Attachment B

HVAC Assessment Report

California Schools Healthy Air, Plumbing, and Efficiency Ventilation Program (CalShape - formerly AB 841)

Lighthouse Community School

Lighthouse Community School *– 444 Hegenberger rd. Oakland CA 94621*

Lodestar Community School – *645 105th ave Oakland Ca*

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Abbreviations and Acronyms

ASHREA	American Society of Heating Refrigeration and Air-Conditioning Engineers.
CO2	Carbon Dioxide
DCV	Demand control ventilation
DDC	Direct Digital Control
Ft^2	Square foot, square feet, a measurement of area
CFM	Cubic feet Per Minute, a measure of air volume
HVAC	Heating, ventilation, and air-conditioning
MERV	Minimum Efficiency Reporting Value
EUL	Equipment Expected Useful Life. Source (www.ashrae.org)
CalSHAPE	California Schools Healthy Air, Plumbing, and Efficiency Program
LEA	Local Education Agency
OSA	Outside Air
WC	Water colum

Licenses and Certifications

Personnel and Certifications	Company	License Agency	License / Certification Number
Qualified Testing Personnel	M2 Mechanical	ICB/TABB	MAT11315983T
Certified TAB Technician	M2 Mechanical	ICB/TABB	BB1288589T
Contractor	Alco Building Solutions	Contractor State License Board CSLB	831145
Licensed Professional	Engineering Consulting Design	State Of California	M34941

Engineering Consulting Design

Name:________________________________

Sign:________________________________

Date:________________________________

Stamp:

1.0 Executive Summary

1.1 Background

Research indicates that many California classrooms suffer from poor ventilation, which negatively impacts students' health, academic performance, and attendance. HVAC systems play a crucial role in improving indoor air quality by removing pollutants and regulating CO_2 levels through proper air exchange. However, these systems can also contribute to increased energy consumption. Factors such as filter type, system design, and ventilation volume all influence both energy use and air quality. A thorough analysis of these elements can help school districts develop strategies that enhance air quality while minimizing energy costs.

In response to these challenges, California enacted the Healthy Schools, Healthy Air, Healthy Recovery Bill (AB-841) in 2020, which provides funding for schools to upgrade their ventilation systems. This initiative, now known as the California Schools Healthy Air, Plumbing, and Efficiency Program (CalSHAPE), provides funding for HVAC evaluations, filter replacements, and the installation of CO_2 sensors in classrooms.

1.2 Project Goals and Guidelines

M2 Mechanical Inc. was contracted by Alco Building Solutions to conduct an HVAC assessment as part of the CalSHAPE grant initiative. Our team performed a comprehensive evaluation of the HVAC systems across the Lighthouse Community School District campus, focusing on their ability to meet modern indoor air quality and ventilation standards.

Key assessment areas included:

- HVAC inspection, testing, and maintenance to meet ventilation standards.
- Filter replacement and upgrades for better air quality.
- Repairs or replacements of non-functioning HVAC units.
- Compliance with current outside air ventilation rates
- Carbon dioxide monitoring to ensure proper airflow and C02 reduction in classrooms.
- Overall age and condition of HVAC units

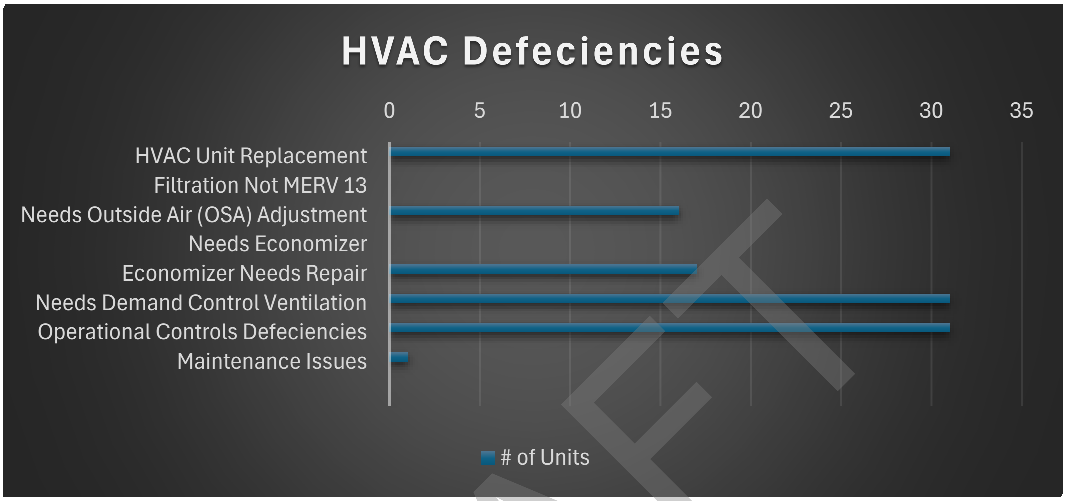
Many older HVAC units were not originally designed to support MERV 13 filtration, nor can they efficiently handle the increased heating and cooling demands required for enhanced outside air ventilation. In cases where systems are nearing the end of their useful life, upgrades may not be a cost-effective solution. While the average lifespan of HVAC equipment is 15-20 years, recommendations for replacement must also consider maintenance history, usage levels, refrigerant type and equipment efficiency and design.

1.3 Benefits to the School District

The findings in this report provide valuable insights for the School District to make informed decisions regarding HVAC infrastructure investments and maintenance planning. Implementing these recommendations will enhance indoor air quality, support student well-being, and optimize energy efficiency. Furthermore, M2 Mechanical Inc. remains committed to supporting the district throughout the implementation process, offering continued guidance and expertise to ensure the success of the proposed improvements.

1.4 Assessment Site Summary

The graph and table below summarize the key findings from the HVAC assessment conducted at Lighthouse Community School. Detailed information for each individual HVAC unit is provided in the appendix, which includes summary tables and data sheets. An overview of the common types of HVAC equipment found at the school is presented in Section 2.4, while Section 2.5 outlines typical deficiencies frequently observed across the campus.



Lighthouse Community School has 31 HVAC units, most of which are around 16 years old and have exceeded their expected useful life. The district has done an excellent job maintaining the equipment, with few reported issues and only a small number of economizers in need of repair. However, due to the age of the systems, they are inherently less efficient, more susceptible to failure, and increasingly expensive to maintain. Rather than continuing to invest in outdated units, a replacement strategy is recommended—one that incorporates modern features such as Demand Control Ventilation (DCV), which adjusts airflow based on occupancy to reduce energy use and improve indoor air quality by lowering CO_2 levels in classrooms and shared areas. All existing units support MERV 13 filters, and using 2-inch thick versions is advised for optimal performance. Upgrading to new systems with these advanced capabilities will enhance comfort, efficiency, and sustainability throughout the school.

Estimated Cost for controls and HVAC replacement at both sites.

Location	Overall Project Investment	Unit Count	Tons	Estimated Cost Per Unit/ Ton		Total Cost
Lode Star	HVAC Unit Replacement	15	54	$6,000	$	324,000
Lode Star	Install Network-Based Wireless Thermostats With DCV Capability		41	$2,000	$	82,000
Lighthouse HS	HVAC Unit Replacement	12	69	$6,000	$	414,000
Lighthouse ES	HVAC Unit Replacement	19	96	$6,000	$	576,000
Lighthouse HS	Install Network-Based Wireless Thermostats With DCV Capability	12		$2,000	$	24,000
Lighthouse ES	Install Network-Based Wireless Thermostats With DCV Capability	19		$2,000	$	38,000
	Total Additional Investment				**$**	**1,458,000**

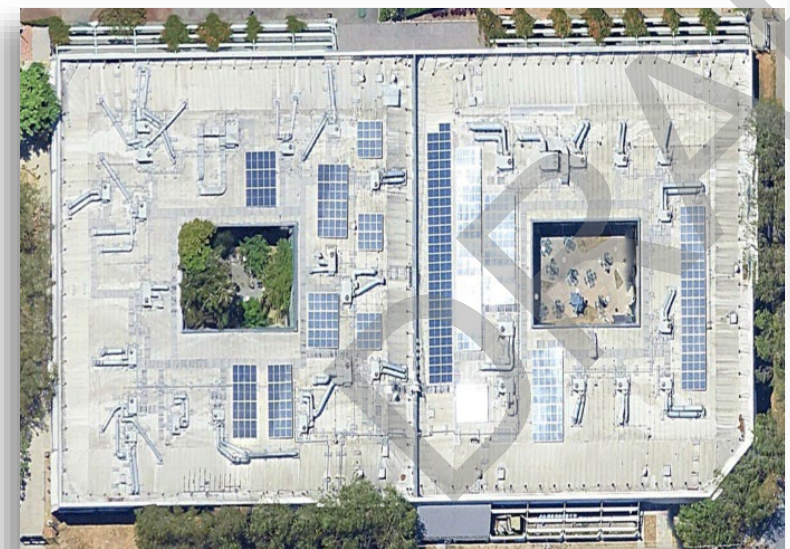
Lighthouse Community School
HVAC Assessment Report

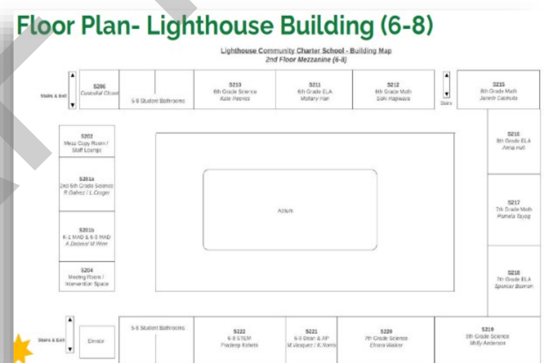
2.0 Lighthouse Community School

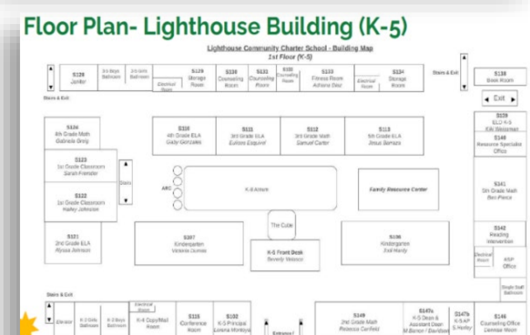
2.1 Campus Description

Lighthouse Community School is located at – *444 Hegenberger rd. Oakland CA 94621*. This campus is made up of one permanent concrete structure.

2.2 Site Maps

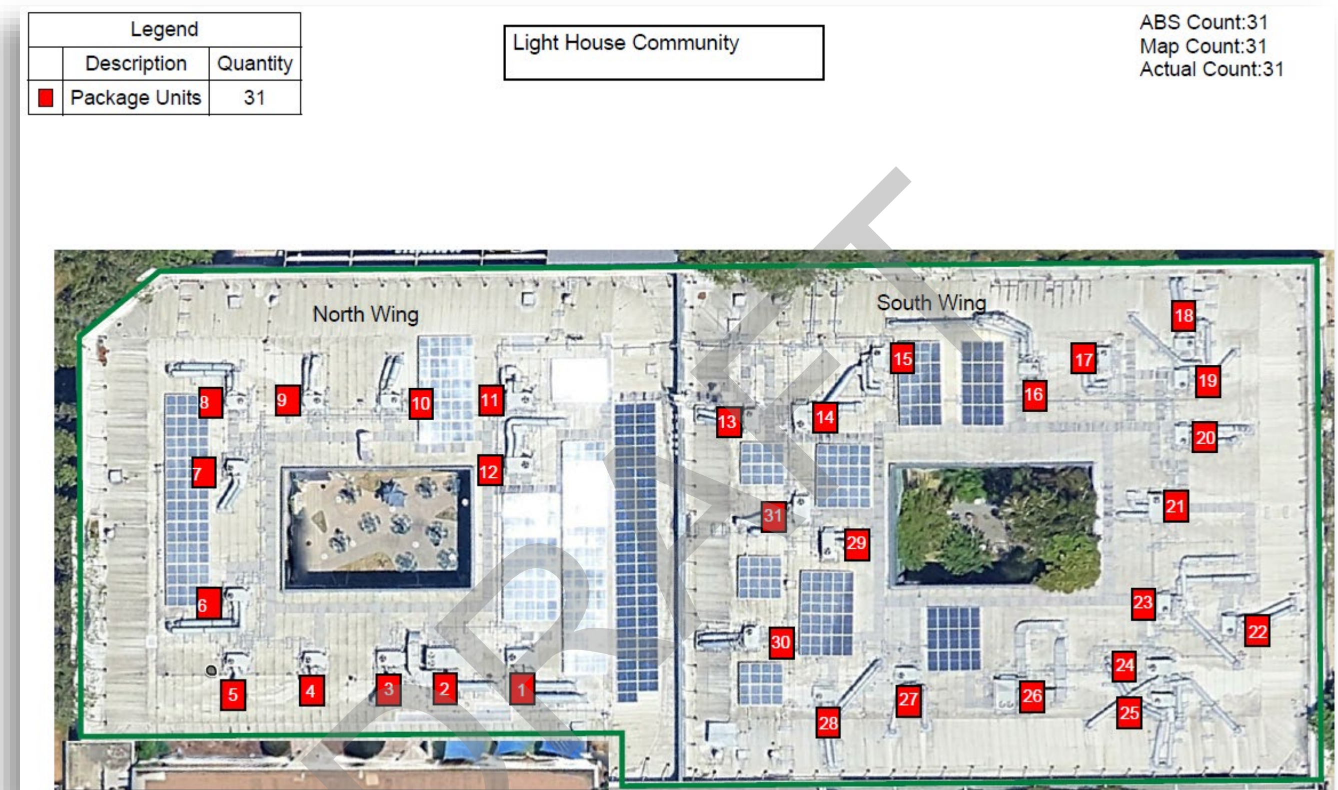






2.3 Equipment Locations

The map below shows the HVAC equipment locations. The different colors indicate the different types of units. This particular school only has various different tonnage of Trane Package units.



2.4 HVAC Equipment Types

Equipment Types

Trane Package Units: #1 -#31

MEV 16 Filters, Zone control board, Ducting with Bypass Damper

Lodestar
HVAC Assessment Report

LODESTAR
A Lighthouse Community Public School

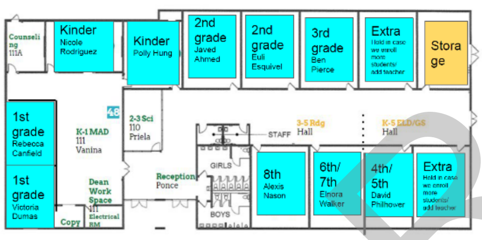
3.0 Lighthouse Community School

3.1 Campus Description

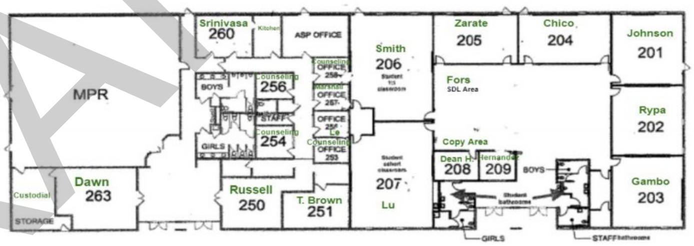
Lighthouse Community School is located at – *444 Hegenberger rd. Oakland CA 94621*. This campus is made up of one permanent concrete structure.

3.2 Site Maps

Floor Plan- Lodestar Building 1 (K-5)

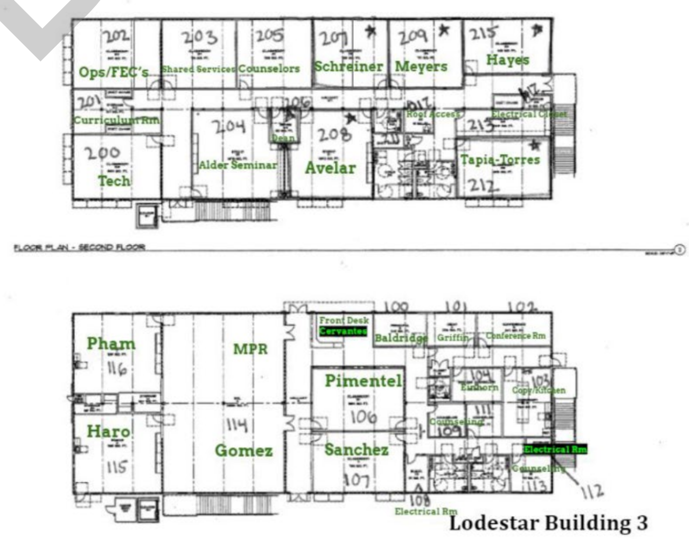


Floor Plan- Lodestar Building 2 (6-8)



Lodestar Building 2

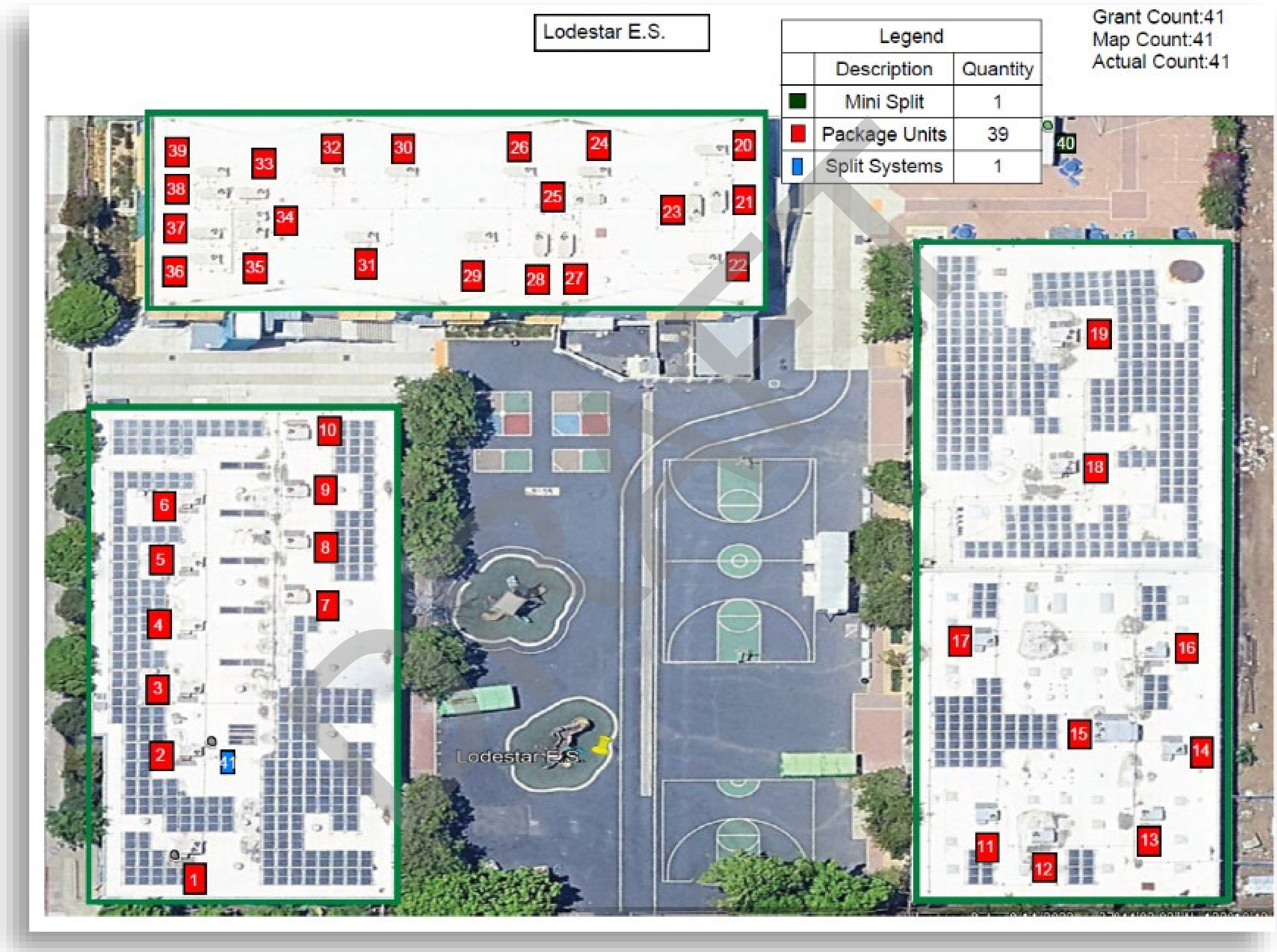
Floor Plan- Lodestar Building 3 (9-10)



Lodestar Building 3

3.3 Equipment Locations

The map below shows the HVAC equipment locations. The different colors indicate the different types of units. This particular school only has various different tonnage of Trane Package units.



3.4 HVAC Equipment Types

Equipment Types

Carrier Package Units: #1 -#19

Lennox Package Units: #20 -#39

Split Systems Units: #40 -#41

3.5 Deficiencies and Recommendations

Filtration

All of the HVAC units on this campus are currently utilizing MERV 16 filters, which exceed the ASHRAE recommendations for improved indoor air quality.

Outside Air

Malfunctioning or undersized outside air dampers resulted in 16 units did not meet ventilation requirements based on ASHRAE 62.1 or Table 120.1-A of the 2019 Title 24 California Building Energy Efficiency Standards.

Economizer Component Degradation in Aged Rooftop Units

Mechanical rooftop units nearing or past their expected service life often experience high failure rates in economizer components. Common issues include corroded dampers, worn linkages, and failed actuators—primarily due to age, wear, and environmental exposure.

While many of these units require economizer repairs, the advanced age of the equipment raises concerns about cost-effectiveness. Repairs may offer limited value as other components are also likely to fail soon.

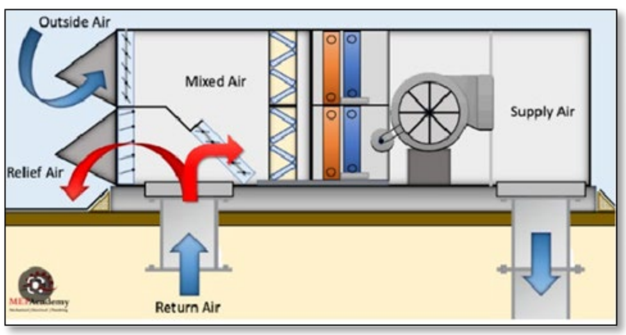
Recommendation: Evaluate the cost-benefit carefully. In many cases, replacing the entire unit may be more prudent than investing in short-term fixes. If the equipment is less than 15 years old and in good functioning shape repairing or adding economizers is recommended.

Demand Control Ventillation (DCV)

The HVAC systems at this school are currently managed through a standalone thermostats, which provides basic operational control. However, the lack of CO_2 monitoring capabilities limits the system's ability to implement Demand-Controlled Ventilation (DCV) — a critical strategy for balancing indoor air quality (IAQ) with energy efficiency.

To address this limitation, it is strongly recommended that the control system be upgraded to include: CO_2 sensors in key occupied zones and DCV logic integration within the building automation system.

By incorporating these enhancements, the system would be capable of modulating ventilation rates in response to real-time occupancy levels, thereby:



- Reducing unnecessary outdoor air intake during low-occupancy periods.
- Improving IAQ by increasing ventilation when CO_2 concentrations rise.
- Lowering energy consumption associated with conditioning excessive outdoor air.

Implementing DCV not only aligns with best practices for energy-efficient building operation but also supports occupant health and compliance with evolving indoor air quality standards.

3.6 Install Network-Based Controls Platform With C02 and DCV

Definition and Features: A network-based controls platform involves connecting HVAC systems and other building management systems (BMS) to a central network, enabling centralized monitoring and control. This platform is often managed through a building automation system (BAS).

Key Benefits:

Centralized Control and Monitoring:

- Facility managers can control and monitor all HVAC units and other systems (like lighting and security) from a single interface. This centralized approach simplifies management and improves operational efficiency.
- For schools, this means that all classrooms and common areas can be managed from a single location, reducing the need for individual adjustments.

Enhanced Energy Management:

- Network-based controls provide detailed analytics and reporting on energy usage. Managers can identify inefficiencies and adjust settings to optimize energy consumption across the entire facility.
- Automated controls can adjust HVAC settings based on occupancy, time of day, or other predefined conditions, ensuring optimal energy use without manual intervention.

Improved Maintenance and Diagnostics:

- The system can alert maintenance staff to issues before they become major problems. Predictive maintenance features can analyze data trends to anticipate and prevent equipment failures.
- Remote diagnostics allow for quick identification and resolution of issues, minimizing downtime and maintenance costs.

Scalability and Flexibility:

- Network-based systems can easily scale to accommodate additional HVAC units or other systems as needed. This flexibility is crucial for growing schools or campuses with varying demands.

Enhanced Indoor Air Quality (IAQ):

- Integrated controls can ensure proper ventilation by adjusting outside air intake based on occupancy and air quality sensors, maintaining a healthy indoor environment.

Wireless thermostats and network-based controls platforms significantly enhance the management and efficiency of HVAC systems in schools. They provide remote access, improve energy savings, integrate with smart home devices, and offer centralized control and monitoring, leading to optimized energy use, better indoor air quality, and enhanced maintenance capabilities. These technologies are valuable tools for creating a comfortable, healthy, and energy-efficient learning environment.

3.7 Old Equipment Needing Replacement

Aging HVAC systems (10–15 yrs for A/C, 15–20 yrs for furnaces) often decline in efficiency and performance, leading to higher energy costs and comfort issues. While maintenance can extend system life, age alone isn't the only factor to consider.

Key Replacement Indicators:

- High Repair Frequency: Annual repairs >50% of replacement cost.
- Inefficiency: Outdated SEER/AFUE ratings, rising utility bills.
- Performance Issues: Inconsistent temps, poor humidity control, unusual noise.
- Air Quality Problems: Dust, odors, or mold.

Recommendation: If multiple factors are present, replacement is typically more cost-effective and reliable than ongoing repairs. New systems can improve comfort, air quality, and energy savings.

3.8 Advanced Control Options for Packaged Rooftop Units

This section evaluates four advanced control strategies for packaged single-zone rooftop units, assessing their energy savings against a baseline:

- Air-side economizers
- Supply-fan speed controls
- Cooling capacity controls
- Demand-controlled ventilation

Air-Side Economizer Controls

Air-side economizers reduce mechanical cooling energy by using cool outdoor air (OA) when conditions are favorable. They modulate OA dampers to exceed minimum ventilation rates, partially or fully offsetting mechanical cooling needs.

Control Strategies:

- Fixed Dry-Bulb / Enthalpy: Compares OA temperature or enthalpy to a fixed setpoint (e.g., 55–75°F or ~28 Btu/lb). If OA is below the setpoint, economizing is enabled.
- Differential Dry-Bulb / Enthalpy: Compares OA to return-air conditions. Economizer operates when OA is cooler or less enthalpic.

Operational Modes:

- Integrated: Uses OA and mechanical cooling simultaneously. Maximizes energy savings by engaging mechanical cooling only as needed.
- Nonintegrated: OA is used alone. Mechanical cooling activates only when OA cannot meet the full load.

4.0 Methodology

Outside Air Requirements

The outside air requirements for the spaces were determined using the 2019 title 24 values from the table below (0.38 CFM/ft^{2}). Each area was measured and the values were multiplied by 0.38 to determine the CFM of fresh air required.

Standard	Method		15 People	25 People	35 People
ASHRAE 62.1 2019	$10\ CFM/person + 0.12\ CFM/ft^2$		258 CFM	358 CFM	458 CFM
California T24 (2019)	$15\ CFM/person$	Use Larger	225 CFM	375 CFM	525 CFM
California Title 24 (2019)	$0.38\ CFM/ft^2$		342 CFM	342 CFM	342 CFM

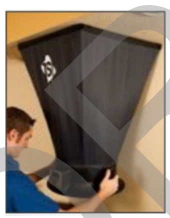
Ventilation Rates

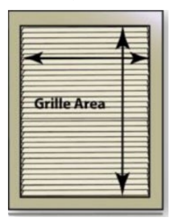
Air Velocity for the return grills was measured using a Evergreen differential pressure sensor and a velocity grid.

Return air grille flow is calculated using the following formula:

Airflow (cfm) =Grille Area (sq.in) ÷ 144 X Face Velocity (fpm)

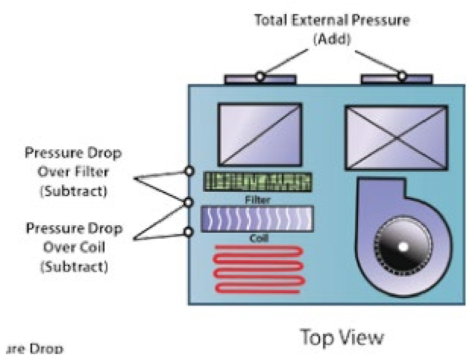
Supply airflow was measured using the duct traverse method or by using a flow hood. The same principle applies for the supply registers, CFM=Area x Velocity.

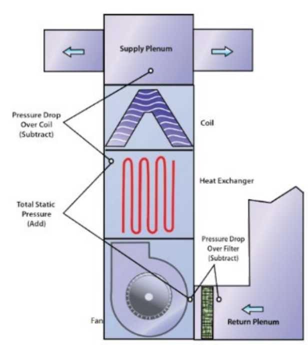




Measuring Static Pressures

Static pressure measurements were taken in specific areas on the different types of equipment to determine if more restrictive MERV 13 filters would restrict airflow and cause the equipment to malfunction.





Ventilation Rate

Volumes of the rooms (LxWxH) were measured with a laser measuring tool.

ACH = [**Equivalent Outdoor air flow (CFM)** X 60 (minutes)] / [Room Volume (ft3)

Equivalent Outdoor air = [% Outside Air in Supply (%OA) + Equivalent Filtered non outside as outside air (OA) air calculated by MERV Filter type] (Sample Calculation in APPENDIX)

TABLE 120.1-A– Minimum Ventilation Rates

Standard	Method	15 People	25 People	35 People
ASHRAE 62.1 2019	$10\ CFM/person + 0.12\ CFM/ft^2$	258 CFM	358 CFM	458 CFM
California T24 (2019)	$15\ CFM/person$ Use Larger	225 CFM	375 CFM	525 CFM
California Title 24 (2019)	$0.38\ CFM/ft^2$	342 CFM	342 CFM	342 CFM

Occupancy Category	Total Outdoor Air Rate[1] R_t (cfm/ft2)	Min Ventilation Air Rate for DCV R_a (cfm/ft2)	Air Class	Notes
Educational Facilities				
Daycare (through age 4)	0.21	0.15	2	
Daycare sickroom	0.15		3	
Classrooms (ages 5-8)	0.38	0.15	1	
Classrooms (age 9 -18)	0.38	0.15	1	
Lecture/postsecondary classroom	0.38	0.15	1	F
Lecture hall (fixed seats)	-	0.15	1	F
Art classroom	0.15		2	
Science laboratories	0.15		2	
University/college laboratories	0.15		2	
Wood/metal shop	0.15		2	
Computer lab	0.15		1	
Media center	0.15		1	A
Music/theater/dance	1.07	0.15	1	F
Multiuse assembly	0.5	0.15	1	F

5.0 Appendices

5.1 Appendix A – Assessment Summary Table

4.1 – Assessment Summary Table

Equipment Information								Areas With Defeciencies				
HVAC Unit Number	Room #	Age (Yrs)	Equipment Meets Minimum Ventilation Requirements [1]	Is there an Economizer	Economizer Functioning Properly	Type of HVAC Controls	DCV Retrofit Recomended?	Due for Replacement	Filteration	Outside Air	Economizer & DCV	Maintenance
1	N121	16	No	Yes	No	Local Thermostat	Yes	✓	✓	X	X	✓
2	Hallway	16	Yes	Yes	Yes	Local Thermostat	Yes	✓	✓	✓	✓	✓
3	101&102	16	No	Yes	No	Local Thermostat	Yes	✓	✓	X	X	✓
4	105-106-108-143-	16	Yes	Yes	Yes	Local Thermostat	Yes	✓	✓	✓	✓	✓
5	N142-Science	16	Yes	Yes	Yes	Local Thermostat	Yes	✓	✓	✓	✓	✓
6	N104	16	Yes	Yes	Yes	Local Thermostat	Yes	✓	✓	✓	✓	✓
7	139-141	16	No	Yes	Yes	Local Thermostat	Yes	✓	✓	X	✓	✓
8	118-140-119	16	No	Yes	No	Local Thermostat	Yes	✓	✓	X	X	✓
9	116-117-119	16	No	Yes	No	Local Thermostat	Yes	✓	✓	X	X	✓
10	109-110	16	No	Yes	Yes	Local Thermostat	Yes	✓	✓	X	✓	✓
11	128-132-133	16	No	Yes	No	Local Thermostat	Yes	✓	✓	X	X	✓
12	N121	16	No	Yes	No	Local Thermostat	Yes	✓	✓	X	X	X
13	123-124	16	No	Yes	Yes	Local Thermostat	Yes	✓	✓	X	✓	✓
14	Hallway	16	No	Yes	No	Local Thermostat	Yes	✓	✓	X	X	✓
15	110-111	16	No	Yes	No	Local Thermostat	Yes	✓	✓	X	X	✓
16	211-212	16	No	Yes	No	Local Thermostat	Yes	✓	✓	X	X	✓
17	112-113	16	No	Yes	No	Local Thermostat	Yes	✓	✓	X	X	✓
18	129-130-131-133-	16	No	Yes	No	Local Thermostat	Yes	✓	✓	X	X	✓
19	213-215	16	No	Yes	No	Local Thermostat	Yes	✓	✓	X	X	✓
20	216	16	Yes	Yes	Yes	Local Thermostat	Yes	✓	✓	✓	✓	✓
21	114	16	Yes	Yes	No	Local Thermostat	Yes	✓	✓	✓	X	✓
22	138-140-141-142	16	No	Yes	Yes	Local Thermostat	Yes	✓	✓	X	✓	✓
23	217-218	16	No	Yes	No	Local Thermostat	Yes	✓	✓	X	X	✓
24	219-220	16	No	Yes	Yes	Local Thermostat	Yes	✓	✓	X	✓	✓
25	106-146-147-148-	16	Yes	Yes	No	Local Thermostat	Yes	✓	✓	✓	X	✓
26	Hallway	16	Yes	Yes	Yes	Local Thermostat	Yes	✓	✓	✓	✓	✓
27	221-222	16	No	Yes	No	Local Thermostat	Yes	✓	✓	X	X	✓
28	102-107-115-116	16	No	Yes	No	Local Thermostat	Yes	✓	✓	X	X	✓
29	109-Hallway	16	Yes	Yes	Yes	Local Thermostat	Yes	✓	✓	✓	✓	✓
30	121-122	16	No	Yes	No	Local Thermostat	Yes	✓	✓	X	X	✓
31	201-202-204-205	16	No	Yes	No	Local Thermostat	Yes	✓	✓	X	X	✓

5.2 Appendix B – Equipment Information – Filters and Belt Sizes

HVAC Equipment Details - Site Summary

General Equipment Information																	
General Equipment Information						Package Unit / Condenser / Chiller (Outdoor Unit)			Furnace / Air Handler / Boiler (Indoor Unit)			Filters and Belts					
HVAC Unit #	Room #	Equipment Type:	Age (years)	Cooling Size (Tons)	Heating (kBtuh)	Make	Model #	Serial #	Make	Model #	Serial #	Recommended MERV Rating	Filter 1 Qty.	Filter 1 Size	Filter 2 Qty	Filter 2 Size	Belt S
—	—	—	2025	—	—	—	NOT A UNIT	—	—	—	—	—	—	—	—	—	—
—	—	—	2025	—	—	—	NOT A UNIT	—	—	—	—	—	—	—	—	—	—
—	—	—	2025	—	—	—	NOT A UNIT	—	—	—	—	—	—	—	—	—	—
—	—	—	2025	—	—	—	NOT A UNIT	—	—	—	—	—	—	—	—	—	—
5	MPR	Package Gas/Elec	16	9	138	Trane	YSC102E4RMA0001	924101604L	—	—	—	13	4	20x25x2	—	N/A	A-3
6	Other (Specify) –	Package Gas/Elec	16	13	150	Trane	YCH150E4LOAA	919100354D	—	—	—	13	4	20x25x2	2	20x20x2	A-6
7	Classroom	Package Gas/Elec	16	6	80	Trane	YSC072ERLACNC	924101725L	—	—	—	13	4	16x25x2	—	N/A	A-3
8	Classroom	Package Gas/Elec	16	3	60	Trane	YSC036E4RLA0001	925100470L	—	—	—	13	2	20x30x2	—	N/A	A-2
9	Classroom	Package Gas/Elec	16	4	80	Trane	YSC048E4RZA001	921191702L	—	—	—	13	2	20x30x2	—	N/A	A-2
10	Classroom	Package Gas/Elec	16	4	80	Trane	YSC048E4RLA0001	924101415L	—	—	—	13	2	20x30x2	—	N/A	A-2
11	Classroom	Package Gas/Elec	16	3	60	Trane	YSC036E4RLA0001	925100456L	—	—	—	13.0	2	20x30x2	—	N/A	A-2
12	Classroom	Package Gas/Elec	16	4	80	Trane	YSC048E4RLA0001	924101152L	—	—	—	13.0	2	20x30x2	—	N/A	A-2
13	Classroom	Package Gas/Elec	16	5	60	Trane	YSC060E4RMA001	924101599L	—	—	—	13	2	20x30x2	—	N/A	A-2
14	Classroom	Package Gas/Elec	16	4	80	Trane	YSC048E4RLA0001	924101714L	—	—	—	13	2	20x30x2	—	N/A	A-2
15	Classroom	Package Gas/Elec	16	6	80	Trane	YSC072ERLACNC	924100991L	—	—	—	13	4	16x25x2	—	N/A	A-3
16	MPR	Package Gas/Elec	16	9	138	Trane	YSC102E4RMA0001	924101618L	—	—	—	13	4	20x25x2	—	N/A	A-2
17	Classroom	Package Gas/Elec	16	3	60	Trane	YSC036E4RLA0001	9241010000L	—	—	—	13.0	2	20x30x2	—	N/A	A-2
18	Other (Specify) –	Package Gas/Elec	16	10	110	Trane	YSC120E4RLA0001	924101204L	—	—	—	13.0	4	16x25x2	—	N/A	A-3
19	Classroom	Package Gas/Elec	16	3	60	Trane	YSC030E4RLA0001	924100986L	—	—	—	13	2	20x30x2	—	N/A	A-2
20	Classroom	Package Gas/Elec	16	5	80	Trane	YSC060E4RHA001	924101112L	—	—	—	13	2	20x30x2	—	N/A	A-2
21	Classroom	Package Gas/Elec	16	3	60	Trane	YSC030E4RLA0001	924101704L	—	—	—	13	2	20x30x2	—	N/A	A-2
22	Classroom	Package Gas/Elec	16	4	80	Trane	YSC048E4RLA001	924101166L	—	—	—	13	2	20x30x2	—	N/A	A-2
23	Classroom	Package Gas/Elec	16	5	80	Trane	YSC060E4RHA001	924101613L	—	—	—	13.0	2	20x30x2	—	N/A	A-2
24	Classroom	Package Gas/Elec	16	4	80	Trane	YSC048E4RLA001	924101726L	—	—	—	13.0	2	20x30x2	—	N/A	A-2
25	Classroom	Package Gas/Elec	16	6	80	Trane	YSC072ERLACNC	924101018L	—	—	—	13	4	16x25x2	—	N/A	A-3
26	Classroom	Package Gas/Elec	16	4	80	Trane	YSC048E4RLA001	924101180L	—	—	—	13	2	20x30x2	—	N/A	A-2
27	Classroom	Package Gas/Elec	16	5	80	Trane	YSC060E4RMA001	924101098L	—	—	—	13	3	20x30x3	—	N/A	A-2
28	Classroom	Package Gas/Elec	16	6	80	Trane	YSC072ERLACNC	924100977L	—	—	—	13	4	16x25x2	—	N/A	A-3
29	Classroom	Package Gas/Elec	16	5	80	Trane	YSC060E4RMA001	924101084L	—	—	—	13.0	2	20x30x2	—	N/A	A-2
30	Other (Specify) –	Package Gas/Elec	16	13	138	Trane	YCH150E4LOAA	923100749D	—	—	—	13.0	4	20x25x2	2	20x20x2	A-6
31	Classroom	Package Gas/Elec	16	3	60	Trane	YSC036E4RLA0001	924101014L	—	—	—	13	2	20x30x2	—	N/A	A-2
32	Classroom	Package Gas/Elec	16	3	60	Trane	YSC036E4RLA0001	924100958L	—	—	—	13	2	20x30x2	—	N/A	A-2
33	Classroom	Package Gas/Elec	16	3	60	Trane	YSC036E4RLA0001	924101716L	—	—	—	13	2	20x30x2	—	N/A	A-2
34	Classroom	Package Gas/Elec	16	6	80	Trane	YSC072ERLACNC	924100990L	—	—	—	13	4	16x25x2	—	N/A	A-3
35	Classroom	Package Gas/Elec	16	6	80	Trane	YSC072ERLACNC	924101004L	—	—	—	13.0	4	16x25x2	—	N/A	A-3

5.3 Appendix C – Certifications

5.4 Appendix D – Test Data

District:	—	Unit#	5	Date :	5/23/2025	OSA Temp	Heating Return Temperature:	Hard Enter	Cooling Return Temperature:	Hard Enter
School:	—	Room #	N121	Lead Technician :	Matt	50	Heating Supply Temperature:	Hard Enter	Cooling Supply Temperature:	Hard Enter
HVAC Unit Name (District ID)	AC-3	Building #	1	Design Drawings ?	No		Heating Temp Split	40	Cooling Temp Split	33

System Components				Outside Air and Economizers		Controls and DCV	
Unit Type	Package Gas/Elec	Heating Type	Gas heat	Type of OSA Damper	Powered Vent	Control Type	Local Thermostat
Economizer Present in system	Yes	Cooling Type	Compressor air conditioning	Occupancy Category (Room Type)	MPR	Controls Access?	Hard Enter
Econ Functioning	No	Cooling Stages	2	Actual Occupancy	25	Controls Functioning Correctly?	Hard Enter
Powered Exhaust Present	No	Heating Stages	1	Floor area (sf)	2100	Existing Co2 (Dcv)?	No
Power Exhaust funct	No	Equipment Age	16	Required OSA (CFM) (Design)	1050	DCV Upgrade Feasable?	Hard Enter

Schedule and Setpoints	Occupied Heating	Occupied Cooling	Unoccupied Heating	Unoccupied Cooling
Time	6:00:00AM	6:00:00AM	5:00:00PM	5:00:00PM
Days	M-F	M-F	Sat-Sun	Sat-Sun
Temp	70	74	50	78
Fan Setting	Auto	Auto	Auto	Auto

Equipment Nameplate Data

Package Unit / Condenser / Chiller (Outdoor Unit)		Data For Both		Furnace/Air Handler / Boiler (Indoor Unit)	
Manufacturer	Trane	Heating Input Capacity (kBtuh)	138	Manufacturer	Trane
Mfg. Date	2009	Heating Output Capacity (kBtuh)	122	Model Number	—
Model Number	YSC102E4RMA0001	Cooling Output Capacity (kBtuh)	102	Serial Number	—
Serial Number	924101604L	Nameplate Max Ext SP	0.7000	Can Filter Rack fit 2"	Yes
Cooling Tons	9	Volts	460	Spare	
Refregerant Type	R-22	Phase	3	Spare	

Filtration	Quantity	Size	Current MERV
Filter 1	4	20x25x2	16
Filter 2	—	N/A	16
Filter 3			
Filter 4			
Filter Count#	4	MERV 13 UPGRADE?	#N/A

Motor Data		Fan Data	
Direct/Belt drive	Belt	Fan Sheave Model	Bk80
Constant / Variable	No	Shaft Diameter (in)	1
Manufacturer	GE	Shaft Centerline (in)	16
Motor RPM	1725	Fan Rpm	880
Hp	2	Grooves (# Belts)	1
Amps	3	Belt Size	A-35
Volts	460		
Phase	3	**Economizer**	
Service Factor	1	Economizer required? (2013)	The system was installed before the 2
Frame Size	145T	Model of Actuator	—
Motor Sheave Model	BK60	High Limit Type	Fixed Enthalpy + Fixed Dry Bulb
Shaft Diameter (in)	1	High Limit Setting	65
Pitch Diameter (in)	5.5"	Min Position (%)	10%
Fan Speed Tap Setting	Med/Low	Low Spd Min Pos (%)	—
		(CO2) Setpoint (ppm)	800

Power Exhaust		Test Notes
Power Exhaust funct :	No	
Supply Airflow CFM	—	
Ext. Airflow CFM	—	

Pre Mod Measurements (As Found)		Post Mod Measurements (As Left)	
Supply Design (CFM)	3400	Supply Design (CFM)	
Supply CFM (Sum Term.)	2438	Supply CFM (Sum Term.)	
Supply CFM (Pitot)	0	Supply CFM (Pitot)	
Return Design (CFM)	3060	Return Design (CFM)	
Return CFM (Sum Term.)	-1587	Return CFM (Sum Term.)	
Return CFM (Pitot)	0	Return CFM (Pitot)	
Estimated OSA (Sup-Ret)	851	Estimated OSA (Sup-Ret)	
Measured OSA CFM	851	Measured OSA CFM	
Motor RPM (Actual)	1725	Motor RPM (Actual)	
Fan RPM (Actual)	880	Fan RPM (Actual)	
Supply SP (inwc)	0.1470	Supply SP (inwc)	
Return SP (inwc)	-0.0927	Return SP (inwc)	
Filter DP	0.0000	Filter DP	
Coil DP	0.0000	Coil DP	
Total Sp. (Fan)	0.000	Total Sp. (Fan)	
Ext. Static Pressure (Actual)	0.240	Ext. Static Pressure (Actual)	
Building Press. (inwc)	0.000	Building Press. (inwc)	
Motor Amps (Actual)	3	Motor Amps (Actual)	
Motor Input Power (BHP)	3	Motor Input Power (BHP)	

Results	
Required Minimum OSA CFM	1050
Equipment Max External Static Pressure	0.70
Measured External Static Pressure	0.24
% OSA (Current OSA/Reqired OSA)	81%
Current OSA Damper Position	10%
CFM/Ton	287
CFM sqft	1.62
Analysis	
Required Outside Air Ventillation (CFM)	1050
Actual Measured Outside Air Ventillation (CFM)	851
OSA Ventillation Pass/Fail	Fail
MERV Rating Target	13
Actual Achievable MERV rating for Unit	13
Filtration Pass/Fail	#N/A
Setpoints and Schedules Optimized for Energy Effeciency?	No
Is Network Based Controls Needed?	No
Does the Unit Currently Have DCV?	Yes
Repair/Replace	Replace
Additional Investment in this Equipment Recommended?	No

Assessed Areas	Repairs and Adjustments	Remaining Deficiencies	Remaining Deficiency Notes
Filters & Airflow Distribution & Pressurization	Belt Replaced	No Remaining Defeciencies	No Additional Notes
Outside Air	No Adjustement Possible	Outdoor air controller is broken (no power or has fault)	No contingency funds available for repairs.
Economizer & DCV	No Adjustement Possible	Trouble shoot Damper Controller	No contingency funds available for repairs.
Operational Controls	No adjustments necessary	Need to Update Controls With wifi, C02 & DCV	Equipment needs to be replaced
General Maintenance	Replaced Belt	Clean condenser and evaporator coils	No contingency funds available for repairs.
Repair or Replacement Recommendation	Replace	Due to high repair costs, increased operational expenses, freq	Due to high repair costs, increased operational expenses, frequent maintenance requirements, decreased reliability, reduced environmental efficiency, and diminished performance