-2-TS-T8	29	2 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-3-TS-T8	25	3 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-4-TS-T8	37	4 Lamp Universal Tombstone Kit with Ballast Disconnect T8
Old Roberto Clemente	151054-103	16	INTERIOR LUMINAIRES, G2 THIN PANEL, 2X2, 40W, 4000K, 120-277VAC, DIMMABLE - DLC LISTED
	202000-413	15	G4 SP 2 Foot 8W 4000K 140LPW Nano Lens SEP LED Tube - DLC Listed
	204001-433	463	Tube Light, T8, G4, 10.5W, 4Ft, SEP, Nano, 4000K, High Efficacy - DLC Listed
	204002-413	424	G4 SP 4 Foot 15W 4000K 140LPW Nano Lens SEP LED Tube - DLC Listed
	22C 3 W10 BL11	1	Retrofit Kit for 2' U-Tube (Includes (3) Sockets)
	8BR30DIM/840	3	LED BR30 8 WATT CLOUD DESIGN, E26 BASE, 120V, 4000K, DIMMABLE (ENERGY STAR)
	9A19G4/840/277V	67	LED A19 9 Watt, Fully Omni, E26 Base, 120-277V, 4000K, Non-Dimmable (Energy Star)
	FL200n	909	T8 non shunted socket - common
	FM11WR40R	1	Metalux AP Series-Round Flush Mount-11" 13.5W 4000K 1100 LUMEN

Building	Post Code	Post Fixture Qty.	DESCRIPTION
	XTS-RT-1-TS-T8	89	1 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-2-TS-T8	364	2 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-4-TS-T8	23	4 Lamp Universal Tombstone Kit with Ballast Disconnect T8
Norman S. Weir	12800W-304	9	ACCESSORY, HIGH BAY, G2 ECO LINEAR, WIRE GUARD KIT, COMPATIBLE WITH 128XX8-3XX (281W) AND 128XX9-3XX (321W)
	128018-303	9	HIGH BAY, G2 ECO LINEAR, 2X4, 281W, 4000K, 120-277VAC, DIMMABLE, MEDIUM OPTIC
	202000-413	6	G4 SP 2 Foot 8W 4000K 140LPW Nano Lens SEP LED Tube - DLC Listed
	204001-433	972	Tube Light, T8, G4, 10.5W, 4Ft, SEP, Nano, 4000K, High Efficacy - DLC Listed
	22C 3 W10 BL11	2	Retrofit Kit for 2' U-Tube (Includes (3) Sockets)
	AL	3	**** ALREADY LED ****
	AL	12	**** ALREADY LED ****
	FL200N	972	Non-Shunted Socket, 600v, 660w
	LC	5	Lens Cover -- Place Holder
	V2-HO-WT40-120-277V	12	Valore Linear High Bay 2' HO DLC LISTED
	XTS-RT-1-TS-T8	608	1 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-2-TS-T8	182	2 Lamp Universal Tombstone Kit with Ballast Disconnect T8
Rosa L. Parks School of Fine and Performing Arts	202000-413	18	G4 SP 2 Foot 8W 4000K 140LPW Nano Lens SEP LED Tube - DLC Listed
	204001-433	1,193	Tube Light, T8, G4, 10.5W, 4Ft, SEP, Nano, 4000K, High Efficacy - DLC Listed
	204002-413	4	G4 SP 4 Foot 15W 4000K 140LPW Nano Lens SEP LED Tube - DLC Listed
	22C 3 W10 BL11	6	Retrofit Kit for 2' U-Tube (Includes (3) Sockets)
	300-WR-240-LED-TS	6	4ft Wrap around 2 lamp
	400-PV-140-LED-TS	24	4ft 1 lamp strip
	400-PV-240-LED-TS	25	4ft 2 lamp strip
	9A19G4/840/277V	20	LED A19 9 Watt, Fully Omni, E26 Base, 120-277V, 4000K, Non-Dimmable (Energy Star)
	AL	3	**** ALREADY LED ****
	FL200n	1,197	T8 non shunted socket - common
	FM11WR40R	5	Metalux AP Series-Round Flush Mount-11" 13.5W 4000K 1100 LUMEN
	LC	64	Lens Cover -- Place Holder
	LY6RCS/41K/WH	14	Super Thin 12W LED 6" Round 4100K White 110° 800lm Type IC Damp ES CRI 80 - Energy Star
	SCH8-LED-PM48-WH-2000L-DIM10-277-ND-35-90-HH8-8501-W-WH	30	8" Architectural Cylinder LED Downlight- Maxilume
	XTS-RT-1-TS-T8	179	1 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-2-TS-T8	453	2 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-4-TS-T8	28	4 Lamp Universal Tombstone Kit with Ballast Disconnect T8

Building	Post Code	Post Fixture Qty.	DESCRIPTION
School 6	11PAR30SNG4DIM/927FL40	61	PAR30, E26 Base, 11 Watt, 120V 40°, 2700K, High CRI, Dimmable - Energy Star
	11PAR30SNG4DIM/940FL40	12	PAR30, E26 Base, 11 Watt, 120V 40°, 4000K, High CRI, Dimmable - Energy Star
	12800W-301	20	ACCESSORY, HIGH BAY, G2 ECO LINEAR, WIRE GUARD KIT, COMPATIBLE WITH 128XX0-3XX (55W), 128XX1-3XX (81W), AND 128XX2-3XX (101W)
	128011-303	28	HIGH BAY, G2 ECO LINEAR, 1X2, 81W, 4000K, 120-277VAC, DIMMABLE, MEDIUM OPTIC
	151053-103	75	INTERIOR LUMINAIRES, G2 THIN PANEL, 2X2, 30W, 4000K, 120-277VAC, DIMMABLE - DLC LISTED
	19PAR38HO/840FL40/277V	35	PAR38, 19 Watt, 120-277V 40°, 4000K, High Output, Non-Dimmable - Energy Star
	204001-433	2,510	Tube Light, T8, G4, 10.5W, 4Ft, SEP, Nano, 4000K, High Efficacy - DLC Listed
	400-PV-240-LED-TS	3	4ft 2 lamp strip
	9A19G4/840/277V	10	LED A19 9 Watt, Fully Omni, E26 Base, 120-277V, 4000K, Non-Dimmable (Energy Star)
	AL	2	**** ALREADY LED ****
	APC7R	4	Cooper Surelite LED Exit/Emergency Combo (Red Letters)
	APEL	30	Cooper Surelite LED Emergency Light With Battery Backup
	FHSKITT04LNC	2	Fulham HotSpot Linear kit: battery/driver/linear array
	FL200n	2,510	T8 non shunted socket - common
	FM15WR40R	15	Metalux AP Series-Round Flush Mount-15"-21.3W 4000K 1700 LUMEN
	LC	75	Lens Cover -- Place Holder
	PRIS 2X4	9	2x4 PRISMATIC LENS
	XTS-RT-1-TS-T8	14	1 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-2-TS-T8	252	2 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-3-TS-T8	628	3 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-4-TS-T8	27	4 Lamp Universal Tombstone Kit with Ballast Disconnect T8
School 7	12800W-302	8	ACCESSORY, HIGH BAY, G2 ECO LINEAR, WIRE GUARD KIT, COMPATIBLE WITH 128XX3-3XX (141W), 128XX5-3XX (161W), AND 128XX6-3XX (201W 2FT)
	128015-313	8	HIGH BAY, G2 ECO LINEAR, 2x2, 161W, 4000K, 120-277VAC, DIMMABLE, GENERAL FROSTED OPTIC
	14070	2	Retrofit Conversion Kit: for 8-FT Fixture, 4 Lamp, for LED's
	202000-413	21	G4 SP 2 Foot 8W 4000K 140LPW Nano Lens SEP LED Tube - DLC Listed
	204001-433	1,216	Tube Light, T8, G4, 10.5W, 4Ft, SEP, Nano, 4000K, High Efficacy - DLC Listed
	22C 3 W10 BL11	7	Retrofit Kit for 2' U-Tube (Includes (3) Sockets)
	9A19G4/840/277V	4	LED A19 9 Watt, Fully Omni, E26 Base, 120-277V, 4000K, Non-Dimmable (Energy Star)
	FL200n	1,216	T8 non shunted socket - common
	FM11WR40R	2	Metalux AP Series-Round Flush Mount-11" 13.5W 4000K 1100 LUMEN
	LC	6	Lens Cover -- Place Holder
	XTS-RT-1-TS-T8	11	1 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-2-TS-T8	513	2 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-3-TS-T8	31	3 Lamp Universal Tombstone Kit with Ballast Disconnect T8

Building	Post Code	Post Fixture Qty.	DESCRIPTION
	XTS-RT-4-TS-T8	18	4 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-6-TS-T8	1	6 Lamp Universal Tombstone Kit with Ballast Disconnect T8
Silk City 2000 Academy	13PLL/840/GL/DIR	44	Green Creative PLL PL EDGE Series, 13 Watt, Glass Lens, Plug and Play, DIRect Ballast, 2G11 Base, 4000K, Dimmable (98479)
	202000-413	75	G4 SP 2 Foot 8W 4000K 140LPW Nano Lens SEP LED Tube - DLC Listed
	202100-113	18	2-ft 9.5W SEP Plastic T5 H.E. LED Tube Lamp, 4000K, 120-277V
	203000-413	4	G4 SP 3 Foot 12W 4000K 120LPW Nano Lens SEP LED Tube
	204001-433	911	Tube Light, T8, G4, 10.5W, 4Ft, SEP, Nano, 4000K, High Efficacy - DLC Listed
	21CDLA6/840/277V	8	6" Retrofit 8.5/14.5/21W Innofit Series 4000K 120-277V Non-Dimmable - Energy Star
	22C 3 W10 BL11	25	Retrofit Kit for 2' U-Tube (Includes (3) Sockets)
	27CDLA8/840/277V	32	8" Retrofit 12/19/27W Innofit Series 4000K 120-277V Non-Dimmable - Energy Star
	4-OW1B-LED-2000L-DIM10-MVOLT-40K-85-MS-FM105	31	4' LED WALL/CEILING FIXTURE 2000 Lmn 0-10 DIM MVOLT 4000K 85 CRI - OCC SENSOR
	9A19G4/840/277V	3	LED A19 9 Watt, Fully Omni, E26 Base, 120-277V, 4000K, Non-Dimmable (Energy Star)
	FL200n	925	T8 non shunted socket - common
	FM11WR40R	3	Metalux AP Series-Round Flush Mount-11" 13.5W 4000K 1100 LUMEN
	FM9WR40R	3	Metalux AP Series-Round Flush Mount-9" 12W 950 LUMEN
	ICN 2TT P40 SC	22	1&2L Biax 40w Ballast
	XTS-RT-1-TS-T5	18	1 Lamp Universal Tombstone Kit with Ballast Disconnect T5
	XTS-RT-1-TS-T8	62	1 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-2-TS-T8	117	2 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-3-TS-T8	85	3 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-4-TS-T8	89	4 Lamp Universal Tombstone Kit with Ballast Disconnect T8

Direct Install			
Building	**Post Code**	**Post Fixture Qty.**	**DESCRIPTION**
Rutland Early Learning Center	151051-103	14	INTERIOR LUMINAIRES, G2 THIN PANEL, 2X2, 20W, 4000K, 120-277VAC, DIMMABLE - DLC LISTED
	153051-103	5	INTERIOR LUMINAIRES, G2 THIN PANEL, 2X4, 36W, 4000K, 120-277VAC, DIMMABLE - DLC LISTED
	202000-413	7	G4 SP 2 Foot 8W 4000K 140LPW Nano Lens SEP LED Tube - DLC Listed
	204001-433	617	Tube Light, T8, G4, 10.5W, 4Ft, SEP, Nano, 4000K, High Efficacy - DLC Listed
	9A19G4/840/277V	12	LED A19 9 Watt, Fully Omni, E26 Base, 120-277V, 4000K, Non-Dimmable (Energy Star)
	FL200N	630	Non-Shunted Socket, 600v, 660w
	LEV-OPP20-D2	8	Low Voltage Power Pack
	LEV-OSC20-RMW	8	Ceiling Sensor
	WSS0S-DOW	8	Decora Wireless Remote Switch
	XTS-RT-1-TS-T8	7	1 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-2-TS-T8	13	2 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-3-TS-T8	197	3 Lamp Universal Tombstone Kit with Ballast Disconnect T8
Early Learning Center	10A19DIM/840	15	LED A19 10 Watt, Fully Omni E26 Base, 120V, 4000K, Dimmable-Enclosed - EnergySt
	14BR40DIM/830	4	BR40, E26 Base, 14 Watt, 120V, 3000K, Dimmable - Energy Star
	202000-413	6	G4 SP 2 Foot 8W 4000K 140LPW Nano Lens SEP LED Tube - DLC Listed
	204001-433	561	Tube Light, T8, G4, 10.5W, 4Ft, SEP, Nano, 4000K, High Efficacy - DLC Listed
	22C 3 W10 BL11	2	Retrofit Kit for 2' U-Tube (Includes (3) Sockets)
	FL200N	600	Non-Shunted Socket, 600v, 660w
	FM11WR40R	1	Metalux AP Series-Round Flush Mount-11" 13.5W 4000K 1100 LUMEN
	LEV-OPP20-D2	3	Low Voltage Power Pack
	LEV-OSC20-RMW	3	Ceiling Sensor
	VANLED20N	1	VANDALPROOF CANOPY 20W 4000K NEUTRAL LED 120-277V W/ DROP LENS BZ
	XTS-RT-1-TS-T8	4	1 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-2-TS-T8	126	2 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-3-TS-T8	99	3 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-4-TS-T8	2	4 Lamp Universal Tombstone Kit with Ballast Disconnect T8
School 17	204001-433	349	Tube Light, T8, G4, 10.5W, 4Ft, SEP, Nano, 4000K, High Efficacy - DLC Listed
	5150002401	7	Lens, Clear Acrylic, 4’, Custom Lens, F904 Series, LRHBT6
	9A19G4/840/277V	1	LED A19 9 Watt, Fully Omni, E26 Base, 120-277V, 4000K, Non-Dimmable (Energy Star)
	FL200N	350	Non-Shunted Socket, 600v, 660w
	FM11WR40R	2	Metalux AP Series-Round Flush Mount-11" 13.5W 4000K 1100 LUMEN
	FM15WR40R	1	Metalux AP Series-Round Flush Mount-15"-21.3W 4000K 1700 LUMEN
	MS-A-102-WH	23	MAESTRO DUAL TECH OCCUPANCY SENSING SWITCH
	XTS-RT-1-TS-T8	205	1 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-2-TS-T8	50	2 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-4-TS-T8	15	4 Lamp Universal Tombstone Kit with Ballast Disconnect T8

Building	Post Code	Post Fixture Qty.	DESCRIPTION
Academy of Earth and Space Sciences (Panther)	10T8/3F/840/DIR	64	LED Tube T8 - 10 Watt 3' Cool White 4000K Ballast Ready
	17PLL/840/DIR	120	PL Stab-In 4 Pin, 2G11, Ballast Compatible, 17W, 4000K
	202000-413	144	G4 SP 2 Foot 8W 4000K 140LPW Nano Lens SEP LED Tube - DLC Listed
	204001-433	678	Tube Light, T8, G4, 10.5W, 4Ft, SEP, Nano, 4000K, High Efficacy - DLC Listed
	22C 3 W10 BL11	20	Retrofit Kit for 2' U-Tube (Includes (3) Sockets)
	22C 4 W10 BL11	16	Retrofit Kit for 2' U-Tube (Includes (4) Sockets)
	27CDLA8/840/277V	14	8" Retrofit 12/19/27W Innofit Series 4000K 120-277V Non-Dimmable - Energy Star
	8.5A19DIM/840R	24	LED A19 8.5 Watt, Fully Omni E26 Base, 120V, 4000K, Dimmable - Energy Star
	8T8/2F/840/DIR	32	2' Ballast Ready LED Tube 8 Watt 4000K (Case Qty of 25 Only) - DLC Listed
	FHSKITT04LNC	18	Fulham HotSpot Linear kit: battery/driver/linear array
	FL200N	850	Non-Shunted Socket, 600v, 660w
	GE232MVPSN-V03	48	GE DIMMABLE BALLAST 0-10V, 120-277V FOR RVLT TUBES
	LC	8	Lens Cover -- Place Holder
	LF-4836U-40-EM	18	MAXLITE - LINEAR L-FORM LED LUMINAIRE 48" 36W 120-277V 4000K, EMERGENCY BATTERY BACK-UP
	LRF2-OCR2B-P-WH	13	Ceiling-Mount Wireless Occupancy/Vacancy Sensors
	PJ2-2B-GWH-L01	13	Pico 2-button wireless remote, On/Off
	QHE2X32T8/UNV/DIM/TC	60	SYLVANIA-POWERSENSE HIGH EFFICIENCY BALLAST 2 LAMP 120-277V DIMMING
	RMJS-16R-DV-B	13	PowPak Relay Module, 120-277v
	XTS-RT-1-TS-T8	126	1 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-2-TS-T8	210	2 Lamp Universal Tombstone Kit with Ballast Disconnect T8
	XTS-RT-3-TS-T8	88	3 Lamp Universal Tombstone Kit with Ballast Disconnect T8

APPENDIX 7. THIRD PARTY ENERGY SAVINGS PLAN REVIEW COMMENTS & CORRESPONDENCE

APPENDIX 8. HVAC EQUIPMENT SCHEDULES

Dale Avenue

BOILERS

Bldg	Quantity	Location	Serves	Estimated Service Life	Mfg.	Model	Fuel Source	Heating Capacity (MBH)	Heating Output (MBH)	Boiler MMBTU
Dale	2	Boiler Room	Building	25	Smith	28A-13	Nat Gas	4180	2560	2.56

DOMESTIC HOT WATER HEATERS

Bldg.	Quantity	Location	Spaces Served	Estimated Service Life	Mfg.	Model	Fuel Source	Capacity (gal)	Heating Capacity (MBH)
Dale	1	Kitchen	Kitchen	20	Vanguard	3WA71	Elec	50	-
Dale	1	External Mech Room	Building	20	Vanguard	-	Nat Gas	50	40

WINDOW AC UNITS

Bldg.	Quantity	Location	Spaces Served	Estimated Service Life	Mfg.	Model	Cooling Technology	Cooling Capacity
Dale Ave	25	Exterior Windows	Classrooms/ Offices	10	-	-	DX	*1.5*

CHILLER

Bldg	Quantity	Location	Serves	Year Installed	Estimated Service Life	Mfg.	Model	kW Input	Cooling Capacity (tons)	Cooling Efficiency (kW/ton)
Dale	1	Ground Level-External	Building	2004	23	McQuay	AGS250B27-ER10	856	243.9	3.51

PUMPS:

Bldg.	Tag#	Quantity	Location	Spaces Served	Year Installed	Estimated Service Life	Motor Mfg.	Motor Model	Motor hp	Efficiency (%)	VFD (Y/N)
Dale	-	3	Boiler Room	Condensate Return	-	20	WEG	HYPRO -50360	2-Jan	66.00%	N
Dale	PCHWP	1	Pump Room	CW System	2004	20	Baldor	M2535T	30	92.4%	Y
Dale	STNDBY P	1	Pump Room	CW System	2004	20	Baldor	M2535T	30	92.4%	Y
Dale	SCHWP	1	Pump Room	CW System	2004	20	Baldor	M2535T	30	92.4%	Y

Department of Facilities

Forced Air Furnace

Bldg.	Mfg.	Model	Heating Capacity (MBH)	Heating Efficiency %
Department of Facilities	-	PDMU-PB30W152A	152	80

GAS UNIT HEATERS

Bldg.	Mfg.	Model	Cooling Capacity (tons)	Cooling Efficiency (EER)	Heating Technology	Heating Capacity (MBH)	Heating Efficiency (%)
Department Of Facilities	York	DAYA-F024070C	2	10	Nat Gas	70	*81*
Department Of Facilities	Trane	YCD151C3HABB	12.5	11.3	Nat Gas	250	*81*
Department Of Facilities	York	DAYA-F030N070c	2.5	10	Nat Gas	70	*81*
Department Of Facilities	Trane	YHC0723A3RHA27C	6	10.3	Nat Gas	150	*81*

GAS UNIT HEATERS

Bldg.	Quantity	Location	Spaces Served	Year Installed	Estimated Service Life	Mfg.	Model	Design Flow (cfm)	Heating Capacity (MBH)	Fuel Source
Department Of Facilities	3	Warehouse	Locker Rooms	2015	*15*	Dayton	4LX60	3200	200	Nat Gas

INFRATED GAS HEATER

Bldg.	Quantity	Location	Estimated Service Life	Mfg.	Model	Length (ft)	Heating Input (MBH)
Department Of Facilities	7	Warehouse	2015	*15*	Sun Star	*20*	*75*

District Central Offices

Bldg.	Tag#	Quantity	Mfg.	Model	Cooling Capacity (tons)	Cooling Efficiency (EER)	Heating	Heating Capacity (MBH)	Heating Efficiency (%)
District Central Office	RTU 1-E	1	Carrier	48HJF 017	15	10.3	Natural Gas	360	81
District Central Office	RTU 405	1	Carrier	48HJE 009	8.5	-	-	-	-
District Central Office	RTU 301	1	Carrier	48EWD 034	30	-	Natural Gas	350	83
District Central Office	RTU 402	1	Carrier	48HJD 025	20	9.3	Natural Gas	222.75	81
District Central Office	RTU 1-S	1	Carrier	48EWE 034	30	-	Natural Gas	425.25	81
District Central Office	RTU 404	1	Carrier	48HJF 017	15	-	Natural Gas	291	81
District Central Office	RTU 201	1	Carrier	48EWD 034	30	-	Natural Gas	283.5	81
District Central Office	RTU 401	1	Carrier	48HJD 025	20	9.3	Natural Gas	291	81
District Central Office	RTU 403	1	Carrier	48HJD0 12641	10	10.5	Natural Gas		81
District Central Office	RTU 1-N	1	Carrier	[48HJ]F 025	20	9.3	Natural Gas	291	81
District Central Office	RTU 202	1	Carrier	38HDC0 24331	2	*12*	n/a	n/a	n/a
District Central Office	RTU 203	1	Carrier	48TJE0 07	6		n/a	n/a	n/a
District Central Office	RTU 204	1	Carrier	48HJE0 12641	10	10.5	Natural Gas	147	81
District Central Office	RTU 205	1	Carrier	48HJE0 04--631	3	9.7	Natural Gas	74	81
District Central Office	RTU 206	1	Carrier	48HJD005-- 631--	4	11	Natural Gas	115	81
District Central Office	RTU 207	1	Carrier	48TJE01 4511	12.5	8.6	Natural Gas	220	81
District Central Office	RTU 208	1	Carrier	48TJD0 08-511GA	7.5	10.1	Natural Gas	125	81
District Central Office	RTU 101	1	Carrier	48EJE 030-	27	-	Natural Gas	300	81
District Central Office	RTU 103	1	Carrier	48HJF 017	15	10.3	Natural Gas	291	81
District Central Office	RTU 102	1	Carrier	48HJF00 8631	7.5	10.1	Natural Gas	125	81

District Central Office	1st Floor	1	Frasier-Johnston	DDUCT15 0N245B	12.5		Natural Gas	245	81

SPLIT UNITS:

Bldg.	Quantity	Location	Type	Estimated Service Life	Mfg.	Model	Cooling Capacity (tons)	Cooling Efficiency (EER)
District Central Office	2	Ground Level	Split (Cond)	15	YORK	HBH-T120AE	10	-
District Central Office	1	Ground Level	Split (AHU)	15	MagicAire	240-BRX-3-B	20	-
District Central Office	1	Ground Level	Split	15	Trane	TTA072C 300A0	6	10
District Central Office	1	Roof	Split	15	Luxaire	THGD42 S41S4A	3.5	
District Central Office	1	Roof	Split	15	Trane	RAUCC25 EBN13D		

PUMPS:

Bldg.	Quantity	Location	Spaces Served	Type	Estimated Service Life	Motor Mfg.	Motor Model	Motor hp	Flow (GPM)	VFD (Y/N)
District Central Office	1	Boiler Room	Boiler	Condensate	20	Marathon	Q E 56C34D1200J	1/3	18	N

BOILERS:

Bldg.	Tag #	Quantity	Location	Spaces Served	Type	Year Installed	Estimated Service Life	Mfg.	Model
District Central Office	-	1	Boiler Room	First Floor Lobby	Firetube	*2012*	25	Weil McLain	688

Early Learning Center

HVAC

Bldg.	Quantity	Mfg.	Model	Cooling Technology	Cooling Capacity (tons)
Early Learning Center	4	Trane	-	DX	-

BOILERS:

Bldg.	Quantity	Location	Spaces Served	Year Installed	Estimated Service Life	Mfg.	Fuel Source	Heating Capacity (MBH)	Heating Output (MBH)	Controls
Early Learning Center	1	Boiler Room	First floor	2003	25	Hydrotherm	Nat Gas	1500	1200	1.44

PUMPS:

Bldg.	Tag#	Quantity	Location	Spaces Served	Estimated Service Life	Motor Mfg.	Motor Model	Motor hp	Efficiency (%)	VFD (Y/N)
Early Learning Center	P-1,2,3	3	Boiler Room	First Floor	20	Baldor	VL1307	3/4	68	N

Eastside High School

Split Units

Bldg.	Quantity	Location	Mfg.	Model	Cooling Capacity (tons)	Cooling Efficiency (EER)
Eastside High School	1	Roof	YORK	HCBA-F060SA	5	9
Eastside High School	8	Cafeteria Roof	Mitsubishi	PU36EK	3	8

HVAC UNITS:

Bldg.	Quantity	Location	Spaces Served	Year Installed	Estimated Service Life	Mfg.	Model	Cooling Technology	Cooling Capacity (tons)
Eastside High School	1	Cafeteria Roof	Cafeteria	*2003*	15	Trane	RAUCC2 54CX13A	DX	25

UNIT VENTILATORS:

Bldg	Room	Equipment	Quantity
Eastside High School	Old Wing Classrooms	Unit Ventilators	73

BOILERS:

Bldg.	Quantity	Location	Spaces Served	Year Installed	Estimated Service Life	Mfg.	Model	Source	Heating Capacity (MBH)	Heating Output (MBH)	Boiler MMBTU
Eastside	4	New BR	New Wing	2015	25	Aerco	BMK 3000	Gas	3000	2790	2.79
Eastside	*4*	Old BR	Old Wing	*2007*	25	Aerco	BMK 2000	Gas	2000	1775	1.775

Edward Kilpatrick

SPLIT UNITS:

Bldg.	Quantity	Location	Spaces Served	Type	Mfg.	Model	Cooling Capacity (tons)
JFK	2	Roof	Nurse/Admin	Split	York	HEHB-T090AA	7.5
JFK	1	Roof	Nurse/Admin	Split	Luxaire	HBBA-F030SE	*2.5*
JFK	1	Roof	Nurse/Admin	Split	Luxaire	HABA-T060SA	*5*
JFK	1	Roof	Health Office	Split	Lenox	HS19-S11U-3D	-
JFK	3	Roof	Library	Mini-Split	Carrier	38HDC048310	4
JFK	8	Roof	Main Cafeteria	Mini-Split	-	-	*4*

SPLIT UNITS:

Bldg	Quantity	Mfg.	Model	Cooling Capacity (tons)	Cooling Efficiency (EER)
Edward Kilpatrick	1	Mitsubishi	PUZ-A36NHA6	3	7.6

UNIT VENTILATORS:

Bldg	Room	Equipment	Manufacturer	Quantity
Edward Kilpatrick	Classrooms	Unit Ventilators	Nesbitt	31

BOILERS

Bldg.	Quantity	Location	Spaces Served	Type	Year Installed	Estimated Service Life	Mfg.	Model	Fuel Source	Blower hp	Heating Capacity (MBH)	Heating Output (MBH)	Boiler MMBTU
Edward Kilpatrick	2	Boiler Room	Building	Firetube	1998	25	Weil Mclain	R10.9G 015	nat gas	1.5	2540	2105	2.1

PUMPS

Bldg.	Tag#	Quantity	Location	Serves	Estimated Service Life	Motor Mfg.	Motor Model	Motor hp	Efficiency (%)	VFD (Y/N)
Edward Kilpatrick	P1,2	2	Boiler Room	Building	20	Baldor	JMM 3211T	3	83	N

John F. Kennedy High School

AIR HANDLERS:

Bldg.	Tag#	Quantity	Location	Spaces Served	Mfg.	Model	Cooling Capacity (tons)	Cooling Efficiency (EER)	Heating Technology
JFK	RTU-1	1	Roof	TV Studio	Trane	TFH181C30BCA	-	-	-
JFK	RTU-2	1	Roof	Auditorium	Trane	SSHFC55F645 7C7BD1001A0	55	-	Steam
JFK	RTU-3	1	Roof	Auditorium	Trane	SSHFC55F64 57C7BD1001A0	55	-	Steam
JFK	-	4	Gym	Gym	-	-	N/A	N/A	Steam

UNIT VENTILATORS:

Bldg	Room	Equipment	Manufacturer	Quantity
JFK	Classrooms	Unit Ventilators	Nesbitt	129

BOILERS

Bldg	Tag #	Serves	Type	Installed	Estimated Service Life	Mfg.	Model	Blower hp	Heating Capacity (MBH)	Heating Output (MBH)	Boiler MMBTU	Eff. %
JFK	1	Building	Firetube	1999	25	Cleaver Brooks	CBL200 400 015	10	16378	13400	13.4	80%
JFK	2	Building	Firetube	1999	25	Cleaver Brooks	CBL200 200 015	15	8369	6695	6.695	80%
JFK	3	Building	Firetube	1963	25	Cleaver Brooks	CB760-350	-	14645	12025	12.205	80%

PUMPS:

Bldg.	Quantity	Location	Serves	Estimated Service Life	Motor Mfg.	Motor Model	Motor hp	Efficiency (%)	Flow (GPM)	Head (ft)	VFD (Y/N)
JFK	3	Boiler Room	Condensate Return	20	WEP	00236OS 3EJPR56JS	2	78.50%	-	-	N
JFK	2	Boiler Room	Hot Water Return	20	Marathon	5VH145T TDR5543 AD	1 1/2	-	9	70	N
JFK	1	Boiler Room	Main Wing Heat Exchanger	20	WEG	00518OP 3E184JP	5	87.50%	116	96	N

New International High School

HVAC UNITS:

School	Tag#	Quantity	Location	Serves	Mfg.	Model	Cooling Technology	Heating Technology
New International	RTU-1	1	Roof	Gym	York	XTO-057X090-HDMK046A	CHW	HW
New International	RTU-2	1	Roof	Cafeteria	York	XTO-048X066-HDKH046A	CHW	HW
New International	RTU-3	1	Roof	-	York	XTO-048X057-HDJHO40A	CHW	HW
New International	RTU-4	1	Roof	Auditorium	York	XTO-054X081-HDLJ046A	CHW	HW

ENERGY RECOVERY UNIT:

School	Tag#	Quantity	Location	Spaces Served	Mfg.	Model	Suply Fan (HP)	Exhaust (HP)
New International	ERU-1	1	Roof	Building	Semco	FV4000V-6RN2AA	2	1.5
New International	ERU-2	1	Roof	Building	Semco	FV2000V-6RN2AB	1.5	0.75
New International	ERU-3	1	Roof	Building	Semco	FV1500H-6RN2AA	7.5	7.5
New International	ERU-4	1	Roof	Building	Semco	FV1500H-6RN2AA	7.5	7.5
New International	ERU-5	1	Roof	Building	Semco	FV2000V-6RN2AB	1.5	1.5

MAKE UP AIR

Bldg.	Tag#	Quantity	Location	Mfg.	Model	Motor hp	Design Flow (cfm)
New International	MAU-1	1	Roof	Captive Aire	A2-I350-G15	3	7,600

BOILERS:

Bldg.	Quantity	Location	Serves	Type	Year Installed	Estimated Service Life	Mfg.	Model	Fuel Source	Heating Capacity (MBH)	Heating Output (MBH)	Controls
New International	2	Boiler Room	Building	Firetube	2001	25	Smith	GG-399 HEC	Nat Gas	3172	2498	*4*

CHILLER

Bldg.	Tag#	Location	Type	Year Installed	Estimated Service Life	Mfg.	Model	Cooling Capacity (tons)	Cooling Efficiency (EER)	Air/Water Cooled	Controls
New International	CH-1	Roof	Air Cooled	2001	20	YORK	YCAV035 7SA46VAABXTO XXXXL	342.9	11.7	Air	Central BMS

PUMPS:

Bldg.	Tag#	Quantity	Location	Year Installed	Estimated Service Life	Motor Mfg.	Motor Model	Motor hp	Efficiency (%)	Flow (GPM)	Head (ft)	VFD (Y/N)
New International	HWP-1,2	2	Boiler Room	2001	20	Emerson	A441	15	93.00%	500	60	N
New International	CHWP-1,2	2	Roof	2001	20	Baldor	EM4104T	30	94.10%	-	-	N

New Roberto Clemente School

HVAC UNITS:

Bldg.	Tag#	Quantity	Location	Spaces Served	Year Installed	Estimated Service Life	Mfg.	Model	Cooling	Cooling Capacity (tons)
New Roberto Clemente	AHU-1	1	Roof	Classrooms 'A1'	*2004*	15	York	CP 530 SWSI AF 40 15460	Chilled Water	45
New Roberto Clemente	AHU-2	1	Roof	Classrooms 'A2'	*2004*	15	York	CP 860 SWSI AF 40 20460	Chilled Water	70
New Roberto Clemente	AHU-3	1	Roof	Admin Area B	*2004*	15	York	CP 680 SWSI AF 40 15460	Chilled Water	56
New Roberto Clemente	AHU-4	1	Roof	Auditorium 'C2'	*2004*	15	York	CP 530 SWSI AF 40 20460	Chilled Water	45
New Roberto Clemente	AHU-5	1	Roof	Gym	*2004*	15	York	CP 530 SWSI AF 40 20460	Chilled Water	45

SPLIT UNITS:

Bldg.	Quantity	Location	Type	Year Installed	Estimated Service Life	Mfg.	Model	Cooling Capacity (tons)
New Roberto Clemente	6	Roof	Split	*2004*	15	York	H2RC024S06A	2

BOILERS:

Bldg.	Quantity	Location	Type	Year Installed	Estimated Service Life	Mfg.	Model	Blower hp	Heating Capacity (MBH)	Heating Output (MBH)	Boiler MMBTU
New Roberto Clemente	2	BR	Firetube	2004	25	Cleaver Brooks	LNICR4-G-30	5	7531	5362	5.36

CHILLER:

Bldg.	Tag #	Location	Spaces Served	Year Installed	Estimated Service Life	Mfg.	Model	kW Input	Cooling Capacity (tons)	Cooling Efficiency (kW/ton)	Air/Water Cooled	Controls
New Roberto Clemente	CH-1	Boiler Room	Building	2004	23	York	YKCFCQ7-CPF	123	400	0.31	Water	Central BMS

COOLING TOWERS:

Bldg.	Tag #	Location	Serve	Year Installed	Estimated Service Life	Mfg.	Model	Capacity (tons)	Motor Model	Fan Motor hp	Fan Motor Efficency (%)	VFD (Y/N)
New Roberto Clemente	CT-1	Roof	Chilled Water	*2004*	20	evapco	LRT 8-124	198	Emerson	*40*	93.6	N

PUMPS:

Bldg.	Tag#	Quantity	Location	Serve	Year Installed	Estimated Service Life	Motor Mfg.	Motor Model	Motor hp	Efficiency (%)	Flow (GPM)	VFD (Y/N)
New Roberto Clemente	HWP-1 HWP-2	2	Boiler Room	Building	*2004*	20	Emerson	638029A	25	93 3/5	650	Y
New Roberto Clemente	CHWP 1,2,3,4	4	Chiller Room	Building	*2004*	20	Emerson	638031	40	94	1000	Y
New Roberto Clemente	CT-1,2	2	Roof	Cooling Tower	*2004*	20	Emerson	HKED 43F2-C	40	93.6	-	Y

New Roberto Clemente K Center

HVAC UNITS:

Bldg.	Tag#	Quantity	Location	Serves	Mfg.	Model	Cooling Technology	Cooling Capacity (tons)	Cooling Efficiency (EER)	Heating Capacity (MBH)	Heating Efficiency (%)
New Roberto Pre-K	RTU-1,2,3,4	4	Roof	Classrooms	Trane	YHC063A3RZA1SH0C0A1B2B004	DX	5	13	125	81
New Roberto Pre-K	RTU-5	1	Roof	Building	Trane	SFHFF20EPH36A2AD1D	DX	20	9.5	220	80

Norman S. Weir School

BOILERS:

Bldg.	Quantity	Location	Spaces Served	Year Installed	Estimated Service Life	Mfg.	Fuel Source	Heating Capacity (MBH)	Heating Capacity (MBH)
Norman S. Weir	1	Boiler Room	Building Hot Water	1989	25	Hydrotherm	Nat Gas	900	900

HEATING UNITS:

Bldg.	Tag#	Quantity	Location	Spaces Served	Mfg.	Model	Heating Technology	Heating Capacity (MBH)
Norman S. Weir	HV-1	1	Roof	Gym	Reznor	HRPB-200	Nat Gas	200
Norman S. Weir	HV-2	1	Roof	Hallways	Reznor	HRPB-400	Nat Gas	200
Norman S. Weir	HV-3	1	Roof	Pool	Reznor	RPBL-600	Nat Gas	200

HVAC UNITS

Bldg.	Tag#	Location	Serves	Mfg.	Model	Cooling	Cooling Capacity (Tons)	Heating	Heating Capacity (MBH)	Heating Efficiency (%)
Norman S. Weir	RTU-1	Roof	Cafeteria	Trane	YHD300F4RV	DX	25	Gas	350	*81*

AIREDALE UNITS:

Bldg.	Quantity	Location	Spaces Served	Mfg.	Model
Norman S. Weir	24	Classrooms	Classrooms	Airedale	CM3

BOILERS:

Bldg.	Quantity	Location	Spaces Served	Year Installed	Estimated Service Life	Mfg.	Fuel Source	Heating Capacity (MBH)	Heating Capacity (MBH)
Norman S. Weir	1	Boiler Room	Building Hot Water	1989	25	Hydrotherm	Nat Gas	900	900

Rev. Dr. Martin Luther King School

SPLIT UNITS:

Bldg	Tag#	Quantity	Location	Spaces Served	Mfg.	Model	Cooling Capacity (tons)	Cooling Efficiency (EER)	Fan Qty.	Fan Motor hp
MLK	-	2	Gym Roof	-	Trane	2TTB3030 A1000AA	2.5	*12*	1	1/8
MLK	ACCU-1	1	Gym Roof	-	-	-	-	-	1	-
MLK	ACCU-3	1	Cafeteria Roof	Cafeteria	Trane	RAUCC60 4BX13OOD	60	11	6	1
MLK	-	2	Old Roof	Old Building	Trane	2TTA0048 A4000AA	4	*10*	1	1/4
MLK	-	3	Old Roof	Old Building	Luxaire	HABA-F01 8SE	2	10	1	-

HVAC UNITS:

Bldg	Tag#	Quantity	Serves	Mfg.	Model	Cooling Capacity (tons)	Cooling Efficiency (EER)	Heating	Heating Capacity (MBH)	Heating Efficiency (%)
MLK	RTU 1-11	11	New Classrooms	York	D1NH024 N03606C	3	10.5	Gas	36	81
MLK	-	2	Gym	Trane	TCH180B 400HA	15	9.9	HHW	-	-
MLK	HVAC-4	1	Old School	Trane	TCH150D 40BBA	12.5	9.8	HHW	-	-
MLK	HVAC-6	1	Old School	Trane	TCH480A 40L2B6J H1ABC000H	40	10.3	n/a	n/a	n/a

UNIT VENTILATORS

Bldg	Room	Equipment	Manufacturer	Quantity
MLK	Classrooms	Unit Vents	Trane	34

BOILERS:

Bldg.	Tag #	Quantity	Location	Spaces Served	Type	Year Installed	Estimated Service Life	Mfg.	Model	Heating Capacity (MBH)
MLK	B-1 B-2	2	Boiler Room	Building	Firetube	1978	25	Cleaver Brooks	CB800-125	320

PUMPS:

Bldg.	Tag#	Quantity	Location	Spaces Served	Type	Estimated Service Life	Motor Mfg.	Motor Model
MLK	P1 P2	2	Boiler Room	Building	End Suction	20	Baldor	M3311 T

Roberto Clemente School

AIR COOLED CONDENSING UNITS

Bldg.	Quantity	Location	Type	Estimated Service Life	Mfg.	Model	Motor hp	Fan Motor Efficiency (%)	Design Flow (cfm)	Number of Fans
Old Roberto Clemente	1	Ground Level	Air Cooled	15	McQuay	ACD08 5A27BY	1.5	*80*	67,000	6

CHILLERS

Bldg.	Location	Spaces Served	Year Installed	Estimated Service Life	Mfg.	Model	kW Input	Cooling Capacity (tons)	Cooling Efficiency (kW/ton)
Old Roberto Clemente	Mech. Room	Building	2002	23	McQuay	WGZ080A W27ER10	275.3	80	3.44125

AIR HANDLERS:

Bldg.	Quantity	Location	Estimated Service Life	Mfg.	Model	Motor hp	Efficiency (%)
Old Roberto Clemente	1	Mech. Room	20	Nesbitt	WA18J4	5	87 1/2

UNIT VENTILATORS

Bldg	Room	Equipment	Manufacturer	Quantity
Old Roberto Clemente	Classrooms	Unit Vents	McQuay	27

PUMPS:

Bldg.	Tag#	Quantity	Location	Spaces Served	Estimated Service Life	Motor Mfg.	Motor hp	VFD (Y/N)
Old Roberto Clemente	P-1,2	2	Mech. Room	Building	20	Armstrong	2	N

Rosa L. Parks School of Fine and Preforming Arts

SPLIT UNITS:

Bldg.	Quantity	Location	Spaces Served	Estimated Service Life	Mfg.	Model	Cooling Capacity (tons)	Cooling Efficiency (EER)
Rosa Parks	1	Lower Roof	Classrooms	15	Carrier	38YCC018440	1.5	9.5
Rosa Parks	1	Lower Roof	Classrooms	15	Carrier	*38YCC018440*	*1.5*	*9.5*
Rosa Parks	1	Upper Roof	Classrooms	15	Mitsubishi	R410A	*2*	*10*

HVAC UNITS:

Bldg.	Tag#	Quantity	Location	Spaces Served	Mfg.	Model	Cooling Capacity (tons)	Cooling Efficiency (EER)	Heating Capacity (MBH)	Heating Efficiency (%)
Rosa Parks	-	1	Lower Roof	Classrooms	Trane	YHC03 6A4R-	3	12	96	81
Rosa Parks	-	1	Lower Roof	Classrooms	Trane	YHC04 8A4R-	4	12	96	81
Rosa Parks	-	1	Lower Roof	Classrooms	Reznor	-	-	-	200	80
Rosa Parks	RTU-5	1	Lower Roof	Classrooms	Trane	YHC06 0A4R-	5	11.8	130	81
Rosa Parks	RTU-3	1	Lower Roof	Classrooms	Trane	YHC06 3AA4R-	5	11.8	130	81
Rosa Parks	RTU-3	1	Lower Roof	Classrooms	Trane	YHC06 3AA4R-	5	11.8	130	81
Rosa Parks	-	1	Lower Roof	Cafeteria /Auditorium	Carrier	48TMF 016-501AA	15	9.5	223	81
Rosa Parks	RTU-1	1	Upper Roof	Cafeteria /Auditorium	Trane	YCD420 B4PM6D2D-	35	-	600	81
Rosa Parks	-	1	Upper Roof	Cafeteria /Auditorium	Reznor	-	-	-	200	80
Rosa Parks	-	1	Upper Roof	Cafeteria /Auditorium	Trane	YCD036 C4LABE	3	12	96	81
Rosa Parks	-	1	Upper Roof	Cafeteria /Auditorium	Trane	-	2	11	96	81

AIREDALE UNITS:

Bldg.	Quantity	Spaces Served	Mfg.	Model
Rosa Parks	9	Classrooms	Airedale	CM3

Rutland Early Childhood Learning Center

HVAC UNITS:

Bldg.	Tag#	Quantity	Location	Spaces Served	Mfg.	Model	Cooling Capacity (tons)	Cooling Efficiency (EER)	Heating Capacity (MBH)	Heating Efficiency (%)
Rutland Early Child Center	RTU 1	1	Roof	Building	Trane	YCD150 C3HCBA	12.5	9.6	250	81
Rutland Early Child Center	RTU 2	1	Roof	Building	Trane	YCD060 C3HCBE	5	14	130	81
Rutland Early Child Center	RTU 3	1	Roof	Building	Trane	YCD075 C3HCBE	7.5	11.2	200	81
Rutland Early Child Center	RTU 4	1	Roof	Building	Trane	YCD15 0C3HCBA	12.5	9.6	250	81
Rutland Early Child Center	RTU 5	1	Roof	Building	Trane	YCC024 F1L0BG	2	9.1	32	78

School 12

HVAC UNITS:

Bldg.	Quantity	Location	Spaces Served	Year Installed	Mfg.	Model	Heating
School 12	1	Ground Level	Gym	*2003*	McQuay	OAH021FHAC	Nat Gas

HVAC UNITS

Bldg.	Quantity	Location	Spaces Served	Type	Estimated Service Life	Mfg.	Model	Cooling Capacity (tons)	Cooling Efficiency (EER)	Fan Qty.	Fan Motor hp
School 12	1	Ground Level, Outdoor	Coach Office 1	Split	15	Trane	2TTR2030 A1000AA	3	-	1	1/8
School 12	1	Ground Level, Outdoor	Coach Office 2	Split	15	Trane	2TTR2030 A1000AA	3	-	1	1/8
School 12	1	Ground Level, Outdoor	Admin Areas	Split	15	Mitsubishi	PUY-A18NHA4	2	8	1	-
School 12	1	Ground Level, Outdoor	Admin Areas	Split	15	Lennox	HS29-042-3P-0PT	4	10	1	1/8
School 12	1	Ground Level, Outdoor	Admin Areas	Split	15	Goodman	GSC13036 1GB	3	11	1	1/8

Unit Ventilators

Bldg.	Quantity	Location	Spaces Served	Mfg.
School 12	40	Classrooms	Classrooms	McQuay

School 13

HVAC UNITS:

Bldg.	Tag#	Quantity	Location	Spaces Served	Mfg.	Model	Cooling Capacity (tons)	Heating
School 13	AHU-1	1	Ground Level	Cafeteria	Trane	TSCA010 U0C	NA	Steam
School 13	AHU-2	1	Original Building Roof	Gym	Trane	TSCA014 U0C	NA	Steam
School 13	6	1	New Roof	Data Room	Carrier	48TJE006-511KB	5	Natural Gas
School 13	7	1	New Roof	Room 7	Carrier	48TJE008-521KB	7.5	Natural Gas
School 13	8	1	New Roof	Room 8	Carrier	48TJE008-521KB	7.5	Natural Gas
School 13	9	1	New Roof	Room 9	Carrier	48TJE005-511KB	4	Natural Gas
School 13	10	1	New Roof	Room 10	Carrier	48TJE006-511KB	5	Natural Gas
School 13	11	1	New Roof	Room 11	Carrier	48TJE005-511KB	4	Natural Gas
School 13	12	1	New Roof	Room 12	Carrier	48TJE005-511KB	4	Natural Gas
School 13	G	1	New Roof	Room G	Carrier	48TJE005-511KB	4	Natural Gas
School 13	H	1	New Roof	Room H	Carrier	48TJE006-511KB	5	Natural Gas
School 13	I	1	New Roof	Room I	Carrier	48TJE005-511KB	4	Natural Gas
School 13	J	1	New Roof	Room J	Carrier	48TJE005-511KB	4	Natural Gas

Split Units

Bldg.	Quantity	Location	Spaces Served	Mfg.	Model	Cooling Capacity (tons)	Cooling Efficiency (EER)
School 13	2	Roof	Computer Room/Library	Mitsubishi	PUG30CKC	2.5	10.5
School 13	2	Roof	Computer Room/Library	Trane	2TTB0042A 1000AA	3.5	*10*
School 13	1	Roof	Gym Office	Mitsubishi	MU09TW	0.7	10.1
School 13	1	Yard	B4/5	Mammoth	-	1	-

BOILERS:

Bldg.	Tag #	Quantity	Location	Year Installed	Estimated Service Life	Mfg.	Model	Boiler MMBTU	Boiler hp	Heating Capacity (MBH)	Heating Output (MBH)
School 13	12	2	BR	2000	25	Eastmond & Sons	ESP100	3.348	2	4200	3348

School 17

UNIT VENTILATORS

Bldg	Room	Equipment	Manufacturer	Quantity
School 17	Classrooms	Unit Vents	Trane	14

BOILERS:

Bldg.	Tag #	Quantity	Location	Type	Year Installed	Estimated Service Life	Mfg.	Model	Heating Capacity (MBH)	Heating Output (MBH)	Boiler MMBTU
School 17	12	2	BR	Firetube	*1996*	25	Smith	28A-10	3172	1939	1.939

PUMPS:

Bldg.	Quantity	Location	Spaces Served	Estimated Service Life	Motor Mfg.	Motor Model	Motor hp	Efficiency (%)	VFD (Y/N)
School 17	3	Boiler Room	Boiler Condensate	20	Baldor	34K83-2534	1/3	79	N

School 18

HVAC UNITS:

Bldg.	Tag#	Quantity	Location	Spaces Served	Year	Estimated Service Life	Mfg.	Model	Cooling	Heating Technology	Heating Capacity (MBH)
School 18	RTU-12	2	Roof	Cafeteria /Gym	*1999*	15	Trane	TSCA025WB	NA	HW	15 HP (Blower)

UNIT VENTILATORS

Bldg	Room	Equipment	Manufacturer	Quantity
School 18	Classrooms	Unit Vents	Trane	49

BOILERS

Bldg.	Tag #	Quantity	Type	Year	Estimated Service Life	Mfg.	Model	Blower hp	Heating Capacity (MBH)	Heating Output (MBH)	Controls
School 18	12	2	Firetube	-	25	Weil-Mclain	1788	5	5485	4370	4.37

PUMPS:

Bldg.	Tag#	Quantity	Location	Spaces Served	Estimated Service Life	Motor Mfg.	Motor Model	Motor hp	Efficiency (%)	Flow (GPM)	VFD (Y/N)
School 18	1 2	2	Boiler Room	Building	20	Baldor	EM33 13T	10	92%	-	N
School 18	3 4	2	Boiler Room	HW Secondary	15	Baldor	JMM3 211T	3	82.5%	90	N
School 18	5 6	2	Boiler Room	HW Secondary	15	Century	E294	3	-	65	N
School 18	7 8	2	Boiler Room	HW Secondary	15	Baldor	JMM3 311T	7.5	85.5%	250	N
School 18	9 10	2	Boiler Room	HW Secondary	15	Baldor	JMM3 211T	3	82.5%	120	N

School 28

HVAC Units

Bldg.	Tag#	Quantity	Location	Spaces Served	Mfg.	Model	Motor Mfg.	Fan Motor hp	Fan Motor Efficiency	Heating Capacity (MBH)
School 28	HV-1	1	Roof MER	Auditorium	AAF	B 5-50	Wagner	7.5	-	9
School 28	HV-2	1	Roof MER	Gym	AAF	B 6-64	Reliance	5	82.5	18.865
School 28	HV-3	1	Roof MER	Locker Rooms	AAF	H-1029	-	1	-	-
School 28	-	2	Cafeteria Roof	Cafeteria	Trane	-	Baldor	5	89.5	-

UNIT VENTILATORS

Bldg	Room	Equipment	Quantity
School 28	Classrooms	Unit Vents	48

BOILERS:

Bldg.	Tag #	Quantity	Location	Type	Year Installed	Estimated Service Life	Mfg.	Model	Heating Capacity (MBH)	Heating Output	Boiler MMBTU
School 28	1 2	2	BR	Firetube	*2002*	25	Smith	28A-SW-17	5525	3793	3.793

PUMPS:

Bldg.	Tag#	Quantity	Location	Estimated Service Life	Motor Mfg.	Motor Model	Motor hp	Efficiency (%)	Flow (GPM)	Head (ft)	VFD (Y/N)
School 28	HP-1,2	2	Boiler Room	20	AO Smith	07360339-01-OJ	10	85	525	63	N

School 6

HVAC UNITS:

Bldg.	Tag#	Quantity	Location	Spaces Served	Mfg.	Model	Cooling Technology
School 6	AHU-1-5	5	Roof	Building	McQuay	CAH004FHAC	NA

UNIT VENTILATORS

Bldg	Room	Equipment	Manufacturer	Model #	Quantity
School 6	Classrooms	Unit Vents	Nesbitt	HOW5123501	47

BOILERS:

Bldg.	Tag #	Quantity	Type	Estimated Service Life	Mfg.	Model	Fuel Source	Blower hp	Heating Capacity (MBH)	Heating Output (MBH)	Boiler MMBTU
School 6	1 2	2	Firetube	25	AO Smith	4500A-17	Gas	5	7309	5032	5.032

PUMPS:

Bldg.	Tag#	Quantity	Location	Estimated Service Life	Motor Mfg.	Motor Model	Motor hp	Efficiency (%)	Flow (GPM)	Head (ft)	VFD (Y/N)
School 6	P-1	1	Boiler Room	20	Baldor	M2513T	15	75	500	55	N
School 6	P-2	1	Boiler Room	20	Baldor	M2513T	15	75	500	55	N
School 6	P-3	1	Boiler Room	20	Baldor	E 3313T	15	75	500	55	N

School 7

SPLIT UNIT

Bldg.	Quantity	Location	Spaces Served	Type	Year Installed	Estimated Service Life	Mfg.	Model	Cooling Capacity (tons)	Cooling Efficiency (EER)
School 7	1	Lower Roof	Classroom	Split	*2003*	20	Trane	2TTA2042B 30000AA	4	12

UNIT VENTILATORS

Bldg	Room	Equipment	Manufacturer	Quantity
School 7	Classrooms	Unit Vents	Nesbitt	32

BOILERS:

Bldg.	Tag #	Quantity	Estimated Service Life	Mfg.	Model	Fuel Source	Blower hp	Heating Capacity (MBH)	Heating Output (MBH)	Controls
School 7	B1 B2	2	25	Weil-McLain	1688	Gas	5	5124	4090	4.1

PUMPS:

Bldg.	Tag#	Quantity	Location	Spaces Served	Estimated Service Life	Motor Mfg.	Motor Model	Motor hp	VFD (Y/N)
School 7	P 1, 2, 3, 4, 5	5	Boiler Room	Steam System	20	AO Smith	P48K2EB7	0.5	N

SPLIT UNITS:

Bldg.	Quantity	Location	Mfg.	Model	Cooling Capacity (tons)	Cooling Efficiency (EER)
Silk City	1	Roof	ICP	CA5560VHD2	5	-

Silk City Academy

HVAC UNITS:

Bldg.	Tag#	Quantity	Location	Spaces Served	Mfg.	Model	Cooling Capacity (tons)	Cooling Efficiency (EER)
Silk City	AC-1	1	Roof	Basement	McQuay	ALP015D	15	*11.4*
Silk City	AC-2	1	Roof	Right Wing	McQuay	ALP012D	12	*11.4*
Silk City	AC-3	1	Roof	Left Wing	McQuay	ALP019D	19	*11.4*

AIR HANDLERS

Bldg.	Tag#	Quantity	Location	Spaces Served	Mfg.	Model	Motor hp
Silk City	AHU-1	1	Basement	Basement	McQuay	LSL111CV	*5*
Silk City	AHU-2	1	Floor 1 MER	Right Wing	McQuay	LSL108CV	*5*
Silk City	AHU-3	1	Floor 1 MER	Left Wing	McQuay	LSL108CV	*5*

UNIT VENTILATORS

Bldg	Room	Equipment	Manufacturer	Quantity
Silk City	Classrooms	Unit Vents	McQuay	17

BOILERS:

Bldg.	Quantity	Location	Spaces Served	Year Installed	Estimated Service Life	Mfg.	Model	Fuel	Blower hp	Heating Capacity (MBH)	Heating Output (MBH)
Silk City	1	Boiler Room	Building	*1997*	25	Smith	28HE81 62412	Gas	1	3033	2513