



**GILES COUNTY**  
PUBLIC SCHOOLS

**DIVISION WIDE FACILITY STUDY  
DECEMBER 2022**



**Crabtree, Rohrbaugh & Associates - Architects**  
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Virginia • Pennsylvania • Maryland • West Virginia



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## INTRODUCTION

- The goal of this report is to provide the Giles County Public Schools with a comprehensive overview and evaluation of the educational buildings, including identifying facility deficiencies and recommendations for improvement. A range of facility concepts, considering both short and long term needs, has been developed for consideration by the Giles County Public Schools. As such, this study is considered to be a benchmark report, developed to provide the School Board with the information and resources to be able to implement an improvement plan and guide facility maintenance, upgrades, renovations, additions, and/or possible new construction in the future.
- The completion of this Facility Study represents the opportunity to begin a more detailed planning and implementation phase, for any identified desirable facility concept.

### Crabtree, Rohrbaugh & Associates Report Team

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***“The Vision of the 21<sup>st</sup> century school is one that is and student centered and teacher facilitated, supporting real-world, authentic project based learning; STEM driven and supported by instructional technology. Globalization and rapid technological advancements will continue to affect school design into the twenty-first century. Schools and their instructional spaces, technology and communities will change over time, in ways that cannot yet be predicted. Technology will increasingly become the facilitator, requiring school facilities to be flexible and adjustable in their organization and use of space”***



## Forward

Crabtree, Rohrbaugh & Associates is pleased to present this Facility Study to the Giles County Public Schools. This report has been developed to assist the Giles County Public Schools Board of Directors, staff and community in the decision making process regarding the future utilization and disposition of the current educational facilities. As such, the report will provide an update as to the current overall status of the high school, with respect to the physical condition as well as the educational adequacy and appropriateness, student enrollment, and building capacity.

This report should be viewed as a starting point, providing the framework from which facilities plan can be implemented for desirable improvements to the educational facilities. Any recommendations that result in new construction and/or upgrades to the present educational facilities should be structured to align with the Giles County Public Schools Goals and Objectives, Educational Philosophy, Core Beliefs and Educational Programs.

### Principles of the Report

In the Commonwealth of Virginia, the Code of Virginia, as well as the Departments of Education, Environmental Quality, and Labor & Industry have established guidelines for school programs, school sites, buildings and supporting facilities needed to provide a well-rounded, complete and safe educational experience for the students. These guidelines include:

- Curriculum regulations, including Virginia Standards of Learning, implementation of the Elementary & Secondary Education Act (NCLB), and changing Special Education and Programming requirements that will continue to impact facilities.
- School sites must be of adequate size to provide for the safety of the students, provide outdoor play areas, bus loading and unloading and parking for staff and visitors.
- Learning environments should be learner-centered, developmentally and age appropriate, safe, comfortable, accessible, flexible, and equitable, in addition to being cost effective.
- School facilities should meet the educational, physical, intellectual, social and emotional needs of students and create an environment that will encourage students to learn.
- Flexibility in design, including providing spaces for 21<sup>st</sup> century collaborative and hands-on learning opportunities, is critical and essential for educational facilities.
- With the ability to communicate globally and the information explosion that technology has facilitated, schools will need to remain flexible and adaptable to respond to twenty first century educational technology and teaching and learning styles.



- Cost of school construction, energy and ongoing maintenance and operation of school facilities will continue to be a major financial impact to school districts. It will become increasingly important to consider cost effective solutions to address these ongoing important issues.

## Forward

### Assumptions

#### General

- The citizens of the Giles County Public Schools desire to provide an educational opportunity for all students and will support the limited funding required to maintain equitable, quality educational environments at all levels.
- The intent of this report is to provide the Giles County Public Schools with the planning information necessary to allow for decision-making regarding the effective and efficient utilization of the existing educational buildings.
- Detailed educational programming and design is not part of the scope of this study. Any planning and design necessary for any project that the school division may undertake should be part of a comprehensive and integrated educational planning and design process, involving all stakeholders.

#### Demographic

- According to the US Census Bureau, the population of Giles County reduced by approximately 1,264 residents from 2010 to 2021. Children under the age of 18 make up approximately 20.4%.
- Between the 2014-15 school year and the 2021-22 school year, student enrollment at Giles County Public Schools reduced by 185 students from 2,423 to 2,238.
- Between the 2014-15 school year and the 2021-22 school year, Eastern Elem/Middle Schools decreased by approximately 65 students, and Narrows and Macy McClaughtery Elem/Middle School increased by approximately 10 and 15 students respectively.
- Between the 2014-15 school year and the 2021-22 school year, Narrows High School and Giles High School decreased by approximately 65 and 144 students respectively.
- Enrollment can be affected by factors such as: internal school division policy changes, external factors, and other considerations such as emerging and changing housing and population trends.



## Forward

### Assumptions, cont'd

- Construction of new housing and annual live birth data may have a direct effect on the enrollment projections and should be monitored annually. Although the population in the school division will likely remain relatively steady or slightly decrease, there is no anticipated significant increase in overall population expected in the near future. Housing and population trends should be monitored annually.
- For planning purposes, reviewing and updating annual live birth and retention ratios, as well as monitoring census data, housing data and changes in local land development is important. Using recent historical averages as a planning tool is recommended.

### Organization / Academic

- Providing space for special programming, social services, special education and “pull-out” programs such as art, music, reading support and other resource activities will reduce the functional capacity of school buildings.
- The class size guidelines of the Giles County Public Schools can have an effect on the day-to-day functional capacity of the facilities.
- As teaching strategies change and programs are adjusted to meet the changing pedagogy of 21<sup>st</sup> century needs and different learning styles of students, facilities are affected. Some students learn best in large groups, while others learn best in visual presentations or through written or spoken communications. Schools must maintain the flexibility to adapt to various teaching strategies and learning styles, and accommodate an ever-increasingly sophisticated and integrated use of instructional technology.
- Providing a school environment that allows for various types of learning and demonstration of competencies requires flexibility and adaptability of physical space.
- School Divisions must accept the challenges of NCLB and the Standards of Learning as a long-term, necessary investment of money, time, and focus in an effort to participate in a state-wide effort to in making a commitment to help all students succeed at the high levels envisioned.

### Facilities

- Schools should be safe and accessible to all students and adults, be adequately sized to meet educational planning standards and criteria, and provide for a comfortable environment to facilitate year-round use and the inclusion of technology as a teaching tool.



- School facilities should include a variety of learning spaces such as instructional classrooms, small and large group learning areas, specialized instruction space and laboratories.

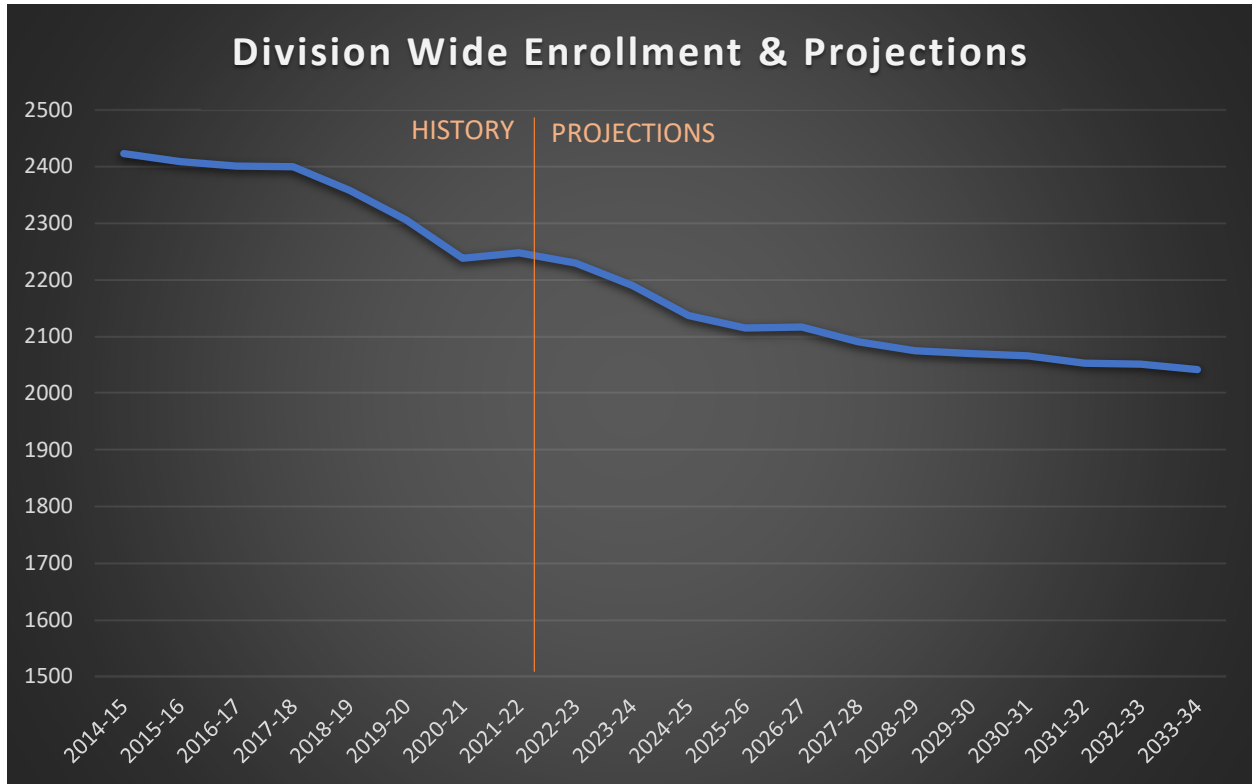
## Forward

### Assumptions, cont'd

- School sites should be safe and accessible and provide for efficient and safe movement of vehicular and pedestrian traffic. Adequate parking and bus drop-off areas should be provided and ideally separated to insure safety and efficiency. Athletic fields and recreation areas should be provided to reinforce the educational program and extra-curricular activities.
- The school should be a permanent part of the community. The potential use of temporary classroom units should be considered as short-term solutions only.
- Schools are dedicated to the concept of group instruction, however, must have the facilities to reinforce the emphasis on self-directed and individualized learning that has emerged. New courses of study and expansion and development of educational curriculum offerings in the school have created the need for more specialized rooms, requiring flexible spaces of varying sizes. School facilities should be efficiently designed, with clearly delineated paths of travel. School buildings need to accommodate large numbers of students in an efficient and safe manner. Opportunities to utilize STEM type, hands-on collaborative learning spaces should be maximized.
- Research shows that student learning styles have changed. In the design of current educational facilities, therefore we need learning spaces to accommodate a new generation who:
  - Prefer multitasking and quick, non linear access to information;
  - Are visually- oriented;
  - Are highly networked, interactive and social;
  - Increasingly mobile;
  - Have a low tolerance for lecture style teaching;
  - Prefer active learning rather than passive learning;
  - Rely heavily on communications technologies to access information and to carry out social and professional interactions.
- The appearance of school buildings provides a first and lasting impression of the school system to both children and adults. The quality of the educational opportunities is inferred. Continuing efforts should be made to maintain the interior and exterior of all school facilities.



**Demographics**



- Between the 2014-15 school year and the 2021-22 school year, student enrollment at Giles County Public Schools reduced by 185 students from 2,423 to 2,238.
- Live births from 2009 – 2020 have remained approximately level with a slight reduction over time.

Giles County

Live Births 2012-2022

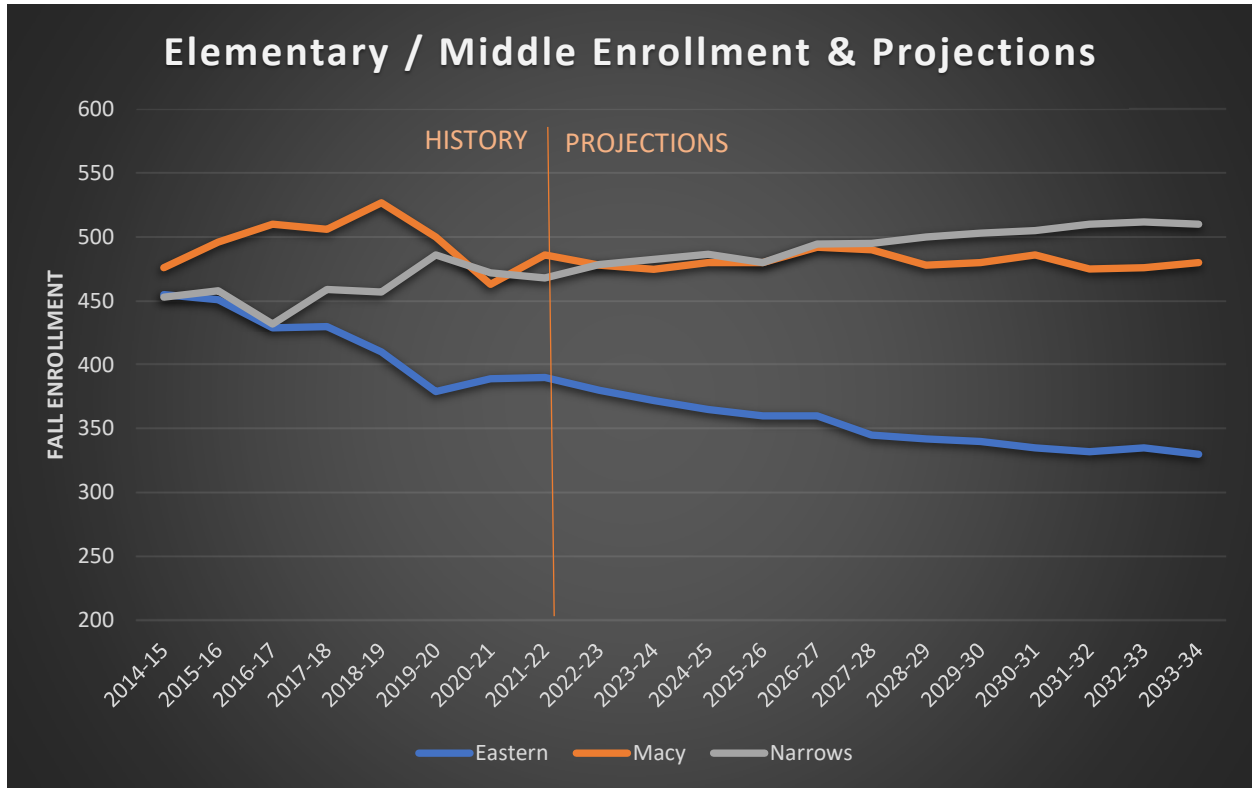
Data: Virginia Department of Health

2009	173	births
2010	196	births
2011	179	births
2012	189	births
2013	149	births
2014	186	births
2016	174	births
2017	165	births
2019	155	births
2020	168	births
2021	not yet available	

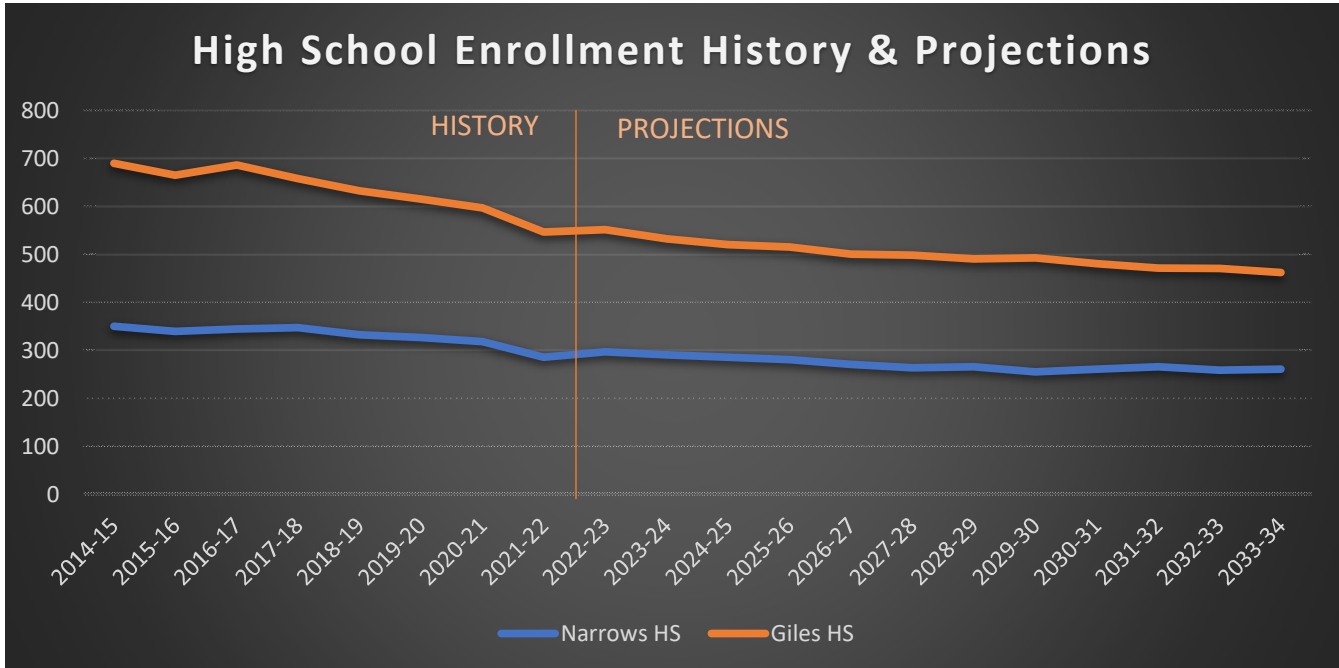




- According to the US Census Bureau, the population of Giles County reduced by approximately 1,264 residents from 2010 to 2021. Children under the age of 18 make up approximately 20.4%.
- It is probable that Giles County Public Schools will see a slight decrease in enrollment over the next 10 years if the population of the County continues to decrease.



- Between the 2014-15 school year and the 2021-22 school year, Eastern Elem/Middle Schools decreased by approximately 65 students, and Narrows and Macy McClauthery Elem/Middle School increased by approximately 10 and 15 students respectively.

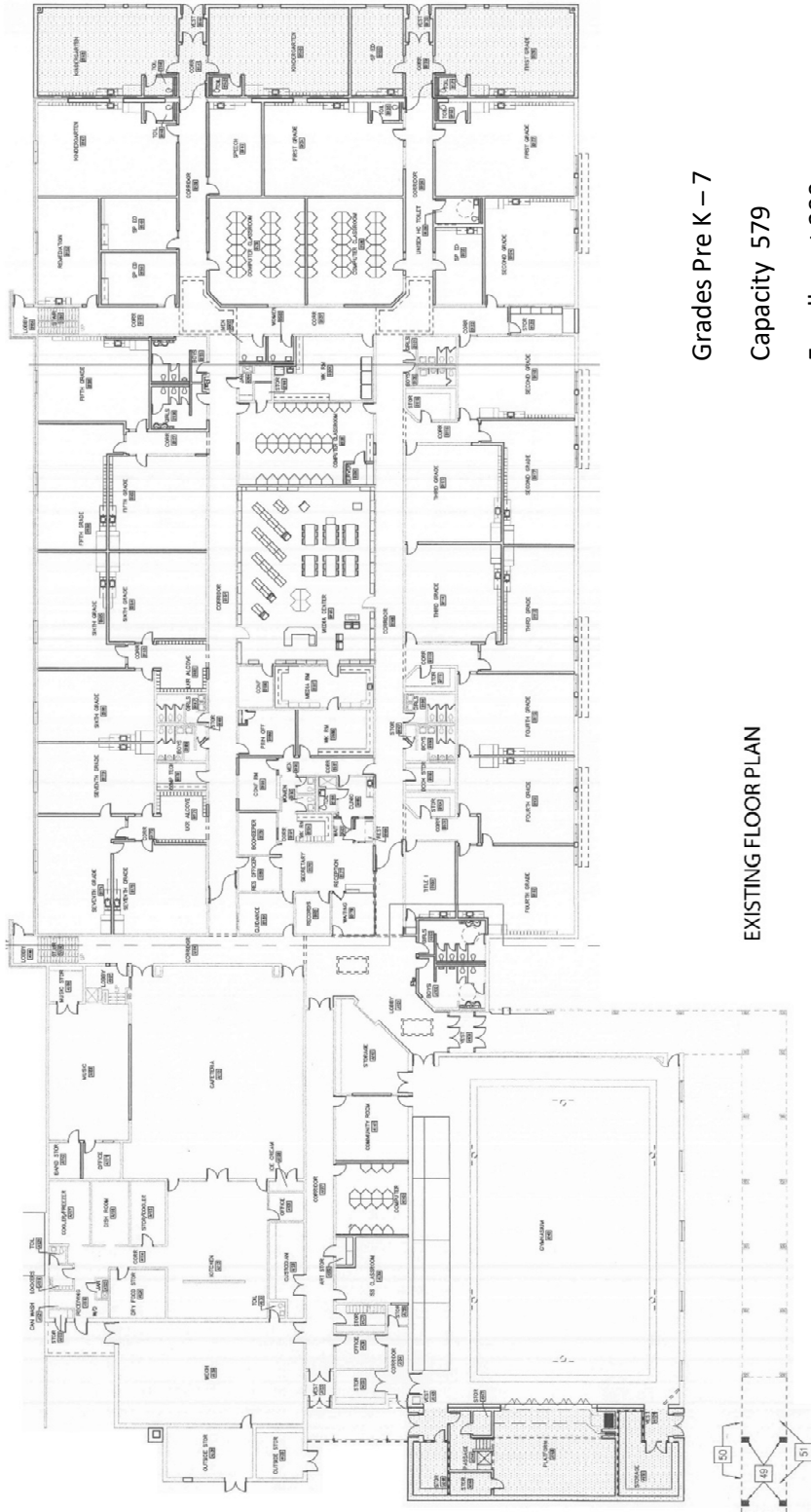


- Between the 2014-15 school year and the 2021-22 school year, Narrows High School and Giles High School decreased by approximately 65 and 144 students respectively.
- Summary: Division Enrollment can be affected by factors such as: internal school division policy changes, external factors, online learning, and other considerations such as emerging and changing housing and population trends. Based on the recent history and relatively flat birthrates, it is probable that enrollment will remain flat or slightly decrease over the next 10 years.



**EXISTING SCHOOL CAPACITY**

Eastern Elementary / Middle School

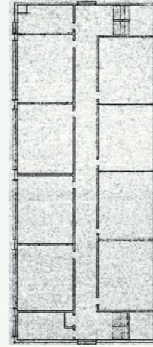
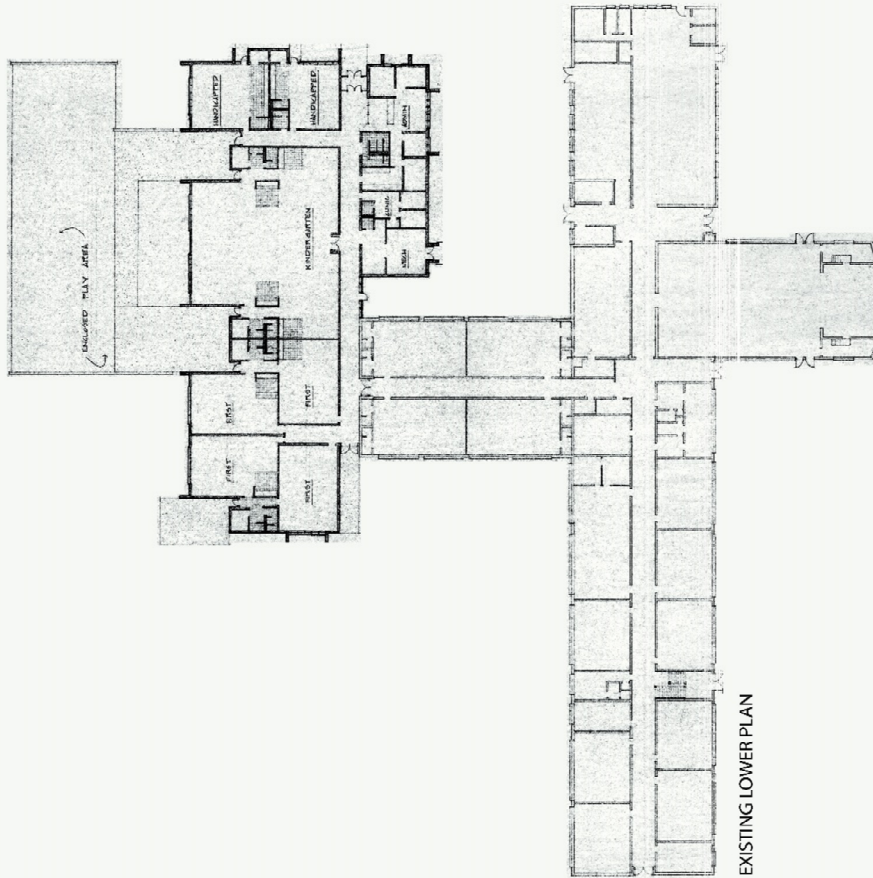


Grades Pre K – 7  
Capacity 579  
Enrollment 390

EXISTING FLOOR PLAN



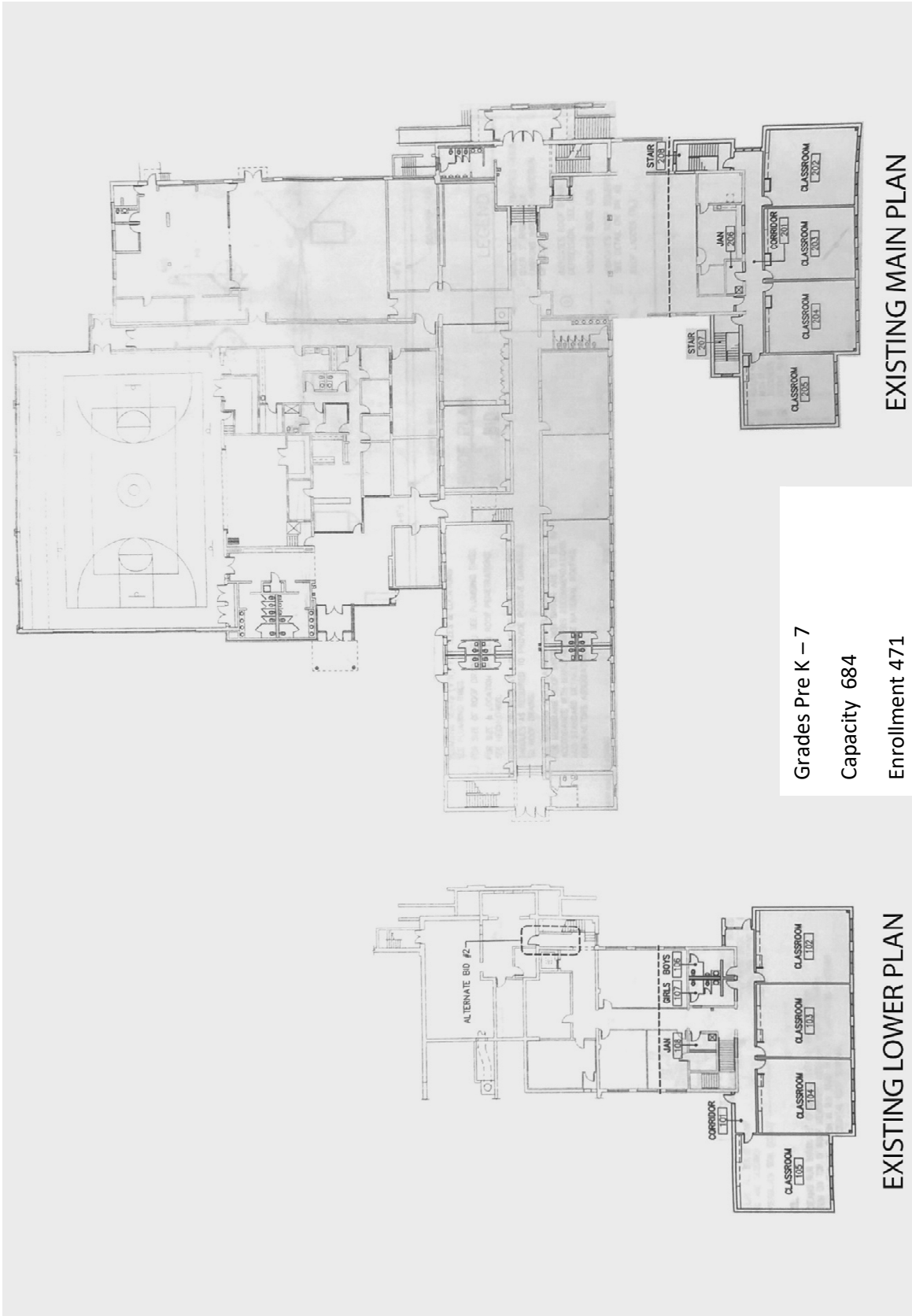
Macy McClauthery Elementary / Middle School



Grades Pre K – 7  
Capacity 457  
Enrollment 472

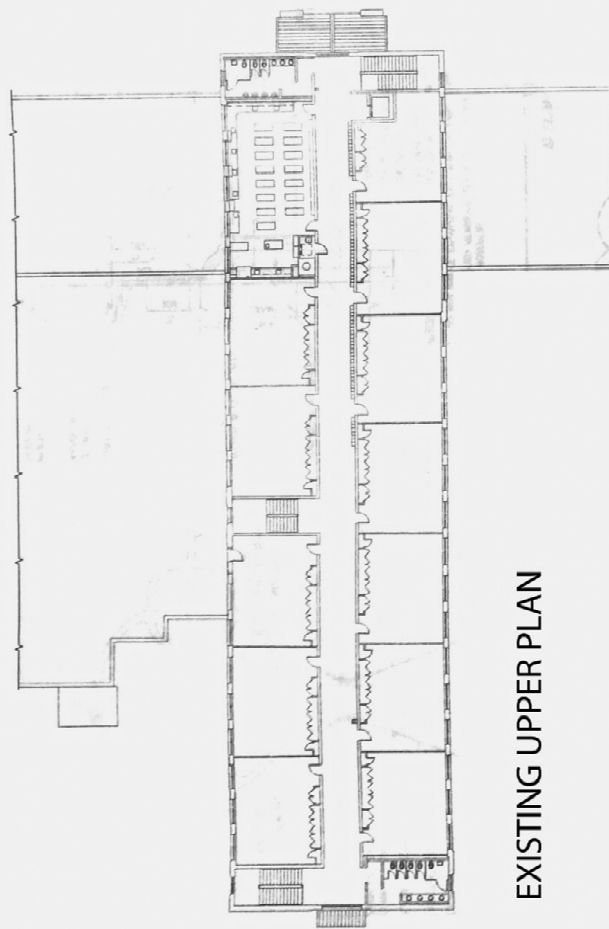


Narrows Elementary / Middle School – First Floor Plan





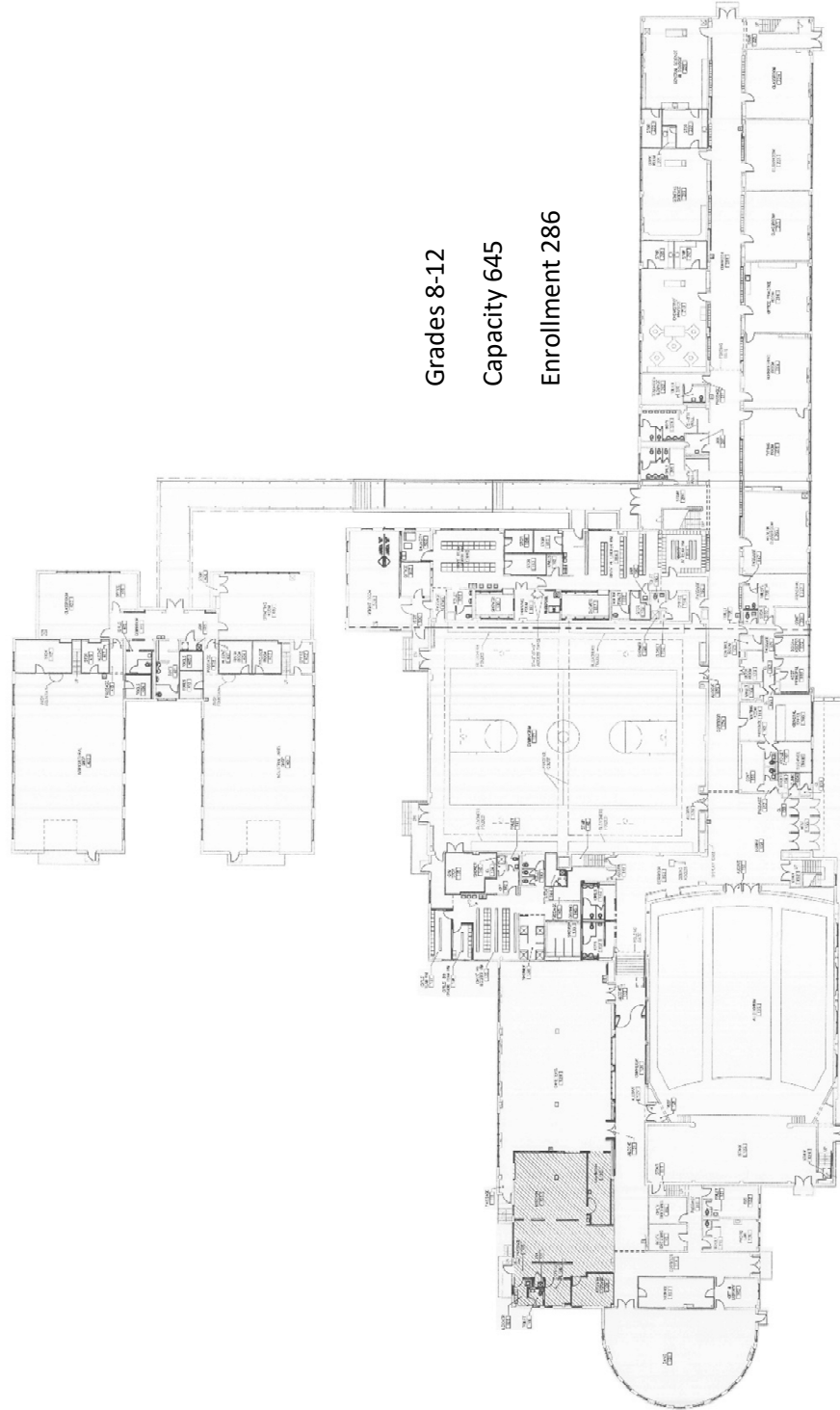
Narrows Elementary / Middle School – Second Floor Plan



EXISTING UPPER PLAN



Narrows High School – First Floor Plan

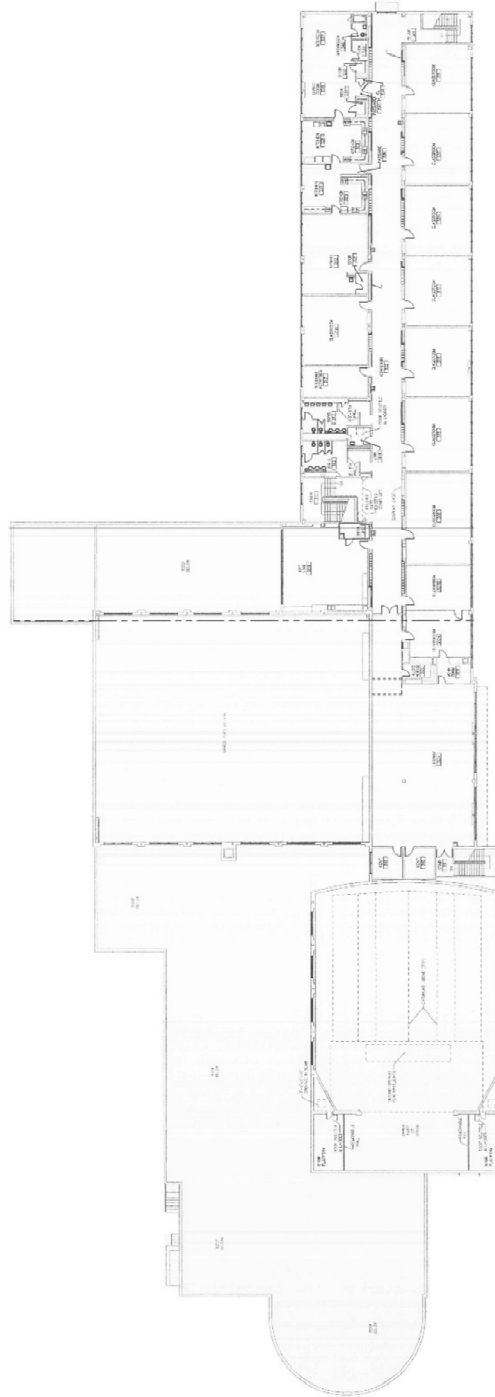


Grades 8-12  
Capacity 645  
Enrollment 286

EXISTING LOWER PLAN



Narrows High School – Second Floor Plan



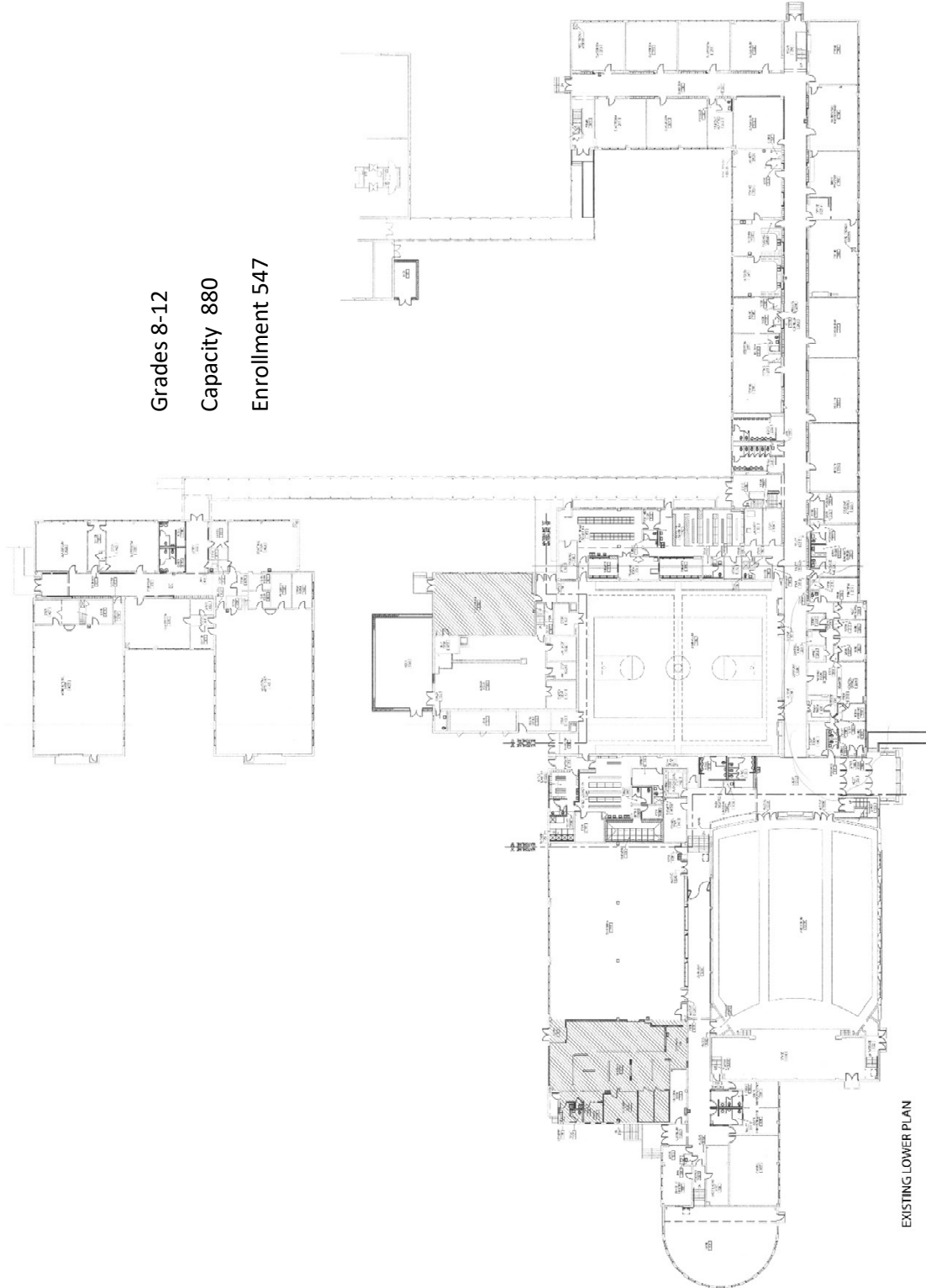
EXISTING UPPER PLAN





Giles High School – First Floor Plan

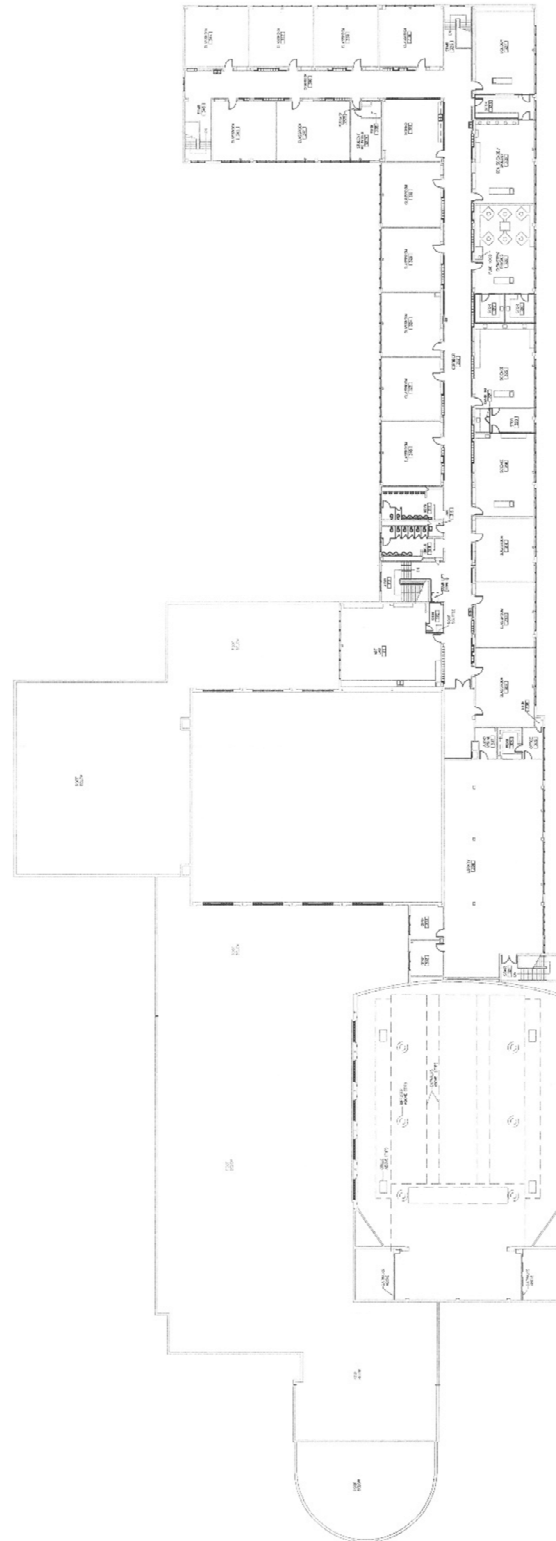
Grades 8-12  
Capacity 880  
Enrollment 547



EXISTING LOWER PLAN



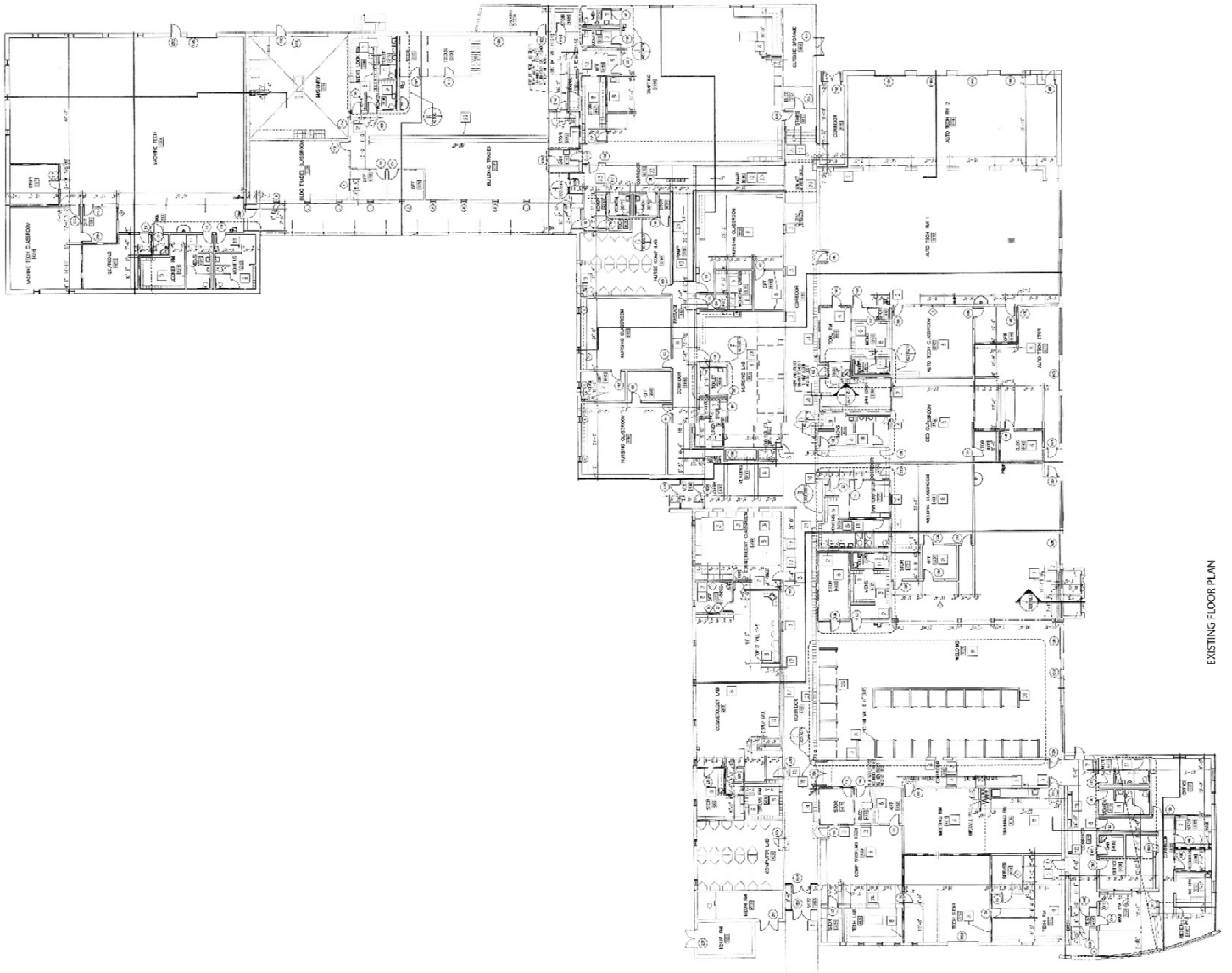
Giles High School – Second Floor Plan



EXISTING UPPER PLAN



Giles Tech Center



EXISTING FLOOR PLAN

GILES COUNTY PUBLIC SCHOOLS  
EASTERN ES-MS

SCALE	DESCRIPTION	FCI %	TIMELINE
5 NEW	New or like-new condition; Reevaluate in 8 - 10 years	91% - 100%	15-20 YRS.
4 GOOD	Minimal wear for age, no issues	61% - 90%	10-15 YRS.
3 FAIR	Average wear for age, approaching end of lifecycle	31% - 60%	6-10 YRS.
2 POOR	Worn from use or age, end of expected lifecycle	16% - 30%	2-6 YRS.
1 CRITICAL	Extremely worn or damaged, replace as soon as possible	0% - 15%	< 2 YRS.

FACILITY CONDITION INDEX (FCI)   Assessed							ESTIMATED CONSTRUCTION COST			
Site	5	4	3	2	1	NA	Comments & Recommendations	Low	to	High
	•	•	•	•	•	•				
1 Perimeter Fencing & Gates						X		\$0	-	\$0
2 Athletic Fields						X		\$0	-	\$0
3 Athletic Field Structures, Scoreboards						X		\$0	-	\$0
4 On-Site Sidewalks		X					Concrete	\$0	-	\$0
5 Play Equipment		X						\$150,000	-	\$180,000
6 Paving		X					Bituminous	\$350,000	-	\$420,000
7 Striping, Markings, Speed Bumps		X						\$0	-	\$0
8 Curbing		X					Concrete	\$210,000	-	\$252,000
9 On-Site Signage		X						\$35,000	-	\$42,000
10 Exterior Furniture, Bike Racks, Storage		X						\$0	-	\$0
11 Retaining Walls, Site Walls						X		\$0	-	\$0
12 Freestanding Walkway Canopies		X					Brick piers with stucco cap.	\$30,000	-	\$36,000
13 General Grounds		X						\$0	-	\$0
							<i>Subtotal</i>	\$775,000	-	\$930,000

Site Accessibility	5	4	3	2	1	NA	Comments & Recommendations	Low	to	High
1 Pedestrian Access - ADA & Safety			X					\$0	-	\$0
2 Vehicular Access - Vehicles		X					Asphalt with concrete curbs.	\$0	-	\$0
3 Vehicular Access - Buses		X					Asphalt with concrete curbs.	\$0	-	\$0
4 Vehicular Access - Deliveries		X						\$0	-	\$0
5 Handicap Parking		X						\$0	-	\$0
6 Accessible Entry		X					Concrete and concrete paver walks.	\$0	-	\$0
7 Exterior Stairs and Railings		X					Concrete stairs with metal pipe rails.	\$0	-	\$0
8 Exterior Ramps		X					Concrete with metal pipe rails. Exterior railings at 36" above finish grade. Ramp located at side of roadside parking lot.	\$0	-	\$0
							<i>Subtotal</i>	\$0	-	\$0



GILES COUNTY PUBLIC SCHOOLS  
EASTERN ES-MS

Exterior Building Envelope	5	4	3	2	1	NA		Low	to	High
1 Structure		X					CMU bearing wall, steel beam and joist roof structure, tectum and metal deck.	\$0	-	\$0
2 General Appearance			X					\$0	-	\$0
3 Roof				X			Membrane roof system, cracking at lap sealants observed. Visible difference between the main building roof and addition. Main building has lifting seams and joints as well as lap sealants that are alligatoring. Perimeter copings have seams that are lifting with broken rivets and screws. Reported minor leaking occurring intermittently. Evidence of scupper overflows.	\$250,000	-	\$325,000
4 Soffits		X					Plaster ceiling surfaces.	\$0	-	\$0
5 Walls				X			Brick condition varies around the building perimeter. In several areas black staining is occurring, which may indicate moisture intrusion issues. Sill surfaces on the north side have moss growing on them. Reported leaking at Gymnasium where sealants have been applied, which has offered some help, but has not eliminated the problem. The sealant in several masonry control joints is separating/cracking. Joints appear too narrow to support sealant which may be contributing to the failure.	\$50,000	-	\$65,000
6 Doors & Hardware			X				Painted aluminum storefront with panic hardware at main entrance. Hollow metal doors and frames at secondary exterior entrances with panic bar hardware. Some areas have worn paint.	\$0	-	\$0
7 Windows				X			Painted aluminum window frames with insulated glazing. Appears to be in good condition. Areas where sealant repair is required	\$5,000	-	\$7,500
8 Miscellaneous								\$0	-	\$0
<i>Subtotal</i>								\$305,000	-	\$397,500

Interior Elements - ENTRY	5	4	3	2	1	NA		Low	to	High
1 Finishes - Walls		X					Painted drywall.	\$0	-	\$0
2 Finishes - Flooring		X					VCT	\$0	-	\$0
3 Finishes - Ceilings		X					Acoustical ceiling tile.	\$0	-	\$0
4 Casework and Millwork							NA	\$0	-	\$0
5 Signage/ Wayfinding		X					Minimal signage and graphics.	\$0	-	\$0
6 Moveable/Operable Partitions							NA	\$0	-	\$0
7 Doors - Frame and Door		X					Painted hollow metal frames with wood doors. Lever hardware.	\$0	-	\$0
8 Food Service Equipment		X					ADA Water fountains. Not recessed, extends into lobby space.	\$0	-	\$0
9 Toilet Rooms		X					Public toilet rooms accessible from the main lobby appear to be recently updated including ADA upgrades. Tile floors, painted CMU walls, acoustical ceiling tiles and solid polymer toilet partitions.	\$0	-	\$0
<i>Subtotal</i>								\$0	-	\$0



GILES COUNTY  
PUBLIC SCHOOLS

DIVISION WIDE FACILITY STUDY



GILES COUNTY PUBLIC SCHOOLS  
EASTERN ES-MS

Interior Elements - ADMINISTRATION	5	4	3	2	1	NA		Low	to	High
1 Finishes - Walls		X					Painted CMU and drywall.	\$0	-	\$0
2 Finishes - Flooring		X					Luxury vinyl tile, VCT in support areas.	\$0	-	\$0
3 Finishes - Ceilings		X					Acoustical ceiling tile.	\$0	-	\$0
4 Casework and Millwork		X					Plastic laminate casework, some doors do not close. No ADA transaction counter. ADA desk at Main Office.	\$0	-	\$0
5 Signage/ Wayfinding		X					Acrylic room name plaques.	\$0	-	\$0
6 Doors - Frame and Door		X					Painted hollow metal frames with wood doors. Lever hardware.	\$0	-	\$0
7 Student Lockers						X	NA	\$0	-	\$0
8 Toilet Rooms			X				Non ADA compliant staff bathroom. CMU walls, VCT floor and acoustical tile ceiling.	\$0	-	\$0
<i>Subtotal</i>								\$0	-	\$0

Interior Elements - CORRIDORS	5	4	3	2	1	NA		Low	to	High
1 Finishes - Walls		X					Painted CMU	\$0	-	\$0
2 Finishes - Flooring		X					VCT	\$0	-	\$0
3 Finishes - Ceilings			X				Acoustical ceiling tile, minor blemishes/staining. Tile staining the result of roof leaks.	\$0	-	\$0
4 Casework and Millwork			X				Casework not used.	\$0	-	\$0
5 Signage/ Wayfinding			X				Acrylic room number and braille plaque into rooms.	\$0	-	\$0
7 Doors - Frame and Door			X				Painted hollow metal frames with wood doors. Lever hardware. Some doors do not have ADA clearance on pull side. 2 - 90 min. fire doors with hold opens as fire separation in corridor.	\$0	-	\$0
8 Student Lockers		X				X	NA	\$0	-	\$0
9 Toilet Rooms		X				X	See core toilet rooms.	\$0	-	\$0
<i>Subtotal</i>								\$0	-	\$0

Interior Elements - CORE TOILET ROOMS	5	4	3	2	1	NA	Core bathrooms in classroom wing.	Low	to	High
1 Finishes - Walls		X					Painted CMU.	\$0	-	\$0
2 Finishes - Flooring		X					Ceramic tile.	\$0	-	\$0
3 Finishes - Ceilings		X					Acoustical ceiling tile.	\$0	-	\$0
4 Casework and Millwork		X					Solid polymer toilet partitions.	\$0	-	\$0
5 Signage/ Wayfinding		X					Boys and girls plaques.	\$0	-	\$0
6 Doors - Frame and Door		X					Painted hollow metal frames with wood doors.	\$0	-	\$0
7 Toilet Rooms		X					4 shared bathrooms in plan, one is ADA compliant.	\$0	-	\$0
<i>Subtotal</i>								\$0	-	\$0



GILES COUNTY PUBLIC SCHOOLS  
EASTERN ES-MS

Interior Elements - CLASSROOMS	5	4	3	2	1	NA		Low	to	High
1 Finishes - Walls		X					Painted CMU.	\$0	-	\$0
2 Finishes - Flooring		X					VCT	\$0	-	\$0
3 Finishes - Ceilings		X					Acoustical ceiling tile.	\$0	-	\$0
4 Casework and Millwork		X					Laminate casework generally throughout.	\$0	-	\$0
5 Signage/ Wayfinding		X					Acrylic name plaques with braille.	\$0	-	\$0
6 Moveable/Operable Partitions						X	NA	\$0	-	\$0
7 Doors - Frame and Door		X					Painted hollow metal frames with wood doors. Lever hardware.	\$0	-	\$0
8 Student Lockers		X					Cubbies in lower grade classrooms.	\$0	-	\$0
9 Toilet Rooms			X				VCT floors with painted CMU walls in lower grade classrooms.	\$0	-	\$0
<i>Subtotal</i>								\$0	-	\$0

Interior Elements - LIBRARY	5	4	3	2	1	NA		Low	to	High
1 Finishes - Walls		X					Painted CMU	\$0	-	\$0
2 Finishes - Flooring		X					Carpet tile, some open seams.	\$0	-	\$0
3 Finishes - Ceilings		X					Acoustical ceiling tile.	\$0	-	\$0
4 Casework and Millwork			X				Plastic laminate casework, circulation desk not ADA.	\$0	-	\$0
5 Signage/ Wayfinding		X					No library signage.	\$0	-	\$0
6 Moveable/Operable Partitions							NA	\$0	-	\$0
7 Doors - Frame and Door		X					Painted hollow metal frames with wood doors. Lever hardware.	\$0	-	\$0
<i>Subtotal</i>								\$0	-	\$0

Interior Elements - CAFETERIA	5	4	3	2	1	NA		Low	to	High
1 Finishes - Walls		X					Painted CMU and brick (Kitchen Ceramic tile over CMU and painted CMU - 4)	\$0	-	\$0
2 Finishes - Flooring		X					VCT (Kitchen quarry tile - 4)	\$0	-	\$0
3 Finishes - Ceilings		X					Acoustical ceiling tile, some staining due to water damage. (Kitchen washable tile - 4)	\$0	-	\$0
4 Casework and Millwork						X	NA	\$0	-	\$0
5 Signage/ Wayfinding						X	No signage, wayfinding lacks throughout the school.	\$0	-	\$0
6 Moveable/Operable Partitions						X		\$0	-	\$0
7 Doors - Frame and Door		X					Painted hollow metal frames with wood doors. Panic hardware.	\$0	-	\$0
8 Food Service Equipment		X					Newer equipment, 7-9 years old. Walk-in coolers, hand sink.	\$0	-	\$0
9 Stage, Curtains, etc.		X					Fabric covered acoustical panels at perimeter walls.	\$0	-	\$0
10 Bleachers - Seating							Portable	\$0	-	\$0
<i>Subtotal</i>								\$0	-	\$0



GILES COUNTY PUBLIC SCHOOLS  
EASTERN ES-MS

Interior Elements - GYMNASIUM	5	4	3	2	1	NA		Low	to	High
1 Finishes - Walls		X					Painted CMU. Leaks at walls reported from ongoing issue. One area observed of recent issue.	\$0	-	\$0
2 Finishes - Flooring		X					Wood athletic floor.	\$0	-	\$0
3 Finishes - Ceilings		X					Exposed structure with painted metal deck.	\$0	-	\$0
4 Casework and Millwork						X	NA	\$0	-	\$0
5 Signage/ Wayfinding						X	NA	\$0	-	\$0
6 Moveable/Operable Partitions			X				Vinyl covered panels located on the stage to enclose the music room.	\$0	-	\$0
7 Doors - Frame and Door		X					Painted hollow metal frames with wood doors. Panic hardware at egress doors, lever hardware at support spaces.	\$0	-	\$0
9 Stage, Curtains, etc.							No divider curtain.	\$0	-	\$0
10 Gymnasium Equipment		X					Padding at each primary end in good condition. Retractable baskets at sides and ends, anchored from ceiling structure. Row of acoustical panels along upper wall perimeter.	\$0	-	\$0
11 Bleachers		X					Molded plastic. Good condition. No maintenance issues reported.	\$0	-	\$0
12 Toilet Rooms						X	NA	\$0	-	\$0
<i>Subtotal</i>								\$0	-	\$0

Interior Accessibility	5	4	3	2	1	NA		Low	to	High
1 Stairs, Ramps and Railings			X				36" high railings at exterior ramp.	\$0	-	\$0
2 Elevators, Chairlifts				X			ADA lift located between corridor and stage/music room, ongoing maintenance issues with lift reported.	\$8,000	-	\$9,600
3 Doors - Openings and Hardware			X					\$0	-	\$0
4 Toilet Rooms				X			Several toilet rooms have ADA upgrades as indicated prior.	\$15,000	-	\$18,000
5 Signage				X			Minimal signage throughout. General wayfinding not present.	\$500	-	\$600
<i>Subtotal</i>								\$23,500	-	\$28,200

Safety & Security	5	4	3	2	1	NA		Low	to	High
1 Appropriate Exterior Lighting			X					\$0	-	\$0
2 Natural Surveillance			X					\$0	-	\$0
3 Camera System - Interior and Exterior			X					\$0	-	\$0
4 Secure Entry Vestibule			X				No direct visual control of main entrance. Remote electronic control with cameras and audio.	\$0	-	\$0
5 Card Access at Exterior Exits			X					\$0	-	\$0
<i>Subtotal</i>								\$0	-	\$0





GILES COUNTY PUBLIC SCHOOLS  
EASTERN ES-MS

Systems - Plumbing & Fire Protection	5	4	3	2	1	NA		Low	to	High
1 Fire Protection System(s) For Entire Building		x					No issues reported with existing fire protection system.	\$0	-	\$0
2 Camera Inspect Sanitary & Storm Piping	x						No issues of plumbing problems reported by owner.	\$0	-	\$0
3 Replace Plumbing Fixtures		x					Most fixtures were replaced during 2008 renovation/addition. Budget \$500-\$1,000 for replacement of existing fixtures.	\$44,000	-	\$52,800
<i>Subtotal</i>								\$44,000	-	\$52,800

Systems - Electrical	5	4	3	2	1	NA		Low	to	High
1 Electrical Distribution	x							\$0	-	\$0
2 Emergency Generator	x							\$0	-	\$0
3 Interior Lighting and Controls		x					Cost to go to LED lighting with full dimming	\$560,000	-	\$700,000
4 Theatrical Lighting and Controls		x					If LED was desired to delete dimming cabinet and maintenance of Incandescent fixtures.	\$30,000	-	\$50,000
5 Exterior Lighting and Controls		x					Upgrade to LED	\$75,000	-	\$125,000
6 Fire Alarm	x							\$5,000	-	\$10,000
7 Clock System	x							\$0	-	\$0
8 Card Access/Access Control/Door Monitoring	x							\$0	-	\$0
9 Paging / Phone Call in System	x						Owner reported a few speakers not working	\$5,000	-	\$10,000
10 Camera system	x							\$0	-	\$0
11 Intrusion Detection	x						If an intrusion detection system was desired	\$50,000	-	\$75,000
12 Network Cabling / COAX/ WAP		x					Cabling upgrade to Cat6 everywhere	\$240,000	-	\$300,000
13 Sound System/AV - Theatre / Gym / Cafeteria	x							\$0	-	\$0
14 Classroom Technology						x		\$0	-	\$0
<i>Subtotal</i>								\$965,000	-	\$1,270,000



GILES COUNTY PUBLIC SCHOOLS  
EASTERN ES-MS

Systems - HVAC	5	4	3	2	1	NA		Low	to	High
1 Upgrade/Replace Existing HVAC system			x				Prices include replacement of existing 4-pipe induction unit system as well as OAUs.	\$2,782,280	-	\$3,825,635
3 Recommission / Upgrade BAS system/controls		x						\$200,000	-	\$240,000
4 Building Ventilation - DOAS/ERU			x				OAUs to be replaced with units that can maintain low dew-point temperature required for dehumidification of spaces.	\$500,000	-	\$600,000
5 MDF/IDF Cooling and/or Ventilation			x					\$30,000	-	\$45,000
<i>Subtotal</i>								\$3,512,280	-	\$4,710,635

	Low Cost	-	High Cost
< 2 YRS.	\$0	-	\$0
2-6 YRS.	\$328,500	-	\$425,700
6-10 YRS.	\$3,312,280	-	\$4,470,635
10-15 YRS.	\$1,924,000	-	\$2,397,800
15-20 YRS.	\$60,000	-	\$95,000
Total Cost to Upgrade to Current Standards:	\$5,624,780	-	\$7,389,135

Total Cost to Upgrade to Current Standards:

\*COSTS PRESENTED ABOVE IN THE FCI ARE BASED ON 2021-22 COSTS FOR MATERIALS AND CONSTRUCTION



**GILES COUNTY**  
PUBLIC SCHOOLS

DIVISION WIDE FACILITY STUDY



GILES COUNTY PUBLIC SCHOOLS  
MACY MCCLAUGHERTY ES-MS

SCALE	DESCRIPTION	FCI %	TIMELINE
5 NEW	New or like-new condition; Reevaluate in 8 - 10 years	91% - 100%	15-20 YRS.
4 GOOD	Minimal wear for age, no issues	61% - 90%	10-15 YRS.
3 FAIR	Average wear for age, approaching end of lifecycle	31% - 60%	6-10 YRS.
2 POOR	Worn from use or age, end of expected lifecycle	16% - 30%	2-6 YRS.
1 CRITICAL	Extremely worn or damaged, replace as soon as possible	0% - 15%	< 2 YRS.

GILES COUNTY PUBLIC SCHOOLS  
MACY MCCLAUGHERTY ES-MS

FACILITY CONDITION INDEX (FCI)   Assessed							ESTIMATED CONSTRUCTION COST			
Site	5	4	3	2	1	NA	Comments & Recommendations	Low	to	High
	•	•	•	•	•	•				
1 Perimeter Fencing & Gates		X					High chain link fence at playground.	\$0	-	\$0
2 Athletic Fields						X		\$0	-	\$0
3 Athletic Field Structures, Scoreboards						X		\$0	-	\$0
4 On-Site Sidewalks			X					\$0	-	\$0
5 Play Equipment		X						\$0	-	\$0
6 Paving			X	X			Worn paving at entrance. Cracking and loose material observed at some areas throughout paved areas.	\$100,000	-	\$130,000
7 Striping, Markings, Speed Bumps				X			Markings are worn.	\$6,000	-	\$9,000
8 Curbing			X				Concrete curbing.	\$0	-	\$0
9 On-Site Signage			X					\$0	-	\$0
10 Exterior Furniture, Bike Racks, Storage						X		\$0	-	\$0
11 Retaining Walls, Site Walls						X		\$0	-	\$0
12 Freestanding Walkway Canopies						X		\$0	-	\$0
13 General Grounds			X					\$0	-	\$0
<i>Subtotal</i>								\$106,000	-	\$139,000



GILES COUNTY PUBLIC SCHOOLS  
MACY MCCLAUGHERTY ES-MS



Site Accessibility	5	4	3	2	1	NA		Low	to	High
1 Pedestrian Access - ADA & Safety				X			Area between ADA parking and main entrance is rough and in poor condition.	\$10,000	-	\$20,000
2 Vehicular Access - Vehicles			X				Separate bus and vehicle drop-off loops.  Accessed of bus loop.	\$0	-	\$0
3 Vehicular Access - Buses			X					\$0	-	\$0
4 Vehicular Access - Deliveries			X					\$0	-	\$0
5 Handicap Parking			X	X			ADA parking directly across from building main entrance. Rough walk between ADA parking spaces and drop-off loop.	\$15,000	-	\$20,000
6 Accessible Entry			X				Entry from grade, slightly sloped.	\$0	-	\$0
7 Exterior Stairs and Railings			X					\$0	-	\$0
8 Exterior Ramps			X					\$0	-	\$0
							<i>Subtotal</i>	\$25,000	-	\$40,000

Exterior Building Envelope	5	4	3	2	1	NA		Low	to	High
1 Structure		X					CMU bearing wall, steel beam and joist roof structure, tectum and metal deck.	\$0	-	\$0
2 General Appearance			X					\$0	-	\$0
3 Roof			X	X			Membrane roof over a majority of the facility. Gym roof in poorest condition where alligatoring of the lap sealants was observed. Some minor roof ponding between roof drains. Additional minor alligatoring of lap sealants throughout remainder of roof. Metal roof at Gym Entrance has several areas of surface rust. Metal copings have some areas with open joints.	\$250,000	-	\$325,000
4 Soffits			X	X			Some areas where paint/plaster is pitting.	\$0	-	\$0
5 Walls			X				Brick condition varies around the building perimeter. At 2 story classroom wing, cracks were observed, possibly due to settlement. Some have been patched/filled.	\$0	-	\$0
6 Doors & Hardware			X				Hollow metal doors and frames at exterior entrances with panic bar hardware. Some areas have worn paint.	\$0	-	\$0
7 Windows		X		X			Painted aluminum window frames with insulated glazing. Appears to be in good condition. Areas where sealant repair is required. Flaking paint, corroding metal and areas of jacking at steel frames at window overall opening.	\$25,000	-	\$50,000
8 Miscellaneous						X		\$0	-	\$0
							<i>Subtotal</i>	\$275,000	-	\$375,000



GILES COUNTY PUBLIC SCHOOLS  
MACY MCCLAUGHERTY ES-MS



Interior Elements - ENTRY	5	4	3	2	1	NA		Low	to	High
1 Finishes - Walls		X					Brick and painted CMU.	\$0	-	\$0
2 Finishes - Flooring		X					Quarry tile. Walk-off mat with quarry tile surround in entrance vestibule.	\$0	-	\$0
3 Finishes - Ceilings			X				Acoustical ceiling tile. Some slightly damaged tiles - chips and dings.	\$0	-	\$0
4 Casework and Millwork							NA	\$0	-	\$0
5 Signage/ Wayfinding		X					No general way finding or graphics.	\$0	-	\$0
6 Moveable/Operable Partitions							NA	\$0	-	\$0
7 Doors - Frame and Door		X					Painted hollow metal frames with wood doors. Staining observed on some wood doors. Lever hardware.	\$0	-	\$0
8 Toilet Rooms						X		\$0	-	\$0
<i>Subtotal</i>								\$0	-	\$0

Interior Elements - ADMINISTRATION	5	4	3	2	1	NA		Low	to	High
1 Finishes - Walls			X				Painted CMU	\$0	-	\$0
2 Finishes - Flooring			X				Tile at main desk, luxury vinyl tile at offices, VCT at support spaces.	\$0	-	\$0
3 Finishes - Ceilings			X				Acoustical ceiling tile. Minor blemishes.	\$0	-	\$0
4 Casework and Millwork				X			Plastic laminate casework, some doors do not close. No ADA transaction counter.	\$15,000	-	\$20,000
5 Signage/ Wayfinding						X	No wayfinding signage. Laminate room name plaques.	\$0	-	\$0
6 Moveable/Operable Partitions						X	NA	\$0	-	\$0
7 Doors - Frame and Door		X					Painted hollow metal frames with wood doors. Chipped paint on frame. Lever hardware.	\$0	-	\$0
9 Toilet Rooms			X				Faculty Restroom, adjacent to Lobby. ADA have been made, some items do not meet current code - lav. top at 2'-10", sink rim higher.	\$0	-	\$0
<i>Subtotal</i>								\$15,000	-	\$20,000

GILES COUNTY PUBLIC SCHOOLS  
MACY MCCLAUGHERTY ES-MS



Interior Elements - CORRIDORS	5	4	3	2	1	NA		Low	to	High
1 Finishes - Walls		X					Painted CMU, glazed block wainscot with plaster above. Glazed block has areas with cracks.	\$0	-	\$0
2 Finishes - Flooring		X					VCT	\$0	-	\$0
3 Finishes - Ceilings			X				Acoustical ceiling tile, minor blemishes.	\$0	-	\$0
4 Casework and Millwork			X				Casework not used.	\$0	-	\$0
5 Signage/ Wayfinding			X				Room number and braille plaque into rooms, not at all locations.	\$0	-	\$0
6 Moveable/Operable Partitions						X	NA	\$0	-	\$0
7 Doors - Frame and Door			X				Painted hollow metal frames with wood doors. Lever hardware. Some doors do not have ADA clearance on pull side. 2 - 90 min. fire doors with hold opens as fire separation.	\$0	-	\$0
8 Student Lockers						X	NA	\$0	-	\$0
9 Toilet Rooms						X	See core toilet rooms.	\$0	-	\$0
<i>Subtotal</i>								\$0	-	\$0

Interior Elements - CORE TOILET ROOMS	5	4	3	2	1	NA		Low	to	High
1 Finishes - Walls			X				Painted CMU with glazed block wainscot, painted CMU with tile wainscot. Glazed block has areas with cracks.	\$0	-	\$0
2 Finishes - Flooring			X				Quarry tile.	\$0	-	\$0
3 Finishes - Ceilings				X			Acoustical ceiling tile.	\$0	-	\$0
4 Casework and Millwork			X				Metal and laminate toilet partitions.	\$0	-	\$0
5 Signage/ Wayfinding			X				Boys and girls plaques.	\$0	-	\$0
6 Doors - Frame and Door			X				Painted hollow metal frames with wood doors.	\$0	-	\$0
7 Toilet Rooms				X			Student toilet room adjacent to entry is serviceable, but worn. Several components do not meet current ADA code requirements. Second floor toilet room has ADA features, lav top is at 2'-10" AFF, not the sink rim.	\$100,000	-	\$130,000
<i>Subtotal</i>								\$100,000	-	\$130,000



GILES COUNTY PUBLIC SCHOOLS  
MACY MCCLAUGHERTY ES-MS

Interior Elements - CLASSROOMS	5	4	3	2	1	NA		Low	to	High
1 Finishes - Walls		X		X			Painted CMU at perimeter with demountable partitions in 1977 addition, CMU and plaster walls in remaining areas.	\$300,000	-	\$390,000
2 Finishes - Flooring			X				VCT		-	\$0
3 Finishes - Ceilings		X	X				Acoustical ceiling tile. Areas of stained tiles due to roof and equipment leaks. Ongoing tile replacement occurs. Reports of ongoing roof leak issues. Facilities reports that the leaks are from equipment, and typically not from the roofs.	\$0	-	\$0
4 Casework and Millwork				X			Wood casework in many single classrooms are damaged/scratched. Laminate casework in open concept classroom areas.	\$100,000	-	\$130,000
5 Signage/ Wayfinding			X				Engraved laminate name plaques.	\$0	-	\$0
6 Moveable/Operable Partitions							NA	\$0	-	\$0
7 Doors - Frame and Door			X				Painted hollow metal frames with various types of wood doors. Lever hardware.	\$0	-	\$0
12 Student Lockers							NA	\$0	-	\$0
13 Toilet Rooms			X				Quarry tile floors with painted CMU walls in lower grade classrooms.	\$0	-	\$0
<i>Subtotal</i>								\$400,000	-	\$520,000

Interior Elements - LIBRARY	5	4	3	2	1	NA		Low	to	High
1 Finishes - Walls		X					Painted CMU	\$0	-	\$0
2 Finishes - Flooring	X						Carpet, new tiles summer 2019.	\$0	-	\$0
3 Finishes - Ceilings		X					Acoustical ceiling tile, no visible defects.	\$0	-	\$0
4 Casework and Millwork			X	X			Built in and free standing oak casework.	\$0	-	\$0
5 Signage/ Wayfinding						X	No library signage.	\$0	-	\$0
6 Moveable/Operable Partitions						X		\$0	-	\$0
7 Doors - Frame and Door			X				Painted hollow metal frames with wood doors. Lever hardware.	\$0	-	\$0
8 Toilet Rooms						X		\$0	-	\$0
<i>Subtotal</i>								\$0	-	\$0



GILES COUNTY PUBLIC SCHOOLS  
MACY MCCLAUGHERTY ES-MS



Interior Elements - CAFETERIA	5	4	3	2	1	NA		Low	to	High
1 Finishes - Walls		X					Painted CMU and brick (Kitchen Painted CMU - 4)	\$0	-	\$0
2 Finishes - Flooring		X					VCT (Kitchen epoxy coating on concrete, worn and discolored - 2)	\$0	-	\$0
3 Finishes - Ceilings		X					Acoustical ceiling tile. (Kitchen washable tile - 4)	\$0	-	\$0
4 Casework and Millwork			X					\$0	-	\$0
5 Signage/ Wayfinding							No signage, wayfinding lacks throughout the school.	\$0	-	\$0
6 Moveable/Operable Partitions								\$0	-	\$0
7 Doors - Frame and Door							Painted hollow metal frames with wood doors. Panic hardware.	\$0	-	\$0
8 Food Service Equipment			X	X			Some older equipment, serviceable. Hard water issues reported.	\$60,000	-	\$80,000
9 Stage, Curtains, etc.		X					Acoustical panels at perimeter walls.	\$0	-	\$0
10 Bleachers - Seating							Portable	\$0	-	\$0
<i>Subtotal</i>								\$60,000	-	\$80,000

Interior Elements - GYMNASIUM	5	4	3	2	1	NA		Low	to	High
1 Finishes - Walls		X					Painted CMU, water staining at perimeter wall from previous leaks. Facilities reports that leaks have been corrected.	\$0	-	\$0
2 Finishes - Flooring			X				Wood athletic floor.	\$0	-	\$0
3 Finishes - Ceilings		X					Exposed structure with tectum deck.	\$0	-	\$0
4 Casework and Millwork								\$0	-	\$0
5 Signage/ Wayfinding								\$0	-	\$0
6 Moveable/Operable Partitions			X	X			Located on the stage to enclose the music room, tears in the finish surface observed.	\$0	-	\$0
7 Doors - Frame and Door		X					Painted hollow metal frames with wood doors. Panic hardware.	\$0	-	\$0
8 Stage, Curtains, etc.						X	No divider curtain.	\$0	-	\$0
9 Gymnasium Equipment		X	X				Padding at each primary end, not wide enough. Pads in good condition. Retractable baskets at sides and ends, anchored from ceiling structure. Scoreboard at one end wall. Rom of acoustical panels along upper wall perimeter.	\$0	-	\$0
10 Bleachers		X					Molded plastic. Good condition. No maintenance issues reported.	\$0	-	\$0
11 Toilet Rooms						X		\$0	-	\$0
<i>Subtotal</i>								\$0	-	\$0





GILES COUNTY PUBLIC SCHOOLS  
MACY MCCLAUGHERTY ES-MS

Interior Accessibility		5	4	3	2	1	NA		Low	to	High
1	Stairs, Ramps and Railings			X				Top of handrails at 2'-5" and do not extend beyond bottom riser. Top of guardrail is 41". 4" clear at balusters.	\$0	-	\$0
2	Elevators, Chairlifts		X					Newer ADA compliant elevator located in 2 story portion of building . ADA lift located between corridor and stage/music room is in good condition.	\$0	-	\$0
3	Doors - Openings and Hardware			X					\$0	-	\$0
4	Toilet Rooms				X			ADA upgrades have been made in some toilet rooms. Instances of various current code violations.	\$0	-	\$0
5	Signage				X			Minimal signage throughout. General wayfinding not present.	\$0	-	\$0
<i>Subtotal</i>									\$0	-	\$0

Safety & Security		5	4	3	2	1	NA		Low	to	High
1	Appropriate Exterior Lighting			X				Downlights at canopies and pole mounted site lights.	\$0	-	\$0
2	Natural Surveillance			X					\$0	-	\$0
3	Camera System - Interior and Exterior			X				Cameras located at building exterior perimeter and interior.	\$0	-	\$0
4	Secure Entry Vestibule			X				Building entry is a secure space, with direct access to administration office. No direct visual control of main entrance. Remote electronic control with cameras and audio.	\$0	-	\$0
5	Card Access at Exterior Exits			X				At exterior access doors.	\$0	-	\$0
<i>Subtotal</i>									\$0	-	\$0



GILES COUNTY PUBLIC SCHOOLS  
MACY MCCLAUGHERTY ES-MS



Systems - Plumbing & Fire Protection	5	4	3	2	1	NA		Low	to	High
1 Fire Protection System(s) For Entire Building	x						Cost to add fire suppression system. Assuming fire pump needed.	\$300,000	-	\$400,000
2 Limited Area Fire Protection System(s)		x						\$0	-	\$0
3 Camera Inspect Sanitary & Storm Piping		x						\$0	-	\$0
3 Replace Plumbing Fixtures			x				Budget \$500-\$1,000 per fixture for replacement.	\$150,000	-	\$180,000
<i>Subtotal</i>								\$450,000	-	\$580,000

Systems - Electrical	5	4	3	2	1	NA		Low	to	High
1 Electrical Distribution		x					Some of the original panels should be replaced	\$350,000	-	\$450,000
2 Emergency Generator						x		\$0	-	\$0
3 Interior Lighting and Controls			x					\$600,000	-	\$750,000
4 Theatrical Lighting and Controls	x						IF LED color changing theatrical lighting was desired	\$30,000	-	\$60,000
5 Exterior Lighting and Controls				x				\$125,000	-	\$150,000
6 Fire Alarm				x			All components should be replaced in the original portion of building	\$60,000	-	\$80,000
7 Clock System					x			\$70,000	-	\$100,000
8 Card Access/Access Control/Door Monitoring		x						\$0	-	\$0
9 Paging / Phone Call in System		x						\$0	-	\$0
10 Camera system		x						\$0	-	\$0
11 Intrusion Detection						x		\$0	-	\$0
12 Network Cabling / COAX/ WAP			x					\$280,000	-	\$350,000
13 Sound System/AV - Theatre / Gym / Cafeteria	x							\$0	-	\$0
14 Classroom Technology						x		\$0	-	\$0
<i>Subtotal</i>								\$1,515,000	-	\$1,940,000



GILES COUNTY PUBLIC SCHOOLS  
MACY MCCLAUGHERTY ES-MS



Systems - HVAC	5	4	3	2	1	NA		Low	to	High
1 Upgrade/Replace Existing HVAC system					X		System has reached the end of its useful life.	\$2,330,840	-	\$3,204,905
2 Upgrade/Replace Kitchen EA & MUA System(s)					X		The three EF/MAU combination systems have considerable age on them and should be considered for replacement.	\$22,750	-	\$64,000
3 Recommission / Upgrade BAS system/control	X						The options for upgrade are a gateway to pull in existing system or a new system throughout.	\$200,000	-	\$240,000
4 Building Ventilation - DOAS/ERU					X		OAU's should be replaced with new units that have integral direct-fired gas heaters in lieu of the current units which have independent gas-fired water heaters that provide heating water to each OAU.	\$528,000	-	\$726,000
<i>Subtotal</i>								\$3,081,590	-	\$4,234,905

	Low Cost	-	High Cost
< 2 YRS.	\$2,951,590	-	\$4,094,905
2-6 YRS.	\$866,000	-	\$1,144,000
6-10 YRS.	\$1,030,000	-	\$1,280,000
10-15 YRS.	\$650,000	-	\$840,000
15-20 YRS.	\$530,000	-	\$700,000
Total Cost to Upgrade to Current Standards:	\$6,027,590	-	\$8,058,905

\*COSTS PRESENTED ABOVE IN THE FCI ARE BASED ON 2021-22 COSTS FOR MATERIALS AND CONSTRUCTION





GILES COUNTY PUBLIC SCHOOLS  
NARROWS ES-MS

SCALE	DESCRIPTION	FCI %	TIMELINE
5 NEW	New or like-new condition; Reevaluate in 8 - 10 years	91% - 100%	15-20 YRS.
4 GOOD	Minimal wear for age, no issues	61% - 90%	10-15 YRS.
3 FAIR	Average wear for age, approaching end of lifecycle	31% - 60%	6-10 YRS.
2 POOR	Worn from use or age, end of expected lifecycle	16% - 30%	2-6 YRS.
1 CRITICAL	Extremely worn or damaged, replace as soon as possible	0% - 15%	< 2 YRS.

FACILITY CONDITION INDEX (FCI)   Assessed							ESTIMATED CONSTRUCTION COST			
Site	5	4	3	2	1	NA	Comments & Recommendations	Low	to	High
	•	•	•	•	•	•				
1 Perimeter Fencing & Gates			X				Galvanized chain link.	\$0	-	\$0
2 Athletic Fields						X		\$0	-	\$0
3 Athletic Field Structures, Scoreboards						X		\$0	-	\$0
4 On-Site Sidewalks				X			Newer walks at main entrance are in good condition. Perimeter walks at rear of building show signs of movement. Some panels have been replaced.	\$0	-	\$0
5 Play Equipment			X					\$150,000	-	\$180,000
6 Paving						X	Building bordered by paved public streets.	\$0	-	\$0
7 Striping, Markings, Speed Bumps			X					\$0	-	\$0
8 Curbing			X				Concrete	\$85,000	-	\$102,000
9 On-Site Signage			X					\$12,500	-	\$15,000
10 Exterior Furniture, Bike Racks, Storage			X				Painted metal benches at entrance.	\$0	-	\$0
11 Retaining Walls, Site Walls				X			Areas of broken brick, moisture migration and decaying site walls along stairs and ramps at rear of building.	\$0	-	\$0
12 Freestanding Walkway Canopies						X		\$0	-	\$0
13 General Grounds			X					\$0	-	\$0
<i>Subtotal</i>								\$247,500	-	\$297,000

GILES COUNTY PUBLIC SCHOOLS  
NARROWS ES-MS



Site Accessibility	5	4	3	2	1	NA		Low	to	High
1 Pedestrian Access - ADA & Safety			X				Remote video control of front entrance, "Code Blue Control System". Only school in county with this system.	\$0	-	\$0
2 Vehicular Access - Vehicles			X				Bus access along street.	\$0	-	\$0
3 Vehicular Access - Buses						X		\$0	-	\$0
4 Vehicular Access - Deliveries			X					\$0	-	\$0
5 Handicap Parking			X					Separate area designated for ADA parking with a newer access ramp. General parking located diagonally across the street.	\$0	-
6 Accessible Entry			X				Entry is lower than street and adjacent parking, requiring navigation via ramps and stairs. No automatic openers.	\$0	-	\$0
7 Exterior Stairs and Railings			X				Some rusting of metal railings. Concrete at rear stair is spauling.	\$0	-	\$0
8 Exterior Ramps			X					\$0	-	\$0
<i>Subtotal</i>								\$0	-	\$0

Exterior Building Envelope	5	4	3	2	1	NA		Low	to	High
1 Structure			X				CMU bearing wall, steel beam and joist roof structure, tectum deck.	\$0	-	\$0
2 General Appearance			X				Areas along perimeter masonry where water run-off or moisture issues exist.	\$0	-	\$0
3 Roof			X				Metal roofing over a majority of the roof. Reported to be between 10-15 years old.	\$0	-	\$0
4 Soffits				X			Linear metal ceiling at main entrance. Soffits rusting along perimeter of gym.	\$25,000	-	\$35,000
5 Walls				X			Brick veneer with CMU back-up. Several areas at the gym perimeter where previous leaks have been reported and fixed. Staining of the exterior brick remains, Moisture issues should be investigated further and brick cleaned. Sealant at control joints has shrunk/cracked and separated, replaced in some areas.	\$100,000	-	\$130,000
6 Doors & Hardware		X					Painted aluminum storefront entrances. Panic bar hardware.	\$0	-	\$0
7 Windows				X			Painted aluminum window frames with insulated glazing. Appears to be in good condition. Areas where sealant repair is required. Painted metal sill flashing peeling in some areas. Significant staining of precast window sills throughout.	\$20,000	-	\$30,000
8 Miscellaneous						X	At rear entrance, previous water leak at elevated grade. Concrete slab pitched to a yard drain has been placed at adjacent area. Reports indicate this has resolved the issue.	\$0	-	\$0
<i>Subtotal</i>								\$145,000	-	\$195,000

GILES COUNTY PUBLIC SCHOOLS  
NARROWS ES-MS

Interior Elements - ENTRY	5	4	3	2	1	NA		Low	to	High
1 Finishes - Walls	X						Painted CMU w/ rubber base.	\$0	-	\$0
2 Finishes - Flooring		X					VCT	\$0	-	\$0
3 Finishes - Ceilings		X					Acoustical ceiling tile. Grid slightly yellowed. Ceilings are @ 8'-0". Kids stick pencils into the tiles. Tile replacement on a maintenance program.	\$0	-	\$0
4 Casework and Millwork		X					Built-in metal frame case.	\$0	-	\$0
5 Signage/ Wayfinding		X					Small plaque wall signage. No general way finding or graphics.	\$0	-	\$0
6 Moveable/Operable Partitions							NA	\$0	-	\$0
7 Doors - Frame and Door		X					Painted hollow metal frames with wood doors. Lever hardware.	\$0	-	\$0
13 Toilet Rooms			X				ADA toilet compartment 4'-11" deep with door that swings in. Metal toilet partitions. Damaged lav counter face. Missing protection on exposed pipes.	\$0	-	\$0
<i>Subtotal</i>								\$0	-	\$0

Interior Elements - ADMINISTRATION	5	4	3	2	1	NA		Low	to	High
1 Finishes - Walls		X					Painted CMU	\$0	-	\$0
2 Finishes - Flooring		X					VCT with rubber base at staff lounge. Wood with rubber base at offices and main office.	\$0	-	\$0
3 Finishes - Ceilings		X					Acoustical ceiling tile.	\$0	-	\$0
4 Casework and Millwork		X					Plastic laminate casework. Sink not at ADA height.	\$0	-	\$0
5 Signage/ Wayfinding						X	No signage	\$0	-	\$0
6 Moveable/Operable Partitions						X	NA	\$0	-	\$0
7 Doors - Frame and Door		X					Painted hollow metal frames with wood doors. Chipped paint on frame. Lever hardware.	\$0	-	\$0
13 Toilet Rooms				X			Small non-ADA bathroom. Tile floor, painted CMU walls and ACT ceiling.	\$0	-	\$0
<i>Subtotal</i>								\$0	-	\$0



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Interior Elements - CORRIDORS	5	4	3	2	1	NA		Low	to	High
1 Finishes - Walls			X				Painted CMU and plaster with glazed block wainscot.	\$0	-	\$0
2 Finishes - Flooring			X				VCT	\$0	-	\$0
3 Finishes - Ceilings			X				Acoustical ceiling tile. Some staining of tiles and discoloration of grid.	\$0	-	\$0
4 Casework and Millwork						X	Casework not used.	\$0	-	\$0
5 Signage/ Wayfinding			X				Room number plaque into rooms, not at all locations.	\$0	-	\$0
6 Doors - Frame and Door			X				Painted hollow metal frames with wood doors. Lever hardware. Some doors do not have ADA clearance on pull side. 2 - 90 min. fire doors with hold opens as fire separation.	\$0	-	\$0
7 Stairs			X				Lower floor elevation at east and west ends. Center handrail but no wall mounted rails. Stairs at central classroom spine are not enclosed at top or bottom. Glazed block at exterior stair wall has efflorescence. Possible moisture migration issue.	\$0	-	\$0
8 Student Lockers			X				Painted metal lockers. Areas where doors are bent, surface scratches and corroding paint.	\$0	-	\$0
9 Toilet Rooms						X	See core toilet rooms.	\$0	-	\$0
<i>Subtotal</i>								\$0	-	\$0

Interior Elements - CORE TOILET ROOMS	5	4	3	2	1	NA	Core bathrooms in classroom wing.	Low	to	High
1 Finishes - Walls			X				Painted CMU with glazed block wainscot. Glazed block is damaged in some areas.	\$0	-	\$0
2 Finishes - Flooring			X				Quarry tile floors in main building, painted concrete at newer wing.	\$0	-	\$0
3 Finishes - Ceilings			X				Acoustical ceiling tile. A few broken tiles.	\$0	-	\$0
4 Casework and Millwork				X			Painted metal toilet partitions. Areas where lavatory casework is sagging at wall and laminate is seperating.	\$10,000	-	\$15,000
5 Signage/ Wayfinding			X				\	\$0	-	\$0
6 Doors - Frame and Door			X				Painted hollow metal frames with wood doors. Lever hardware.	\$0	-	\$0
7 Toilet Rooms				X			ADA upgrades have occurred, several infractions from current code requirements exists - examples include sink heights, stall depths.	\$0	-	\$0
<i>Subtotal</i>								\$10,000	-	\$15,000



GILES COUNTY PUBLIC SCHOOLS  
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Interior Elements - CLASSROOMS	5	4	3	2	1	NA		Low	to	High
1 Finishes - Walls		X					Painted CMU, exterior walls plastered.	\$0	-	\$0
2 Finishes - Flooring			X				VCT - evidence of wear and chipping at several locations.	\$0	-	\$0
3 Finishes - Ceilings			X				Acoustical ceiling tile. Areas of stained tiles due to roof and equipment leaks. Ongoing tile replacement occurs.	\$0	-	\$0
4 Casework and Millwork			X				Original built-in wood casework. Markerboards, smartboards and tack boards utilized.	\$0	-	\$0
5 Signage/ Wayfinding			X				Small room number plaques.	\$0	-	\$0
6 Moveable/Operable Partitions							NA	\$0	-	\$0
7 Doors - Frame and Door			X				Painted hollow metal frames with wood doors. Lever hardware. ADA pull side access issues.	\$0	-	\$0
8 Student Lockers							NA	\$0	-	\$0
9 Toilet Rooms							NA	\$0	-	\$0
<i>Subtotal</i>								\$0	-	\$0

Interior Elements - SCIENCE CLASSROOMS	5	4	3	2	1	NA		Low	to	High
1 Finishes - Walls		X					Painted CMU, exterior walls plastered.	\$0	-	\$0
2 Finishes - Flooring			X				VCT	\$0	-	\$0
3 Finishes - Ceilings			X				Area of staining and chipped tiles observed.	\$0	-	\$0
4 Casework and Millwork		X					Wood casework with science tops at room perimeter, matching wall cabinets.	\$0	-	\$0
5 Signage/ Wayfinding			X				Small room number plaques.	\$0	-	\$0
6 Moveable/Operable Partitions						X		\$0	-	\$0
7 Doors - Frame and Door			X				Painted hollow metal frames with wood doors. Lever hardware.	\$0	-	\$0
8 Equipment			X				Items stored in fume hood. Does not appear to be utilized.	\$0	-	\$0
12 Student Lockers						X		\$0	-	\$0
13 Toilet Rooms						X		\$0	-	\$0
<i>Subtotal</i>								\$0	-	\$0



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Interior Elements - LIBRARY	5	4	3	2	1	NA		Low	to	High
1 Finishes - Walls		X					Painted CMU and brick.	\$0	-	\$0
2 Finishes - Flooring		X					Carpet, VCT at entry.	\$0	-	\$0
3 Finishes - Ceilings		X					Acoustical ceiling tile.	\$0	-	\$0
4 Casework and Millwork			X				Wood circulation desk 36 1/2" tall w/o ADA access. Free standing wood casework.	\$0	-	\$0
5 Signage/ Wayfinding						X		\$0	-	\$0
6 Moveable/Operable Partitions						X		\$0	-	\$0
7 Doors - Frame and Door			X				Painted hollow metal frames with wood doors. Panic hardware. Some paint chipping at door frame.	\$0	-	\$0
13 Toilet Rooms						X		\$0	-	\$0
<i>Subtotal</i>								\$0	-	\$0

Interior Elements - CAFETERIA	5	4	3	2	1	NA		Low	to	High
1 Finishes - Walls		X					Painted CMU and brick. Tectum panels for acoustics.(Kitchen Painted CMU - 4) Evidence of moisture issues at exterior window sills.	\$0	-	\$0
2 Finishes - Flooring			X				VCT (Kitchen epoxy coating on concrete, worn and discolored - 2)	\$0	-	\$0
3 Finishes - Ceilings				X			Acoustical ceiling tile. ACT grid is discolored and rusted. (Kitchen washable tile - 2 stained/discolored)	\$15,000	-	\$20,000
4 Casework and Millwork			X					\$0	-	\$0
5 Signage/ Wayfinding							No signage, wayfinding lacks throughout the school.	\$0	-	\$0
6 Moveable/Operable Partitions						X		\$0	-	\$0
7 Doors - Frame and Door			X				Painted hollow metal frames with wood doors. Panic hardware.	\$0	-	\$0
8 Food Service Equipment			X				Equipment appears to be in good condition. Newer dishwasher. No reports of maintenance issues.	\$0	-	\$0
9 Stage, Curtains, etc.								\$0	-	\$0
10 Bleachers - Seating							Portable	\$0	-	\$0
11 Toilet Rooms						X		\$0	-	\$0
<i>Subtotal</i>								\$15,000	-	\$20,000



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Interior Elements - GYMNASIUM	5	4	3	2	1	NA		Low	to	High
1 Finishes - Walls		X					Painted CMU. Tectum acoustical panels at ceiling perimeter.	\$0	-	\$0
2 Finishes - Flooring			X				Wood athletic floor.	\$0	-	\$0
3 Finishes - Ceilings		X					Exposed structure with tectum panels. No staining observed.	\$0	-	\$0
4 Casework and Millwork						X		\$0	-	\$0
5 Signage/ Wayfinding						X		\$0	-	\$0
6 Moveable/Operable Partitions		X					Folding partition at stage.	\$0	-	\$0
7 Doors - Frame and Door			X				Painted hollow metal frames with wood doors. Panic hardware.	\$0	-	\$0
9 Stage, Curtains, etc.			X				Stage has VCT floor. ADA access via vertical lift which reportedly does not have any maintenance issues. Minimal access clearance at bottom of lift.	\$0	-	\$0
10 Gymnasium Equipment			X				Padding at each primary end, not wide enough. Pads in good condition. Retractable baskets at sides and ends, anchored from ceiling structure. Scoreboard at one end wall.	\$0	-	\$0
11 Bleachers			X				Older wood bleachers. Good condition. No maintenance issues reported.	\$0	-	\$0
12 Student Lockers - Locker Room						X		\$0	-	\$0
<i>Subtotal</i>								\$0	-	\$0

Interior Accessibility	5	4	3	2	1	NA		Low	to	High
1 Stairs, Ramps and Railings			X					\$0	-	\$0
2 Elevators, Chairlifts		X					Multi-stop elevator.	\$0	-	\$0
3 Doors - Openings and Hardware		X					Lever and panis hardware generally used throughout. Some doors with access clearance issues.	\$0	-	\$0
4 Toilet Rooms			X				ADA upgrades throughout most toilet rooms. Instances of various current code violations.	\$0	-	\$0
5 Signage			X				Minimal signage throughout. General wayfinding not present.	\$0	-	\$0
<i>Subtotal</i>								\$0	-	\$0

Safety & Security	5	4	3	2	1	NA		Low	to	High
1 Appropriate Exterior Lighting		X					Ceiling mounted canopy lighting, wall packs and pole mounted site lights.	\$0	-	\$0
2 Natural Surveillance			X					\$0	-	\$0
3 Camera System - Interior and Exterior			X					\$0	-	\$0
4 Secure Entry Vestibule			X				Remote video control of main entrance doors from admin. office. Code Blue control system, only school in county with this system.	\$0	-	\$0
5 Card Access at Exterior Exits			X					\$0	-	\$0
<i>Subtotal</i>								\$0	-	\$0



GILES COUNTY PUBLIC SCHOOLS  
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Systems - Plumbing & Fire Protection	5	4	3	2	1	NA		Low	to	High
1 Fire Protection System(s) For Entire Building	x						Cost to add fire suppression system. Assuming fire pump needed.	\$300,000	-	\$400,000
2 Limited Area Fire Protection System(s)		x						\$0	-	\$0
3 Camera Inspect Sanitary & Storm Piping		x						\$0	-	\$0
4 Replace Plumbing Fixtures		x					Budget \$500-\$1,000 per fixture for replacement	\$46,000	-	\$55,200
<i>Subtotal</i>								\$346,000	-	\$455,200

Systems - Electrical	5	4	3	2	1	NA		Low	to	High
1 Electrical Distribution		x						\$0	-	\$0
2 Emergency Generator						x		\$0	-	\$0
3 Interior Lighting and Controls			x				To replace with LED and dimming controls	\$600,000	-	\$750,000
4 Theatrical Lighting and Controls	x						If a theatrical lighting system was desired	\$50,000	-	\$75,000
5 Exterior Lighting and Controls				x			To replace with LED and add additional fixtures.	\$50,000	-	\$150,000
6 Fire Alarm	x							\$0	-	\$0
7 Clock System	x							\$0	-	\$0
8 Card Access/Access Control/Door Monitoring	x							\$0	-	\$0
9 Paging / Phone Call in System		x						\$0	-	\$0
10 Camera system		x						\$0	-	\$0
11 Intrusion Detection	x							\$0	-	\$0
12 Network Cabling / COAX/ WAP			x					\$280,000	-	\$350,000
13 Sound System/AV - Theatre / Gym / Cafeteria		x						\$25,000	-	\$35,000
14 Classroom Technology						x		\$0	-	\$0
<i>Subtotal</i>								\$1,005,000	-	\$1,360,000



GILES COUNTY PUBLIC SCHOOLS  
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Systems - HVAC	5	4	3	2	1	NA		Low	to	High
1 Upgrade/Replace Existing HVAC system				x			Prices include replacement of WSHPs, Cooling Tower, & Boilers.	\$1,200,160	-	\$1,500,200
2 Upgrade/Replace Kitchen EA & MUA System(s)				x				\$22,750	-	\$64,000
3 Recommission / Upgrade BAS system/control	x						The options for upgrade are a gateway to pull in existing system or a new system throughout.	\$200,000	-	\$240,000
4 Building Ventilation - DOAS/ERU				x			ERVs are showing age and should be given thorough maintenance and consideration for replacement.	\$330,000	-	\$462,000
5 MDF/IDF Cooling and/or Ventilation		x					Replacement of existing split systems serving IT rooms.	\$42,000	-	\$54,000
<i>Subtotal</i>								\$1,794,910	-	\$2,320,200

	Low Cost	-	High Cost
< 2 YRS.	\$0	-	\$0
2-6 YRS.	\$1,772,910	-	\$2,406,200
6-10 YRS.	\$1,127,500	-	\$1,397,000
10-15 YRS.	\$113,000	-	\$144,200
15-20 YRS.	\$550,000	-	\$715,000
Total Cost to Upgrade to Current Standards:	\$3,563,410	-	\$4,662,400

\*COSTS PRESENTED ABOVE IN THE FCI ARE BASED ON 2021-22 COSTS FOR MATERIALS AND CONSTRUCTION





GILES COUNTY PUBLIC SCHOOLS  
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SCALE	DESCRIPTION	FCI %	TIMELINE
5 NEW	New or like-new condition; Reevaluate in 8 - 10 years	91% - 100%	15-20 YRS.
4 GOOD	Minimal wear for age, no issues	61% - 90%	10-15 YRS.
3 FAIR	Average wear for age, approaching end of lifecycle	31% - 60%	6-10 YRS.
2 POOR	Worn from use or age, end of expected lifecycle	16% - 30%	2-6 YRS.
1 CRITICAL	Extremely worn or damaged, replace as soon as possible	0% - 15%	< 2 YRS.

FACILITY CONDITION INDEX (FCI)   Assessed							ESTIMATED CONSTRUCTION COST			
Site	5	4	3	2	1	NA	Comments & Recommendations	Low	to	High
	•	•	•	•	•	•				
1 Perimeter Fencing & Gates						X		\$0.00	-	\$0.00
2 Athletic Fields						X		\$0.00	-	\$0.00
3 Athletic Field Structures, Scoreboards						X		\$0.00	-	\$0.00
4 On-Site Sidewalks			X				Concrete. Areas where panels have been replaced. Some areas where cracks and loose material exists. Concrete finishes do not all match.	\$0.00	-	\$0.00
5 Play Equipment						X		\$0.00	-	\$0.00
6 Paving			X				Bituminous.	\$0.00	-	\$0.00
7 Striping, Markings, Speed Bumps			X					\$0.00	-	\$0.00
8 Curbing			X				Concrete. Curbing typically depresseded to plain of pavement.	\$0.00	-	\$0.00
9 On-Site Signage			X					\$0.00	-	\$0.00
10 Exterior Furniture, Bike Racks, Storage						X		\$0.00	-	\$0.00
11 Retaining Walls, Site Walls						X		\$0.00	-	\$0.00
12 Freestanding Walkway Canopies				X			Serviceable, yet heavily worn. Some ponding and leaking on the roofs. Steel framed flat roof structures with formed metal trim at fascia, membrane roof and painted panel ceiling. Areas of ponding on the roof from poor drainage, staining of fascia's and soffits from drainage overflow.	\$80,000.00	-	\$105,000.00
13 General Grounds			X							
<i>Subtotal</i>								\$80,000.00	-	\$105,000.00

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Site Accessibility	5	4	3	2	1	NA		Low	to	High
1 Pedestrian Access - ADA & Safety			X				Buildings main entrance is at grade.	\$0.00	-	\$0.00
2 Vehicular Access - Vehicles			X				Separate bus entrance and drop-off loop. Potential traffic conflict between vehicles entering and busses exiting.	\$0.00	-	\$0.00
3 Vehicular Access - Buses			X					\$0.00	-	\$0.00
4 Vehicular Access - Deliveries				X				\$0.00	-	\$0.00
5 Handicap Parking			X					\$0.00	-	\$0.00
6 Accessible Entry			X				Entrance at grade. No automatic openers.	\$0.00	-	\$0.00
7 Exterior Stairs and Railings				X			Deteriorated concrete at service entrance stairs.	\$0.00	-	\$0.00
8 Exterior Ramps				X				\$0.00	-	\$0.00
							<i>Subtotal</i>	\$0.00	-	\$0.00

Exterior Building Envelope	5	4	3	2	1	NA		Low	to	High
1 Structure			X				CMU bearing wall, steel beam and joist roof structure, tectum deck.	\$0.00	-	\$0.00
2 General Appearance			X					\$0.00	-	\$0.00
3 Roof				X			Rubber roof membrane over rigid insulation. Several areas were observed to have failing lap splices and lap sealants that are alligatoring.	\$650,000.00	-	\$850,000.00
4 Soffits				X			Peeling paint at main entrance canopy. Evidence of sagging plywood soffits at secondary entrances.	\$25,000.00	-	\$33,000.00
5 Walls			X				Brick veneer with CMU back-up. Concrete window sill- significant staining. Areas of mortar deterioration. Sealant has shrunk/cracked and separated, replaced in some areas. All sealant joints should be inspected and replaced as required.	\$50,000.00	-	\$65,000.00
6 Doors & Hardware			X				Clear anodized aluminum storefront entrances. Panic bar hardware.	\$0.00	-	\$0.00
7 Windows				X			Painted aluminum window frames with insulated glazing. Some instances where the window seals have broken and the windows have fogged. Translucent panels in upper portions of window openings. Paint on the exterior is beginning to chalk.	\$500,000.00	-	\$650,000.00
8 Miscellaneous						X		\$0.00	-	\$0.00
							<i>Subtotal</i>	\$1,225,000.00	-	\$1,598,000.00



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Interior Elements - ENTRY	5	4	3	2	1	NA		Low	to	High
1 Finishes - Walls		X					Painted CMU	\$0	-	\$0
2 Finishes - Flooring		X					Terrazzo	\$0	-	\$0
3 Finishes - Ceilings			X				Acoustical ceiling tile. Grid slightly yellowed. Ceilings are @ 8'-0". Kids stick pencils into the tiles. Tile replacement on a maintenance program.	\$0	-	\$0
4 Casework and Millwork			X				Wood display cases recessed into walls. All cases extremely full.	\$0	-	\$0
5 Signage/ Wayfinding		X					Minimal signage. Small plaque only. No general way finding or graphics.	\$0	-	\$0
6 Moveable/Operable Partitions							NA	\$0	-	\$0
7 Doors - Frame and Door			X				Painted hollow metal frames with wood doors. Lever hardware.	\$0	-	\$0
8 Toilet Rooms						X		\$0	-	\$0
							<i>Subtotal</i>	\$0	-	\$0

Interior Elements - ADMINISTRATION	5	4	3	2	1	NA		Low	to	High
1 Finishes - Walls		X					Painted CMU	\$0	-	\$0
2 Finishes - Flooring		X					Tile	\$0	-	\$0
3 Finishes - Ceilings		X					Acoustical ceiling tile.	\$0	-	\$0
4 Casework and Millwork			X				Plastic laminate casework	\$0	-	\$0
5 Signage/ Wayfinding							No signage	\$0	-	\$0
6 Moveable/Operable Partitions							NA	\$0	-	\$0
7 Doors - Frame and Door			X				Painted hollow metal frames with wood doors. Chipped paint on frame. Lever hardware.	\$0	-	\$0
8 Toilet Rooms				X			Small non-ADA bathroom with very narrow door.	\$10,000	-	\$20,000
							<i>Subtotal</i>	\$10,000	-	\$20,000



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Interior Elements - CORRIDORS	5	4	3	2	1	NA		Low	to	High
1 Finishes - Walls		X					Painted CMU with glazed block wainscot.	\$0	-	\$0
2 Finishes - Flooring		X					Terrazzo	\$0	-	\$0
3 Finishes - Ceilings		X					Acoustical ceiling tile.	\$0	-	\$0
4 Casework and Millwork			X				Built-in display cases.	\$0	-	\$0
5 Signage/ Wayfinding			X				Small plaques with room numbers and braille, not at all locations.	\$0	-	\$0
6 Moveable/Operable Partitions						X	NA	\$0	-	\$0
7 Doors - Frame and Door			X				Painted hollow metal frames with wood doors. Lever hardware. Chipped/worn paint on frames	\$0	-	\$0
8 Stairs			X				Heavily worn treads. Stairs are not enclosed at top or bottom, which does not meet current code requirements. Wall mounted lift utilized for lower corridor access. All/most lifts reported to be unreliable and have maintenance issues. No handrail on lift side. Handrails at 2'-6".	\$0	-	\$0
9 Student Lockers			X				Recessed into corridor walls.	\$0	-	\$0
10 Toilet Rooms						X	See core toilet rooms.	\$0	-	\$0
<i>Subtotal</i>								\$0	-	\$0

Interior Elements - CORE TOILET ROOMS	5	4	3	2	1	NA	Core bathrooms in classroom wing.	Low	to	High
1 Finishes - Walls			X	X			Painted CMU with glazed block wainscot. Staining at Glazed block mortar joints.	\$0	-	\$0
2 Finishes - Flooring			X				Painted/epoxy over concrete.	\$0	-	\$0
3 Finishes - Ceilings			X				Acoustical ceiling tile. A few broken tiles.	\$0	-	\$0
4 Casework and Millwork				X			Laminate toilet partitions. Partitions starting to delaminate.	\$15,000	-	\$20,000
5 Signage/ Wayfinding			X					\$0	-	\$0
6 Moveable/Operable Partitions							NA	\$0	-	\$0
7 Doors - Frame and Door			X				Painted hollow metal frames with wood doors. Lever hardware.	\$0	-	\$0
8 Toilet Rooms				X			ADA upgrades have occurred with minor infractions from current code. Soap and towel dispensers wrong height and location.	\$0	-	\$0
<i>Subtotal</i>								\$15,000	-	\$20,000



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Interior Elements - CLASSROOMS	5	4	3	2	1	NA		Low	to	High
1 Finishes - Walls		X					Painted CMU	\$0	-	\$0
2 Finishes - Flooring		X	X				VCT - evidence of wear and chipping at several locations.	\$0	-	\$0
3 Finishes - Ceilings		X	X				Acoustical ceiling tile. Areas of stained tiles due to roof and equipment leaks. Ongoing tile replacement occurs.	\$0	-	\$0
4 Casework and Millwork			X				Original built-in wood casework. Markerboards, smartboards and tack boards utilized.	\$0	-	\$0
5 Signage/ Wayfinding			X				Small room number plaques with braille.	\$0	-	\$0
6 Moveable/Operable Partitions						X	NA	\$0	-	\$0
7 Doors - Frame and Door			X				Painted hollow metal frames with wood doors. Lever hardware. ADA pull side access issues.	\$0	-	\$0
8 Student Lockers						X	NA	\$0	-	\$0
9 Toilet Rooms						X	NA	\$0	-	\$0
<i>Subtotal</i>								\$0	-	\$0

Interior Elements - SCIENCE CLASSROOMS	5	4	3	2	1	NA		Low	to	High
1 Finishes - Walls		X					Painted CMU	\$0	-	\$0
2 Finishes - Flooring		X	X				VCT - evidence of wear and chipping at several locations.	\$0	-	\$0
3 Finishes - Ceilings		X	X				Area of staining and chipped tiles observed. Water stains suggest potential roof leak issues.	\$0	-	\$0
4 Casework and Millwork				X			Mix of old wood casework and new wood casework with science tops at room perimeter. Gas turrets unhooked.	\$0	-	\$0
5 Signage/ Wayfinding		X						\$0	-	\$0
6 Moveable/Operable Partitions						X		\$0	-	\$0
7 Doors - Frame and Door			X				Painted hollow metal frames with wood doors. Lever hardware. Some door frames are heavily scratched.	\$0	-	\$0
8 Equipment				X			Older fume hoods.	\$0	-	\$0
9 Student Lockers						X		\$0	-	\$0
10 Toilet Rooms						X		\$0	-	\$0
<i>Subtotal</i>								\$0	-	\$0



GILES COUNTY PUBLIC SCHOOLS  
NARROWS HIGH SCHOOL



Interior Elements - LIBRARY	5	4	3	2	1	NA		Low	to	High
1 Finishes - Walls		X					Painted CMU	\$0	-	\$0
2 Finishes - Flooring			X				Carpet, areas with stains, minimal wear patterns.	\$0	-	\$0
3 Finishes - Ceilings		X					Acoustical ceiling tile.	\$0	-	\$0
4 Casework and Millwork				X			Circulation desk very worn, 32" high ADA desk attached to side. Shelving serviceable.	\$0	-	\$0
5 Signage/ Wayfinding			X					\$0	-	\$0
6 Moveable/Operable Partitions						X		\$0	-	\$0
7 Doors - Frame and Door			X				Painted hollow metal frames with wood doors. Lever hardware.	\$0	-	\$0
8 Toilet Rooms						X		\$0	-	\$0
<i>Subtotal</i>								\$0	-	\$0

Interior Elements - CAFETERIA	5	4	3	2	1	NA		Low	to	High
1 Finishes - Walls		X					Painted CMU (Kitchen Painted CMU - 4)	\$0	-	\$0
2 Finishes - Flooring			X				VCT (Kitchen epoxy coating on concrete, worn and discolored - 2)	\$0	-	\$0
3 Finishes - Ceilings				X			Acoustical ceiling tile. ACT grid is discolored and rusted. (Kitchen washable tile - 2 stained/discolored)	\$15,000	-	\$20,000
4 Casework and Millwork			X					\$0	-	\$0
5 Signage/ Wayfinding			X				No signage, wayfinding lacks throughout the school.	\$0	-	\$0
6 Moveable/Operable Partitions						X		\$0	-	\$0
7 Doors - Frame and Door			X				Painted hollow metal frames with wood doors. Lever hardware. Significant wear on door and frames surfaces.	\$0	-	\$0
8 Food Service Equipment				X			Equipment appears to be older. No reports if all is in reliable working order.	\$100,000	-	\$130,000
9 Stage, Curtains, etc.						X		\$0	-	\$0
11 Bleachers - Seating						X	Portable tables and seating	\$0	-	\$0
13 Toilet Rooms						X		\$0	-	\$0
<i>Subtotal</i>								\$115,000	-	\$150,000

GILES COUNTY PUBLIC SCHOOLS  
NARROWS HIGH SCHOOL



Interior Elements - GYMNASIUM	5	4	3	2	1	NA		Low	to	High
1 Finishes - Walls		X					Painted CMU	\$0	-	\$0
2 Finishes - Flooring			X				Wood athletic floor.	\$0	-	\$0
3 Finishes - Ceilings			X				Exposed structure with tectum deck. No staining observed.	\$0	-	\$0
4 Casework and Millwork								\$0	-	\$0
5 Signage/ Wayfinding								\$0	-	\$0
6 Moveable/Operable Partitions								\$0	-	\$0
7 Doors - Frame and Door			X				Painted hollow metal frames with wood doors. Lever hardware.	\$0	-	\$0
8 Food Service Equipment								\$0	-	\$0
9 Stage, Curtains, etc.							No divider curtain.	\$0	-	\$0
10 Gymnasium Equipment			X				Padding at each primary end, not wide enough. Pads in good condition. Retractable baskets at sides and ends, anchored from ceiling structure. Scoreboard at one end wall.	\$0	-	\$0
11 Bleachers			X				Molded plastic. Good condition. No maintenance issues reported.	\$0	-	\$0
12 Student Lockers - Locker Room				X			Some of the lockers are older and exhibit surface rust.	\$0	-	\$0
13 Toilet Rooms - Locker Rooms				X			Terrazzo floors, ACT ceilings and painted CMU walls with glazed block wainscot. Tile over CMU in shower areas. Glazed block is stained, with areas of patched mortar. Shower and toilet partitions are laminate - heavily worn. Most areas exhibit extensive wear.	\$0	-	\$0
<i>Subtotal</i>								\$0	-	\$0

Interior Elements - AUDITORIUM	5	4	3	2	1	NA	Accessible seating only possible at top landing.	Low	to	High
1 Finishes - Walls		X					Painted CMU	\$0	-	\$0
2 Finishes - Flooring				X			Concrete with carpet runners at circulation areas. Carpet stains in front of stage.	\$0	-	\$0
3 Finishes - Ceilings		X					Plaster	\$0	-	\$0
4 Casework and Millwork			X				Dated, scuffed and scarred wood.	\$0	-	\$0
5 Signage/ Wayfinding							NA	\$0	-	\$0
6 Moveable/Operable Partitions			X				Acoustical treatment - Heavy blinds at side walls and solid panels at rear wall.	\$0	-	\$0
7 Doors - Frame and Door							Painted hollow metal frames with wood doors. Height of panic hardware.	\$0	-	\$0
8 Stage, Curtains, etc.			X				Wood floor. Handrails not on each side of stairs onto stage. Stage not accessible. Stage curtain slightly worn.	\$0	-	\$0
9 Bleachers - Seating				X			Formed wood seats with metal frames. Solid yet most likely original.	\$0	-	\$0
10 Toilet Rooms								\$0	-	\$0
<i>Subtotal</i>								\$0	-	\$0



GILES COUNTY PUBLIC SCHOOLS  
NARROWS HIGH SCHOOL



Interior Elements - MUSIC	5	4	3	2	1	NA		Low	to	High
1 Finishes - Walls		X					Painted CMU with brick wainscot.	\$0	-	\$0
2 Finishes - Flooring			X				VCT	\$0	-	\$0
3 Finishes - Ceilings				X			Acoustical ceiling tile. Damaged tiles - stains and chips/breaks.	\$0	-	\$0
4 Casework and Millwork							NA	\$0	-	\$0
5 Signage/ Wayfinding							None	\$0	-	\$0
6 Moveable/Operable Partitions								\$0	-	\$0
7 Doors - Frame and Door							Painted hollow metal frames with wood doors. Lever hardware.	\$0	-	\$0
8 Stage, Curtains, etc.			X				Sound panels on walls. Acoustic issues in room. Sound deadens in some areas, echoes at podium.	\$0	-	\$0
9 Equipment - Lift							Music room accessed by stairs with a wall mounted lift.	\$0	-	\$0
10 Toilet Rooms								\$0	-	\$0
<i>Subtotal</i>								\$0	-	\$0

Interior Elements - VOCATIONAL CLASSROOMS	5	4	3	2	1	NA		Low	to	High
1 Finishes - Walls		X					Painted CMU	\$0	-	\$0
2 Finishes - Flooring		X					Corridors Terrazzo, Classrooms VCT, Exposed concrete in vocational classrooms.	\$0	-	\$0
3 Finishes - Ceilings			X				Acoustical ceiling tile. Exposed structure with tectum deck in vocational spaces.	\$0	-	\$0
4 Casework and Millwork				X			Work benches with lockers very worn with some breaks.	\$0	-	\$0
5 Signage/ Wayfinding						X		\$0	-	\$0
6 Moveable/Operable Partitions						X		\$0	-	\$0
7 Doors - Frame and Door			X				Painted hollow metal frames with wood doors. Lever hardware. No entrance control	\$0	-	\$0
8 Equipment				X			Stairs to shop mezzanine storage very steep and w/o handrails	\$0	-	\$0
9 Student Lockers			X				Several recessed lockers in entrance lobby.	\$0	-	\$0
10 Toilet Rooms			X				Painted CMU walls, VCT floors and ACT ceilings. Some ADA upgrades. Several items do not meet current ADA code requirements.	\$0	-	\$0
<i>Subtotal</i>								\$0	-	\$0



GILES COUNTY PUBLIC SCHOOLS  
NARROWS HIGH SCHOOL



Interior Accessibility		5	4	3	2	1	NA		Low	to	High
1	Stairs, Ramps and Railings				X				\$0.00	-	\$0.00
2	Elevators, Chairlifts				X			No elevator in building. Only wall mounted lifts. Constant maintenance and reliability issues reported.	\$15,000.00	-	\$20,000.00
3	Doors - Openings and Hardware			X				Doors typically have lever or panic hardware. Some instances of clearance issues at door approaches.	\$0.00	-	\$0.00
4	Toilet Rooms			X				ADA upgrades throughout most toilet rooms. Instances of various current code violations.	\$0.00	-	\$0.00
5	Signage			X				Minimal signage throughout. General wayfinding not present.	\$0.00	-	\$0.00
<i>Subtotal</i>									\$15,000.00	-	\$20,000.00

Safety & Security		5	4	3	2	1	NA		Low	to	High
1	Appropriate Exterior Lighting			X				Ceiling mounted lighting at main entrance, wall packs at secondary exits. Pole mounted site lighting.	\$0.00	-	\$0.00
2	Natural Surveillance			X					\$0.00	-	\$0.00
3	Camera System - Interior and Exterior						X		\$0.00	-	\$0.00
4	Secure Entry Vestibule						X	Call box located at exterior vestibule door. Visitors are screened through voice and security cameras. No direct visual access to exterior doors. Electronic door hardware is unlocked remotely.	\$0.00	-	\$0.00
5	Card Access at Exterior Exits			X					\$0.00	-	\$0.00
<i>Subtotal</i>									\$0.00	-	\$0.00

Systems - Plumbing & Fire Protection		5	4	3	2	1	NA		Low	to	High
1	Fire Protection System(s) For Entire Building	X						Cost to add fire suppression system. Assuming fire pump would be needed.	\$425,000.00	-	\$600,000.00
2	Limited Area Fire Protection System(s)		X						\$0.00	-	\$0.00
3	Camera Inspect Sanitary & Storm Piping						X		\$0.00	-	\$0.00
4	Replace Plumbing Fixtures			X				Budget \$500-\$1,000 for replacement of existing fixtures.	\$27,000.00	-	\$32,400.00
<i>Subtotal</i>									\$452,000.00	-	\$632,400.00

GILES COUNTY PUBLIC SCHOOLS  
NARROWS HIGH SCHOOL

Systems - Electrical	5	4	3	2	1	NA		Low	to	High
1 Electrical Distribution		x						\$0.00	-	\$0.00
2 Emergency Generator		x						\$0.00	-	\$0.00
3 Interior Lighting and Controls			x				To replace with LED and dimming controls	\$1,000,000.00	-	\$1,200,000.00
4 Theatrical Lighting and Controls			x				To replace with LED and dimming controls	\$75,000.00	-	\$125,000.00
5 Exterior Lighting and Controls				x			Replace with LED and add additional fixtures	\$50,000.00	-	\$200,000.00
6 Fire Alarm		x						\$0.00	-	\$0.00
7 Clock System				x				\$120,000.00	-	\$150,000.00
8 Card Access/Access Control/Door Monitoring		x						\$0.00	-	\$0.00
9 Paging / Phone Call in System			x					\$120,000.00	-	\$150,000.00
10 Camera system		x						\$0.00	-	\$0.00
11 Intrusion Detection	x						Costs for intrusion detection system	\$75,000.00	-	\$100,000.00
12 Network Cabling / COAX/ WAP			x					\$475,000.00	-	\$575,000.00
13 Sound System/AV - Theatre / Gym / Cafeteria			x				gym system is ok, cost for auditorium	\$75,000.00	-	\$125,000.00
14 Classroom Technology						x		\$0.00	-	\$0.00
<i>Subtotal</i>								\$1,990,000.00	-	\$2,625,000.00



GILES COUNTY PUBLIC SCHOOLS  
NARROWS HIGH SCHOOL



Systems - HVAC	5	4	3	2	1	NA		Low	to	High
1 Upgrade/Replace Existing HVAC system			x				Prices include replacement of 4-pipe system as well as OAU's.	\$3,398,360.00	-	\$4,672,745.00
2 Upgrade/Replace Kitchen EA & MUA System(s)			x					\$22,750.00	-	\$64,000.00
3 Recommission / Upgrade BAS system/control	x						The options for upgrade are a gateway to pull in existing system or a new system throughout.	\$250,000.00	-	\$500,000.00
4 Building Ventilation - DOAS/ERU				x			OAU's should be replaced with new units that have integral direct-fired gas heaters in lieu of the current units which have independent gas-fired water heaters that provide heating water to each OAU.	\$528,000.00	-	\$726,000.00
5 MDF/IDF Cooling and/or Ventilation			x				Replacement of existing split systems serving IT rooms.	\$42,000.00	-	\$54,000.00
<i>Subtotal</i>								\$4,241,110.00	-	\$6,016,745.00
								\$8,143,110.00		\$11,187,145.00

	Low Cost	-	High Cost
< 2 YRS.	\$0.00	-	\$0.00
2-6 YRS.	\$2,108,000.00	-	\$2,924,000.00
6-10 YRS.	\$5,285,110.00	-	\$7,063,145.00
10-15 YRS.	\$0.00	-	\$0.00
15-20 YRS.	\$750,000.00	-	\$1,200,000.00
Total Cost to Upgrade to Current Standards:	\$8,143,110.00	-	\$11,187,145.00

\*COSTS PRESENTED ABOVE IN THE FCI ARE BASED ON 2021-22 COSTS FOR MATERIALS AND CONSTRUCTION



GILES COUNTY PUBLIC SCHOOLS  
GILES HIGH SCHOOL

SCALE	DESCRIPTION	FCI %	TIMELINE
5 NEW	New or like-new condition; Reevaluate in 8 - 10 years	91% - 100%	15-20 YRS.
4 GOOD	Minimal wear for age, no issues	61% - 90%	10-15 YRS.
3 FAIR	Average wear for age, approaching end of lifecycle	31% - 60%	6-10 YRS.
2 POOR	Worn from use or age, end of expected lifecycle	16% - 30%	2-6 YRS.
1 CRITICAL	Extremely worn or damaged, replace as soon as possible	0% - 15%	< 2 YRS.

FACILITY CONDITION INDEX (FCI)   Assessed							ESTIMATED CONSTRUCTION COST			
Site	5	4	3	2	1	NA	Comments & Recommendations	Low	to	High
	•	•	•	•	•	•				
1 Perimeter Fencing & Gates						X		\$0	-	\$0
2 Athletic Fields						X		\$0	-	\$0
3 Athletic Field Structures, Scoreboards						X		\$0	-	\$0
4 On-Site Sidewalks				X			Areas where panels of sidewalk have been replaced over time.	\$0	-	\$0
5 Play Equipment				X		X		\$0	-	\$0
6 Paving				X			Worn paving at entrance. Paving throughout site has area of patching, minor ponding and loose material.	\$100,000	-	\$150,000
7 Striping, Markings, Speed Bumps				X				\$5,000	-	\$6,500
8 Curbing			X				Typically the pavement and sidewalks are at the same plane. Concrete curbing where curbing is utilized.	\$0	-	\$0
9 On-Site Signage			X					\$0	-	\$0
10 Exterior Furniture, Bike Racks, Storage			X					\$0	-	\$0
11 Retaining Walls, Site Walls						X		\$0	-	\$0
12 Freestanding Walkway Canopies				X			Serviceable, yet heavily worn. Some ponding and leaking on the roofs. Steel framed flat roof structures with formed metal trim at fascia, membrane roof and painted panel ceiling. Areas of ponding on the roof from poor drainage, staining of fascia's and soffits from drainage overflow.	\$100,000	-	\$150,000
13 General Grounds			X				Area of ponding between the High School and the Ag. Building.	\$0	-	\$0
<i>Subtotal</i>								\$205,000	-	\$306,500





GILES COUNTY PUBLIC SCHOOLS  
GILES HIGH SCHOOL

Site Accessibility	5	4	3	2	1	NA		Low	to	High
1 Pedestrian Access - ADA & Safety			X				Several areas where sections of walk have been replaced. Concrete finishes do not all match.	\$0	-	\$0
2 Vehicular Access - Vehicles			X				Bus stacking issues reported. Circulation conflicts between cars entering and exiting parking and buses exiting.	\$0	-	\$0
3 Vehicular Access - Buses			X					\$0	-	\$0
4 Vehicular Access - Deliveries				X				\$0	-	\$0
5 Handicap Parking								\$0	-	\$0
6 Accessible Entry			X				ADA ramp at front entrance. No automatic openers.	\$0	-	\$0
7 Exterior Stairs and Railings			X	X			Deteriorated concrete at service entrance stairs.	\$0	-	\$0
8 Exterior Ramps				X				\$0	-	\$0
<i>Subtotal</i>								\$0	-	\$0

Exterior Building Envelope	5	4	3	2	1	NA		Low	to	High
1 Structure			X				CMU bearing wall, steel beam and joist roof structure, tectum deck.	\$0	-	\$0
2 General Appearance			X					\$0	-	\$0
3 Roof				X			Rubber roof membrane over rigid insulation. Several areas were observed to have failing lap splices and lap sealants that are alligating.	\$650,000	-	\$800,000
4 Soffits				X			Evidence of sagging plywood soffits in areas.	\$20,000	-	\$30,000
5 Walls			X				Brick veneer with CMU back-up.	\$0	-	\$0
6 Doors & Hardware			X				Painted aluminum storefront entrances. Panic bar hardware.	\$0	-	\$0
7 Windows				X			Painted aluminum window frames with insulated glazing. Some instances where the window seals have broken and the windows have fogged. Paint on the exterior is beginning to chalk.	\$500,000	-	\$650,000
8 Miscellaneous				X			Sealed joints have become brittle, contracted and cracked. Canopies at main entrance and exit doors are in poor condition.	\$150,000	-	\$200,000
<i>Subtotal</i>								\$1,320,000	-	\$1,680,000



GILES COUNTY  
PUBLIC SCHOOLS

DIVISION WIDE FACILITY STUDY



GILES COUNTY PUBLIC SCHOOLS  
GILES HIGH SCHOOL



Interior Elements - ENTRY	5	4	3	2	1	NA		Low	to	High
1 Finishes - Walls		X					Painted CMU	\$0	-	\$0
2 Finishes - Flooring		X					Terrazzo	\$0	-	\$0
3 Finishes - Ceilings		X					Acoustical ceiling tile.	\$0	-	\$0
4 Casework and Millwork		X					Wood display cases recessed into walls. All cases extremely full.	\$0	-	\$0
5 Signage/ Wayfinding		X					Minimal signage. Small plaque only. No general way finding or graphics.	\$0	-	\$0
7 Doors - Frame and Door			X				Painted hollow metal frames with wood doors. Lever hardware.	\$0	-	\$0
8 Toilet Rooms				X			Public toilet off lobby is serviceable. Has not been upgraded for ADA. Toilet partitions are very worn. No privacy screens at urinals.	\$0	-	\$0
<i>Subtotal</i>								\$0	-	\$0

Interior Elements - ADMINISTRATION	5	4	3	2	1	NA		Low	to	High
1 Finishes - Walls		X					Painted CMU	\$0	-	\$0
2 Finishes - Flooring		X					Tile	\$0	-	\$0
3 Finishes - Ceilings		X					Acoustical ceiling tile.	\$0	-	\$0
4 Casework and Millwork			X				Plastic laminate casework	\$0	-	\$0
5 Signage/ Wayfinding			X				Small room signage "OFFICE" with braille.	\$0	-	\$0
6 Moveable/Operable Partitions						X	NA	\$0	-	\$0
7 Doors - Frame and Door			X				Painted hollow metal frames with wood doors. Lever hardware.	\$0	-	\$0
8 Toilet Rooms				X			Small non-ADA bathroom with very narrow door.	\$10,000	-	\$20,000
<i>Subtotal</i>								\$10,000	-	\$20,000



GILES COUNTY PUBLIC SCHOOLS  
GILES HIGH SCHOOL

Interior Elements - CORRIDORS	5	4	3	2	1	NA		Low	to	High
1 Finishes - Walls		X					Painted CMU	\$0	-	\$0
2 Finishes - Flooring		X					Terrazzo	\$0	-	\$0
3 Finishes - Ceilings		X					Acoustical ceiling tile.	\$0	-	\$0
4 Casework and Millwork			X				Casework not used.	\$0	-	\$0
5 Signage/ Wayfinding							Text and braille plaque into rooms.	\$0	-	\$0
6 Moveable/Operable Partitions							NA	\$0	-	\$0
7 Doors - Frame and Door			X				Painted hollow metal frames with wood doors. Lever hardware. Chipped/worn paint on frames. ADA clearance pull side issues.	\$0	-	\$0
8 Stairs				X			Heavily worn treads (slate?) Stairs are not enclosed at top or bottom, which does not meet current code requirements. Wall mounted lift utilized for lower corridor access. All/most lifts reported to be unreliable and have maintenance issues.	\$200,000	-	\$250,000
9 Student Lockers						X	NA	\$0	-	\$0
10 Toilet Rooms						X	See core toilet rooms.	\$0	-	\$0
<i>Subtotal</i>								\$200,000	-	\$250,000

Interior Elements - CORE TOILET ROOMS	5	4	3	2	1	NA	Core bathrooms in classroom wing.	Low	to	High
1 Finishes - Walls			X				Painted CMU	\$0	-	\$0
2 Finishes - Flooring			X				Painted/epoxy over concrete.	\$0	-	\$0
3 Finishes - Ceilings			X				Acoustical ceiling tile.	\$0	-	\$0
4 Casework and Millwork				X			Laminate toilet partitions.	\$25,000	-	\$35,000
5 Signage/ Wayfinding			X					\$0	-	\$0
6 Moveable/Operable Partitions							NA	\$0	-	\$0
7 Doors - Frame and Door			X				Painted hollow metal frames with wood doors. Lever hardware.	\$0	-	\$0
8 Toilet Rooms				X			ADA upgrades have occurred with minor infractions from current code. Grab bars in ADA toilet raised due to plumbing conflict. Soap dispensers wrong height and location.	\$50,000	-	\$75,000
<i>Subtotal</i>								\$75,000	-	\$110,000



GILES COUNTY PUBLIC SCHOOLS  
GILES HIGH SCHOOL

Interior Elements - CLASSROOMS	5	4	3	2	1	NA		Low	to	High
1 Finishes - Walls		X					Painted CMU	\$0	-	\$0
2 Finishes - Flooring			X				VCT - worn in many locations.	\$0	-	\$0
3 Finishes - Ceilings		X	X				Acoustical ceiling tile. Areas of stained tiles due to roof and equipment leaks. Ongoing tile replacement occurs.	\$0	-	\$0
4 Casework and Millwork			X				Original built-in wood casework. Markerboards, smartboards and tack boards utilized.	\$0	-	\$0
5 Signage/ Wayfinding						X	Hand made paper signs identifying classrooms.	\$0	-	\$0
6 Moveable/Operable Partitions						X	NA	\$0	-	\$0
7 Doors - Frame and Door			X				Painted hollow metal frames with wood doors. Lever hardware. ADA access pull side clearance issues.	\$0	-	\$0
8 Student Lockers						X	NA	\$0	-	\$0
9 Toilet Rooms						X	NA	\$0	-	\$0
<i>Subtotal</i>								\$0	-	\$0

Interior Elements - SCIENCE CLASSROOMS	5	4	3	2	1	NA	Science rooms on second floor. New science room to be built next year on first floor for ADA access.	Low	to	High
1 Finishes - Walls		X					Painted CMU	\$0	-	\$0
2 Finishes - Flooring			X				VCT	\$0	-	\$0
3 Finishes - Ceilings		X	X				Area of staining and chipped tiles observed.	\$0	-	\$0
4 Casework and Millwork				X			Old casework with science tops at room perimeter. Gas turrets unhooked.	\$0	-	\$0
5 Signage/ Wayfinding		X						\$0	-	\$0
6 Moveable/Operable Partitions						X		\$0	-	\$0
7 Doors - Frame and Door			X				Painted hollow metal frames with wood doors. Lever hardware.	\$0	-	\$0
12 Student Lockers						X		\$0	-	\$0
13 Toilet Rooms						X		\$0	-	\$0
<i>Subtotal</i>								\$0	-	\$0



GILES COUNTY PUBLIC SCHOOLS  
GILES HIGH SCHOOL

Interior Elements - LIBRARY	5	4	3	2	1	NA		Low	to	High
1 Finishes - Walls			X				Painted CMU	\$0	-	\$0
2 Finishes - Flooring			X				Carpet	\$0	-	\$0
3 Finishes - Ceilings			X				Acoustical ceiling tile.	\$0	-	\$0
4 Casework and Millwork			X				Wood wall cabinets and island cabinets.	\$0	-	\$0
5 Signage/ Wayfinding						X		\$0	-	\$0
6 Moveable/Operable Partitions						X		\$0	-	\$0
7 Doors - Frame and Door			X				Painted hollow metal frames with wood doors. Panic hardware.	\$0	-	\$0
<i>Subtotal</i>								\$0	-	\$0

Interior Elements - CAFETERIA	5	4	3	2	1	NA		Low	to	High
1 Finishes - Walls		X					Painted CMU (Kitchen Painted CMU - 4)	\$0	-	\$0
2 Finishes - Flooring		X					VCT (Kitchen epoxy coating on concrete - 3)	\$0	-	\$0
3 Finishes - Ceilings			X				Acoustical ceiling tile. (Kitchen washable tile - 2 stained/discolored)	\$0	-	\$0
4 Casework and Millwork			X					\$0	-	\$0
5 Signage/ Wayfinding						X	No signage	\$0	-	\$0
6 Moveable/Operable Partitions						X		\$0	-	\$0
7 Doors - Frame and Door				X			Painted hollow metal frames with wood doors. Lever hardware. Significant wear on door and frames surfaces.	\$0	-	\$0
8 Food Service Equipment				X			Issues reported with gas range and hood. Equipment is older, reported serviceable.	\$100,000	-	\$150,000
9 Stage, Curtains, etc.						X		\$0	-	\$0
10 Bleachers - Seating						X	Portable	\$0	-	\$0
11 Toilet Rooms						X		\$0	-	\$0
<i>Subtotal</i>								\$100,000	-	\$150,000



GILES COUNTY PUBLIC SCHOOLS  
GILES HIGH SCHOOL

Interior Elements - GYMNASIUM	5	4	3	2	1	NA		Low	to	High
1 Finishes - Walls		X					Painted CMU	\$0	-	\$0
2 Finishes - Flooring			X				Wood athletic floor.	\$0	-	\$0
3 Finishes - Ceilings			X				Exposed structure with tectum deck. No staining observed.	\$0	-	\$0
4 Casework and Millwork			X				Padding at each primary end, good condition.	\$0	-	\$0
6 Moveable/Operable Partitions						X		\$0	-	\$0
7 Doors - Frame and Door			X				Painted hollow metal frames with wood doors. Lever hardware.	\$0	-	\$0
9 Stage, Curtains, etc.						X	No divider curtain.	\$0	-	\$0
10 Gymnasium Equipment			X					\$0	-	\$0
11 Bleachers			X				Molded plastic. Good condition. No maintenance issues reported.	\$0	-	\$0
12 Toilet Rooms - Locker Rooms				X			Terrazzo floors, ACT ceilings and painted CMU walls. Tile over CMU in shower areas. Glazed block in weight room and lockers. Area of patched mortar. Shower and toilet partitions are laminate - heavily worn. Most areas exhibit extensive wear. Rusting observed on some lockers.	\$250,000	-	\$350,000
<i>Subtotal</i>								\$250,000	-	\$350,000

Interior Elements - AUDITORIUM	5	4	3	2	1	NA	Accessible seating only possible at top landing.	Low	to	High
1 Finishes - Walls		X					Painted CMU	\$0	-	\$0
2 Finishes - Flooring		X					Concrete with carpet runners at circulation areas.	\$0	-	\$0
3 Finishes - Ceilings		X					Plaster	\$0	-	\$0
4 Casework and Millwork			X				Dated, scuffed and scarred wood.	\$0	-	\$0
5 Signage/ Wayfinding							NA	\$0	-	\$0
6 Moveable/Operable Partitions			X				Acoustical treatment - Heavy blinds at side walls and solid panels at rear wall.	\$0	-	\$0
7 Doors - Frame and Door			X				Painted hollow metal frames with wood doors.	\$0	-	\$0
8 Stage, Curtains, etc.			X				Wood floor. Handrails not on each side of stairs onto stage. Stage not accessible.	\$0	-	\$0
9 Bleachers - Seating				X			Formed wood seats with metal frames. Solid yet most likely original.	\$0	-	\$0
10 Toilet Rooms						X		\$0	-	\$0
<i>Subtotal</i>								\$0	-	\$0



GILES COUNTY PUBLIC SCHOOLS  
GILES HIGH SCHOOL

Interior Elements - MUSIC	5	4	3	2	1	NA		Low	to	High
1 Finishes - Walls		X					Painted CMU with brick wainscot.	\$0	-	\$0
2 Finishes - Flooring			X				VCT	\$0	-	\$0
3 Finishes - Ceilings				X			Acoustical ceiling tile. Damaged tiles - stains and chips/breaks.	\$10,000	-	\$15,000
4 Casework and Millwork						X	NA	\$0	-	\$0
5 Signage/ Wayfinding						X	None	\$0	-	\$0
6 Moveable/Operable Partitions						X		\$0	-	\$0
7 Doors - Frame and Door			X				Painted hollow metal frames with wood doors. Lever hardware.	\$0	-	\$0
9 Stage, Curtains, etc.			X				Sound panels on walls. Acoustic issues in room. Sound deadens in some areas, echoes at podium.	\$0	-	\$0
10 Equipment - Lift							Music room accessed by stairs with a wall mounted lift.	\$0	-	\$0
<i>Subtotal</i>								\$10,000	-	\$15,000

Interior Elements - VOCATIONAL CLASSROOMS	5	4	3	2	1	NA	Separate building (Ag. Building)	Low	to	High
1 Finishes - Walls		X					Painted CMU	\$0	-	\$0
2 Finishes - Flooring		X					Corridors Terrazzo, Classrooms VCT, Exposed concrete in vocational classrooms.	\$0	-	\$0
3 Finishes - Ceilings			X				Acoustical ceiling tile. Exposed structure with tectum deck in vocational spaces.	\$0	-	\$0
4 Casework and Millwork				X			Work benches with lockers very worn with some breaks.	\$0	-	\$0
5 Signage/ Wayfinding								\$0	-	\$0
6 Moveable/Operable Partitions								\$0	-	\$0
7 Doors - Frame and Door			X				Painted hollow metal frames with wood doors. Lever hardware. No entrance control	\$0	-	\$0
8 Equipment				X			Stairs to shop mezzanine storage very steep and w/o handrails	\$0	-	\$0
9 Toilet Rooms						X		\$0	-	\$0
<i>Subtotal</i>								\$0	-	\$0



GILES COUNTY PUBLIC SCHOOLS  
GILES HIGH SCHOOL

Interior Accessibility	5	4	3	2	1	NA		Low	to	High
1 Stairs, Ramps and Railings			X					\$0	-	\$0
2 Elevators, Chairlifts				X			No elevator in building. Only wall mounted lifts. Constant maintenance and reliability issues reported.	\$15,000	-	\$25,000
3 Doors - Openings and Hardware			X				ADA clearance issues at doors throughout the building.	\$0	-	\$0
4 Toilet Rooms			X				ADA upgrades throughout most toilet rooms. Instances of various current code violations remain.	\$0	-	\$0
5 Signage						X	Minimal signage throughout. General wayfinding not present.	\$0	-	\$0
<i>Subtotal</i>								\$15,000	-	\$25,000

Safety & Security	5	4	3	2	1	NA		Low	to	High
1 Appropriate Exterior Lighting				X			Minimal wall packs at building perimeter. Door canopies have ceiling lights.	\$0	-	\$0
2 Natural Surveillance			X					\$0	-	\$0
3 Camera System - Interior and Exterior						X		\$0	-	\$0
4 Secure Entry Vestibule			X				Call box located at exterior vestibule door. Visitors are screened through voice and security cameras. No direct visual access to exterior doors. Electronic door hardware is unlocked remotely.	\$0	-	\$0
5 Card Access at Exterior Exits			X				Card access at perimeter doors.	\$0	-	\$0
<i>Subtotal</i>								\$0	-	\$0





GILES COUNTY PUBLIC SCHOOLS  
GILES HIGH SCHOOL

Systems - Plumbing & Fire Protection	5	4	3	2	1	NA		Low	to	High
1 Fire Protection System(s) For Entire Building	x						cost provided if fire suppression system desired - includes fire pump	\$475,000	-	\$600,000
2 Limited Area Fire Protection System(s)		x						\$0	-	\$0
3 Camera Inspect Sanitary & Storm Piping	x							\$0	-	\$0
4 Replace Plumbing Fixtures			x				Budget \$500-\$1,000 for replacement of existing fixtures.	\$56,000	-	\$67,200
<i>Subtotal</i>								\$531,000	-	\$667,200

Systems - Electrical	5	4	3	2	1	NA		Low	to	High
1 Electrical Distribution		x						\$0	-	\$0
2 Emergency Generator		x						\$0	-	\$0
3 Interior Lighting and Controls			x				To replace with LED and dimming controls	\$1,100,000	-	\$1,300,000
4 Theatrical Lighting and Controls			x				To replace with LED and dimming controls	\$75,000	-	\$125,000
5 Exterior Lighting and Controls		x					Replace with LED and add additional fixtures	\$50,000	-	\$200,000
6 Fire Alarm		x						\$0	-	\$0
7 Clock System				x				\$150,000	-	\$200,000
8 Card Access/Access Control/Door Monitoring		x						\$0	-	\$0
9 Paging / Phone Call in System			x					\$150,000	-	\$200,000
10 Camera system		x						\$0	-	\$0
11 Intrusion Detection	x						Costs for intrusion detection system	\$75,000	-	\$100,000
12 Network Cabling / COAX/ WAP			x					\$550,000	-	\$700,000
13 Sound System/AV - Theatre / Gym / Cafeteria			x				gym system is ok, cost for auditorium	\$75,000	-	\$125,000
14 Classroom Technology						x		\$0	-	\$0
<i>Subtotal</i>								\$2,225,000	-	\$2,950,000



GILES COUNTY PUBLIC SCHOOLS  
GILES HIGH SCHOOL



Systems - HVAC	5	4	3	2	1	NA		Low	to	High
1 Upgrade/Replace Existing HVAC system			x				Prices include replacement of 4-pipe system as well as OAUs.	\$4,940,320	-	\$6,792,940
2 Upgrade/Replace Kitchen EA & MUA System(s)			x					\$22,750	-	\$56,000
3 Recommission / Upgrade BAS system/control	x						The options for upgrade are a gateway to pull in existing system or a new system throughout.	\$250,000	-	\$500,000
4 Building Ventilation - DOAS/ERU				x			OAUs should be replaced with new units that have integral direct-fired gas heaters in lieu of the current units which have independent gas-fired water heaters that provide heating water to each OAU.	\$864,000	-	\$1,056,000
5 MDF/IDF Cooling and/or Ventilation			x				Replacement of existing split systems serving IT rooms.	\$42,000	-	\$64,000
<i>Subtotal</i>								\$6,119,070	-	\$8,468,940

	Low Cost	-	High Cost
< 2 YRS.	\$0	-	\$0
2-6 YRS.	\$3,199,000	-	\$4,162,500
6-10 YRS.	\$7,011,070	-	\$9,430,140
10-15 YRS.	\$50,000	-	\$200,000
15-20 YRS.	\$800,000	-	\$1,200,000
Total Cost to Upgrade to Current Standards:	\$11,060,070	-	\$14,992,640

\*COSTS PRESENTED ABOVE IN THE FCI ARE BASED ON 2021-22 COSTS FOR MATERIALS AND CONSTRUCTION



**Giles High School**  
**LIFE CYCLE COST ANALYSIS / SYSTEM COMPARISON**

**PREPARED FOR:**  
**Giles County Public Schools**

**PREPARED BY:**

**Drew Roberts, PE**  
**August 11, 2021**



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## INTRODUCTION

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CMTA was asked by Giles County Public Schools and Crabtree, Rohrbaugh, & Associates Architects to present a life cycle cost comparison between potential HVAC system replacement/upgrade options for the mechanical systems at the existing Giles County High School in Pearisburg, Virginia. The systems to be compared were a geothermal water source heat pump system, a boiler/cooling-tower water source heat pump system, and a high performance 4-pipe system.

The following report includes a brief overview of each system, a comparison of each system which includes some of the pros and cons of each as it applies to the proposed project, and finally a full life cycle cost analysis for each system is presented. **This life cycle cost analysis is based off historical project data and actual cost of construction benchmarked in previous projects. Future cost opinions for the project will be updated when the design further progresses.**

## EXISTING SYSTEMS

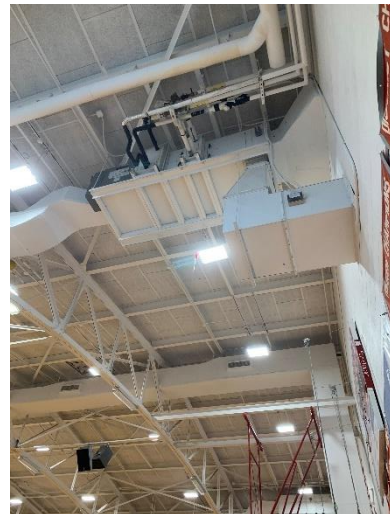
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### General

The existing building is served by a 4-pipe chilled water and hot water system that primarily utilizes unit ventilators and fan coils to serve the HVAC loads of the spaces/zones. The ventilation for the educational wing of the building is provided by dedicated outside air systems (DOAS) located on the roof(s) that have DX cooling coils, hot water heating coils, and energy recovery wheels. There are some larger spaces, such as the gym, that utilize four pipe blower coils to condition the space loads and the ventilation air is provided by a rooftop DOAS unit.



*Typical Unit Ventilator - Classroom*



*Typical Blower Coil - Gymnasium*

## Central Plant Equipment

The existing central plant is made up of two 97.5-ton split DX air-cooled chillers and two 1,600MBH natural gas boilers. The chillers, boilers, and associated pumps are located in the lower-level main mechanical room adjacent to the gymnasium, and the split DX condensers for the chillers are located on the roof above the gym storage area. A majority of the central plant equipment is from the previous 1999/2000 HVAC renovation that replaced the old coal-fired steam boiler system and unit ventilators.



*Existing Chillers*



*Existing Gas Fired Boilers*

## Ventilation Air - Dedicated Outside Air Systems

A majority of the ventilation air for the school building is provided by dedicated rooftop outside air units that were installed during the 1999/2000 HVAC renovation. The units are custom Dectron energy recovery units that have a DX cooling coil and a hot water heating coil. The units are installed on exterior structural dunnage that also supports a split DX condenser and natural gas-fired heating water boiler. Each DOAS unit has its own dedicated split DX condenser and heating water boiler which is a maintenance issue which should be addressed no matter the final central plant solution that is chosen.



*Typical Built-Up DOAS*

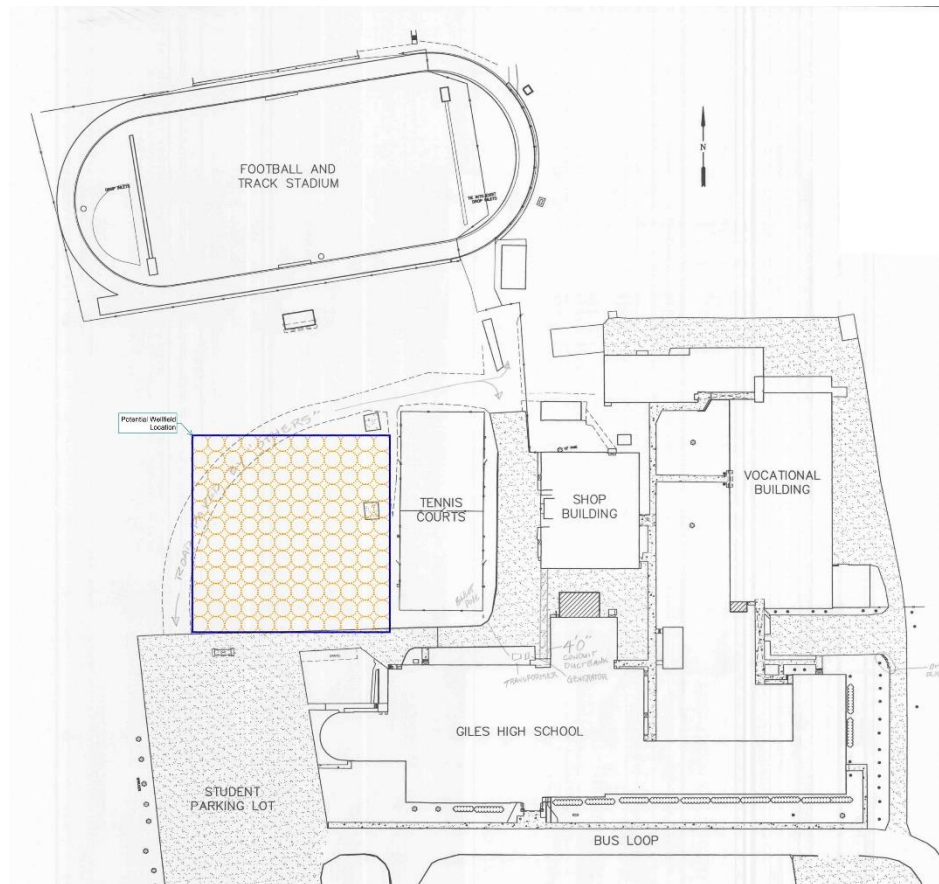


*Typical Built-Up DOAS*

## OVERVIEW OF SYSTEM REPLACEMENT OPTIONS

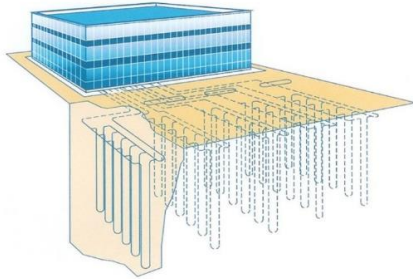
### Option 1 - Geothermal Water Source Heat Pump System

In a geothermal water-source heat pump system, conditioning equipment (typically referred to as heat pumps) heats and cools the building and absorbs or rejects this heat to water which is circulated to all the heat pumps through a two-pipe heat pump water loop. High-Efficiency water-source heat pumps with a geothermal wellfield would be utilized. Cooling EERs are typically up to 21.6 full load (using AHRI ground loop conditions) and heating COPs are up to 6.4 at full load (using AHRI ground loop conditions). Horizontal heat pumps would be located above the ceilings to serve the spaces/zone. The existing hydronic piping likely **could not** be repurposed to circulate the heat pump loop water, due to the fact that the water flows required are significantly higher than chilled water and/or heating water of the existing four pipe system, and thus new hydronic piping would be required throughout the building. The geothermal wellfield could be located under the existing green space adjacent the existing tennis courts. Figure 1 below presents an example illustrating a geothermal wellfield layout that could be used at the school.

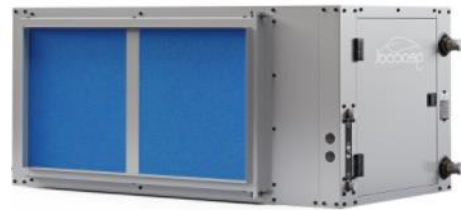


**Figure 1: Potential Wellfield Layout**

The anticipated wellfield layout would use circuits of 350'-400' ft deep wells, spaced equally on 20 ft. centers. The wellfield would not be visible as it is entirely underground. To balance and maintain the wellfield there are typically two (2) options available to the owner: an indoor located geothermal header and a vault located outside. The header and the vault contain the same main components including valves and accessories to maintain the wellfield; the key difference is the location of each. CMTA typically recommends utilizing an indoor geothermal header if space is available, but many clients choose an exterior vault depending on space availability and preference. We would anticipate there being a geothermal header located in the existing boiler room as well as the associated wellfield and building loop pumps.



*Geothermal Wellfield*



*Horizontal Heat pump*



*Vertical Heat Pump*



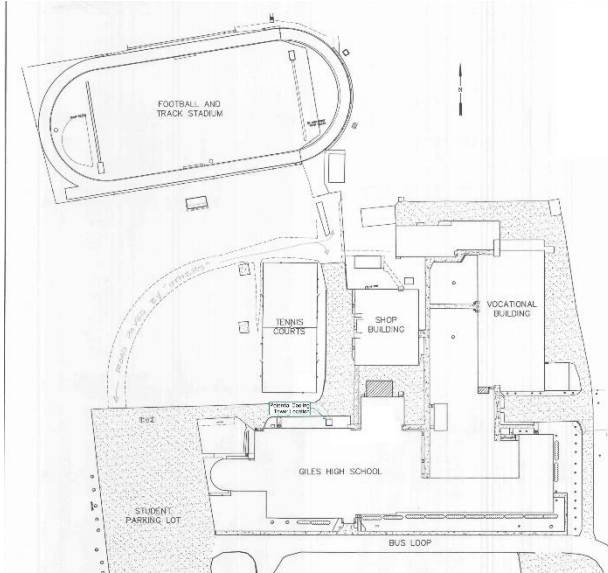
*Console Heat Pump*

Refer to the Dedicated Outside Air System section for ventilation system description.

[Option 2 - Boiler / Cooling Tower Water Source Heat Pump System](#)

In a boiler / cooling tower water-source heat pump system, conditioning equipment (referred to as heat pumps) heats and cools the building and absorbs or rejects this heat to a two-pipe heat pump loop which is then heated or cooled using the boiler or cooling tower. Cooling EERs is typically 17.0 at full-load and 19.5 at part-load (using AHRI water loop conditions). Heating COP is 5.4 at full-load and 5.2 at part-load. Heat pumps would be located and selected in three different arrangements: horizontal, vertical, and console. Careful planning of the cooling tower location would be required to lessen the impact of noise and line of sight. Figure 2 below presents an example of the estimated foot print and example location of the cooling tower – note that this location can be revised, it is just for illustrative purposes.





**Figure 2: Cooling Tower Foot Print and Example Location.**

The cooling tower would need to be carefully located to mitigate sound that is generated and lessen the line of sight.



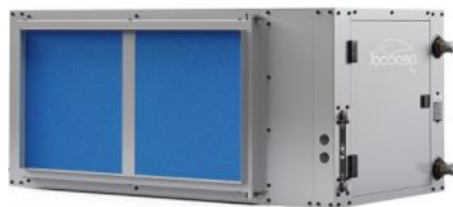
*Boiler*



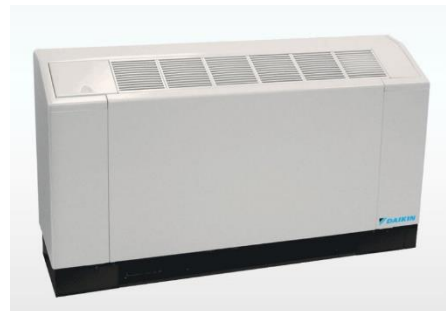
*Cooling Tower*



*Vertical heat Pump*



*Horizontal Heat Pump*



*Console Heat Pump*

Refer to the Dedicated Outside Air System section for ventilation system description.

### Option 3 – High Efficiency Four Pipe Fan Coil System

This system employs an air source chiller to generate chilled water for cooling and high efficiency boilers to generate hot water for heating. The terminal units in this system are fan coils in lieu of heat pumps which do not have compressors and only consist of a fan, heating coil, and cooling coil. The compressors are centralized at the outdoor air source chiller. Rather than a common pair of pipes this system uses two pair of pipes (4-pipe system), one pair for heating and one pair for cooling. This system may also require antifreeze in the chilled water and more pumps compared to the geothermal system; a set of pumps for the heating water and a set of pumps for the chilled water. Fan coil units would be located and selected in two different arrangements: horizontal and console. Careful planning of the chiller location would be required to lessen the impact of noise and line of sight as well as any structural concerns.



*Boiler*



*Air Source Chiller*



*Horizontal Fan Coil Unit*



*Console Fan Coil Unit*

Refer to the Dedicated Outside Air System section for ventilation system description.

### Ventilation Air - Dedicated Outdoor Air Systems

As noted in the existing systems section above, we would recommend replacing the existing built-up DOAS units with new packaged DX/natural gas fired DOAS units. The system will be sized for the population of the school and the ventilation air flows will be modulated based on carbon dioxide levels in each space. This allows for the ventilation air to “follow” the occupants of the building a provide the correct air flow needed when the occupants are in each space. This approach helps to save energy by reducing

unnecessary overventilation of lightly occupied or unoccupied spaces, as well as reduce the overall size and cost of the overall ventilation system(s). The dedicated outside air system air handling unit will be provided with a total enthalpy wheel for energy recovery and a DX cooling coil with hot gas reheat for humidity control. The ventilation air will be delivered dehumidified at a room neutral temperature. The units will be located on the existing structural dunnage that is currently serving the built-up units.



*Packaged DOAS Unit w/ ERW*

## SYSTEM COMPARISON

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### Geothermal Water Source Heat Pump

- **Maintainability – Excellent**
  - No Boilers or Chillers to maintain.
  - Regular maintenance includes filter changes and water treatment for heat pump water loop.
  - Wellfield life of 50+ years will extend long beyond even the service life of the heat pump system.
  - Heat Pumps located above ceiling, in mechanical rooms, and/or in classrooms if console units are selected. Filter accessible from ground thru filter grilles or available at the unit for vertical and console type heat pumps.
  - Hydronic accessories located above ceiling or in mechanical room (strainers at heat pump).
  - Wells located in field adjacent to building, but will have 20-year warranty and will last at least 50+ years.
  - No antifreeze required in water loop and no heat tracing of piping.
  - Units can be worked on and maintained by residential licensed HVAC contractor.
- **Energy Performance – Excellent**
  - Most energy efficient system. EUI (20-25)
  - Lower entering water temperatures from the ground source result in optimal heat pump performance and life.
- **Space/Aesthetic impact – Good**

- Requires mechanical room space for pumps and closets for vertical heat pumps.
- 2-pipe system.
- Units are located above ceilings for horizontal style units, in mechanical rooms for vertical style units, or in the space for console type units.
- **Cons**
  - Vertical Heat Pumps take up program/floor space.
  - Compressors and Fans located above ceilings for horizontal type units.
  - System is ducted; sheet metal must be routed and located above ceiling.
  - New piping would be required to be run to serve the heat pump water loop.

### Boiler / Cooling Tower Water Source Heat Pump

- **Maintainability – Fair**
  - Cooling Tower requires monthly and quarterly maintenance of fans/pumps/motors.
  - Regular maintenance includes filter changes and water treatment (requires ongoing contract with vendor if owner's staff is unable to perform).
- **Energy Performance – Good**
  - Good efficiency, but proven system. EUI (35 to 45).
  - Life cycle is about 15-20 years.
- **Space/Aesthetic Impact – Good to Excellent**
  - Requires mechanical room space for boilers, pumps, and water basin.
  - Screening would be required to hide cooling tower.
  - The cooling tower would need to be located strategically, preferably isolated, to lower the impact of noise that is generated.
- **Cons**
  - Vertical Heat Pumps take up program/floor space.
  - Compressors and Fans located above ceilings for horizontal type units.
  - System is ducted; sheet metal must be routed and located above ceiling.
  - More intense/involved water treatment.
  - If drain-back design cannot be achieved, a basin heater will be required to prevent the cooling tower from freezing and causing damage during winter months.
  - New piping would be required to be run to serve the heat pump water loop.

### High Efficiency Four Pipe System

- **Maintainability – Good**
  - System requires four (4) pumps.
  - System may require antifreeze.
  - Takes up additional space due to quantity of pumps and freeze protection equipment.

- Regular maintenance includes filter changes and water treatment (requires ongoing contract with vendor if owner's staff is unable to perform maintaining of antifreeze).
  - Four (4) pipes instead of two (2).
  - Compressors are centralized and located outside.
  - Fan coils with hydronic accessories and filters located above ceiling.
  - Requires the most above ceiling clear space. (Heat Pumps = 24-30 inches; Fan Coils = 18-24 inches).
  - Typical system most contractors can service.
  - Two (2) hydronic systems instead of one (1). Hot water and Chilled Water
- **Energy Performance – Fair**
    - Fair efficiency but proven system. EUI (50 to 60)
    - Chiller is least efficient means of cooling.
    - Energy penalty for use of anti-freeze due to pumping viscous fluid and heat transfer reduction.
  - **Space/Aesthetic Impact – Fair**
    - Requires most room in the mechanical room.
    - Horizontal and cassette type fan coils located above ceilings with hydronic valving.
    - Ducted system; thus, sheet metal must route above ceiling.
  - **Cons**
    - Four (4) pipes instead of two (2).
    - Least efficient but most common system.
    - May require a larger mechanical room.
    - Requires anti-freeze.
    - Fan coils located above ceiling for horizontal and cassette type units.
    - Insulation required in contrast to WSHP systems.
    - More hydronic accessories above ceiling due to additional piping systems (4 pipes compared to 2).

## LIFE CYCLE COST ANALYSIS: EXECUTIVE SUMMARY

A life cycle cost analysis by its very nature, relies upon educated assumptions about the future based upon analysis of past performance and benchmarking. Factors considered in producing this report include historical energy modeling data, historical system performance data, system first cost, energy cost, maintenance cost, inflation, equipment life expectancies, and equipment replacement costs. The tables below outline the assumptions made for each system and using these assumptions a life cycle cost analysis was developed for the three different (3) systems.

System Summary											
System Type	Overall Building EUI	HVAC EUI @ 45% of Total EUI		Building Area ft <sup>2</sup>	Yearly Energy Usage		Yearly Energy Cost		Yearly Maintenance Cost		Total \$
		kBtu/ft <sup>2</sup> -yr	kWh/ft <sup>2</sup> -yr		kWh	therms	Elec	Gas	\$/ft <sup>2</sup>	\$	
GSHP	35	16	4.6	123,508	570,120	0	\$ 51,311	\$ -	\$ 0.20	\$ 24,702	\$ 76,012
WSHP	45	20	5.9		641,386	3,126	\$ 57,725	\$ 950	\$ 0.30	\$ 37,052	\$ 94,777
HE FP	55	25	7.3		739,120	5,349	\$ 66,521	\$ 1,626	\$ 0.25	\$ 30,877	\$ 97,398

Geothermal Heat Pump System First Cost			
Component	Cost [\$/ft <sup>2</sup> ]	Total Cost [\$]	Service Life [yrs]
Heat Pumps	\$6.50	\$802,802	20
Geothermal Well Field	-	\$988,064	50
Building Mechanical Piping	\$6.00	\$741,048	35
Pumps & Hydronic Specialties	\$2.00	\$247,016	25
Chemical Treatment	-	\$10,000	-
Test & Balance	\$0.50	\$61,754	-
DOAS System	-	\$750,000	25
Insulation - Duct & Pipe	\$2.00	\$247,016	30
Ductwork	\$2.50	\$308,770	30
Registers, Grilles, & Diffusers	\$0.50	\$61,754	35
Controls	\$1.50	\$185,262	20
Condensate Piping	\$0.50	\$61,754	35
<b>Total</b>	<b>\$36.15</b>	<b>\$4,465,240</b>	

<b>Boiler/Tower WSHP System First Cost</b>			
<b>Component</b>	<b>Cost [\$/ft<sup>2</sup>]</b>	<b>Total Cost [\$]</b>	<b>Service Life [yrs]</b>
Heat Pumps	\$6.50	\$802,802	20
Cooling Tower & Boiler	\$5.50	\$679,294	20
Building Mechanical Piping	\$6.00	\$741,048	35
Pumps & Hydronic Specialties	\$2.15	\$265,542	25
Chemical Treatment	-	\$30,000	-
Test & Balance	\$0.50	\$61,754	-
DOAS System	-	\$750,000	25
Insulation - Duct & Pipe	\$2.00	\$247,016	30
Ductwork	\$2.50	\$308,770	30
Registers, Grilles, & Diffusers	\$0.50	\$61,754	35
Controls	\$1.75	\$216,139	20
Condensate Piping	\$0.50	\$61,754	35
<b>Total</b>	<b>\$34.22</b>	<b>\$4,225,873</b>	

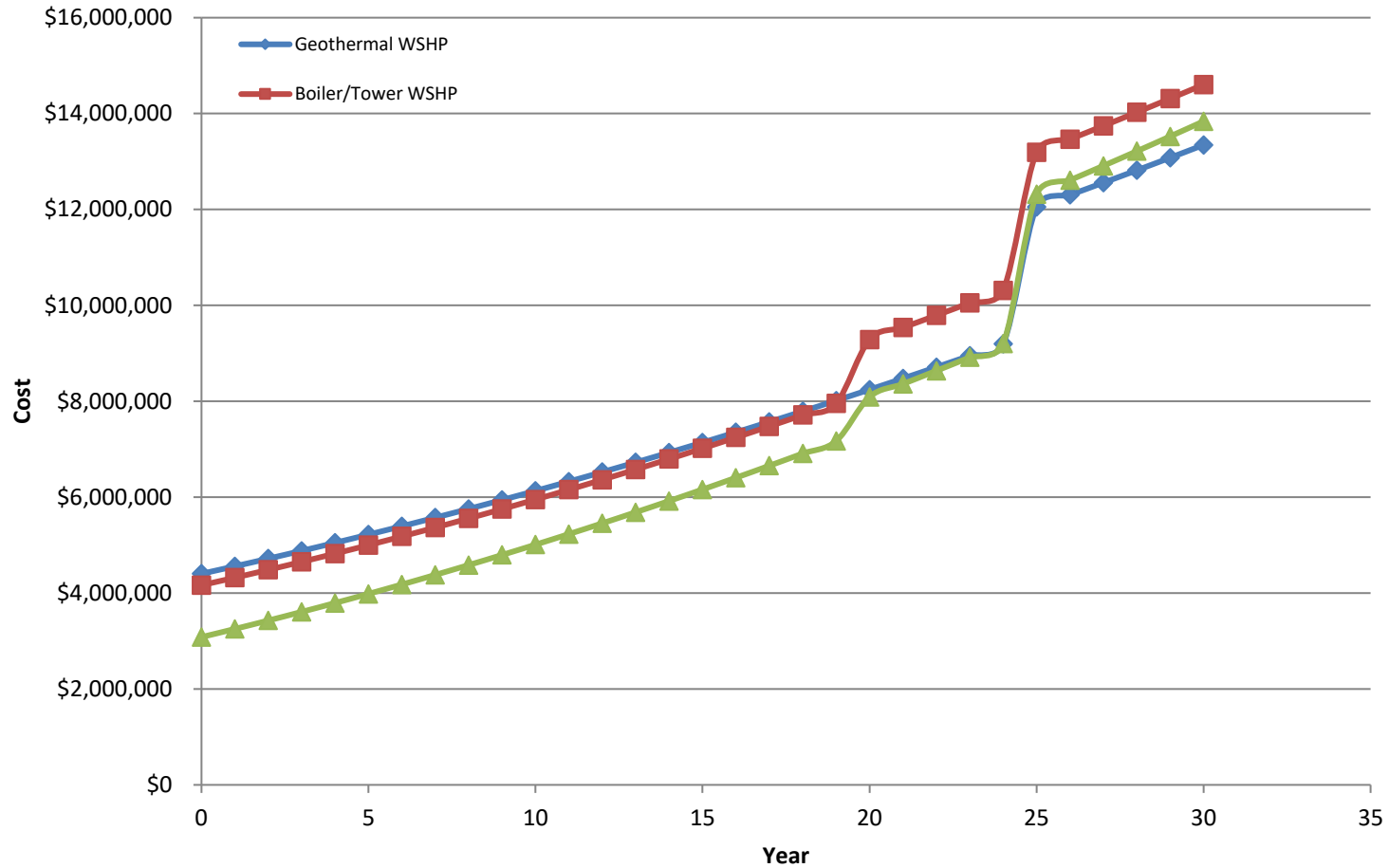
<b>High Efficiency Four Pipe System First Cost</b>			
<b>Component</b>	<b>Cost [\$/ft<sup>2</sup>]</b>	<b>Total Cost [\$]</b>	<b>Service Life [yrs]</b>
Fan Coils	\$5.00	\$617,540	25
Chiller(s)	-	\$225,000	20
Boilers	-	\$175,000	20
Refrigerant Piping	-	\$10,000	20
Mechanical Piping	\$2.00	\$247,016	25
Pumps & Hydronic Specialties	\$2.00	\$247,016	25
Chemical Treatment	-	\$20,000	-
Test & Balance	\$0.65	\$80,280	-
DOAS System	-	\$750,000	25
Insulation - Duct & Pipe	\$0.50	\$61,754	30
Ductwork	\$2.50	\$308,770	30
Registers, Grilles, & Diffusers	\$0.50	\$61,754	35
Controls	\$1.75	\$216,139	20
Condensate Piping	\$0.50	\$61,754	35
<b>Total</b>	<b>\$24.95</b>	<b>\$3,082,023</b>	

	Geothermal WSHP					Boiler/Tower WSHP								High Efficiency Four Pipe Fan Coil								
Year	GSHP Equipment Cost	GSHP Yearly Interest Costs	GSHP Energy Costs	GSHP Maintenance Cost	GSHP Total Cost	WSHP Equipment Cost	WSHP Yearly Interest Costs	WSHP Electricity Costs	WSHP Natural Gas Costs	WSHP Energy Costs	WSHP Maintenance Costs	WSHP Total Cost	GSHP / WSHP Difference [\$]	GSHP / WSHP % Difference	HEFP Equipment Cost	HEFP Electricity Costs	HEFP Natural Gas Costs	HEFP Energy Costs	HEFP Maintenance Cost	HEFP Total Cost	GSHP / HEFP Difference [\$]	GSHP / HEFP % Difference
0	\$4,403,486	\$0	\$0	\$0	\$4,403,486	\$4,164,119	\$0	\$0	\$0	\$0	\$0	\$4,164,119	\$239,367	5.6%	\$3,082,023	\$0	\$0	\$0	\$0	\$3,082,023	\$1,321,463	35.3%
1	\$0	\$24,579	\$52,850	\$78,293	\$4,559,208	\$0	\$22,438	\$59,456	\$979	\$60,435	\$97,620	\$4,322,175	\$237,033	5.3%	\$0	\$68,516	\$1,674	\$70,191	\$100,320	\$3,252,534	\$1,306,674	33.5%
2	\$0	\$24,579	\$54,389	\$80,573	\$4,718,749	\$0	\$22,438	\$61,188	\$1,007	\$62,195	\$100,464	\$4,484,834	\$233,915	5.1%	\$0	\$70,512	\$1,723	\$72,235	\$103,242	\$3,428,011	\$1,290,738	31.7%
3	\$0	\$24,579	\$55,929	\$82,854	\$4,882,110	\$0	\$22,438	\$62,920	\$1,036	\$63,956	\$103,307	\$4,652,096	\$230,014	4.8%	\$0	\$72,508	\$1,772	\$74,280	\$106,164	\$3,608,454	\$1,273,656	30.0%
4	\$0	\$24,579	\$57,468	\$85,134	\$5,049,291	\$0	\$22,438	\$64,652	\$1,064	\$65,716	\$106,150	\$4,823,962	\$225,328	4.6%	\$0	\$74,503	\$1,821	\$76,324	\$109,086	\$3,793,864	\$1,255,427	28.4%
5	\$0	\$24,579	\$59,007	\$87,414	\$5,220,291	\$0	\$22,438	\$66,383	\$1,093	\$67,476	\$108,994	\$5,000,432	\$219,859	4.3%	\$0	\$76,499	\$1,870	\$78,369	\$112,008	\$3,984,240	\$1,236,051	26.9%
6	\$0	\$24,579	\$60,547	\$89,695	\$5,395,111	\$0	\$22,438	\$68,115	\$1,121	\$69,236	\$111,837	\$5,181,505	\$213,606	4.0%	\$0	\$78,495	\$1,918	\$80,413	\$114,929	\$4,179,582	\$1,215,529	25.4%
7	\$0	\$24,579	\$62,086	\$91,975	\$5,573,751	\$0	\$22,438	\$69,847	\$1,150	\$70,996	\$114,680	\$5,367,182	\$206,569	3.8%	\$0	\$80,490	\$1,967	\$82,457	\$117,851	\$4,379,891	\$1,193,860	24.0%
8	\$0	\$24,579	\$63,625	\$94,255	\$5,756,210	\$0	\$22,438	\$71,579	\$1,178	\$72,757	\$117,524	\$5,557,462	\$198,748	3.5%	\$0	\$82,486	\$2,016	\$84,502	\$120,773	\$4,585,166	\$1,171,044	22.6%
9	\$0	\$24,579	\$65,165	\$96,536	\$5,942,490	\$0	\$22,438	\$73,310	\$1,207	\$74,517	\$120,367	\$5,752,346	\$190,143	3.3%	\$0	\$84,481	\$2,065	\$86,546	\$123,695	\$4,795,407	\$1,147,082	21.4%
10	\$0	\$24,579	\$66,704	\$98,816	\$6,132,588	\$0	\$22,438	\$75,042	\$1,235	\$76,277	\$123,210	\$5,951,834	\$180,755	3.0%	\$0	\$86,477	\$2,113	\$88,590	\$126,617	\$5,010,615	\$1,121,973	20.1%
11	\$0	\$24,579	\$68,243	\$101,097	\$6,326,507	\$0	\$22,438	\$76,774	\$1,264	\$78,037	\$126,054	\$6,155,925	\$170,583	2.7%	\$0	\$88,473	\$2,162	\$90,635	\$129,539	\$5,230,789	\$1,095,718	19.0%
12	\$0	\$24,579	\$69,783	\$103,377	\$6,524,245	\$0	\$22,438	\$78,506	\$1,292	\$79,798	\$128,897	\$6,364,619	\$159,626	2.5%	\$0	\$90,468	\$2,211	\$92,679	\$132,461	\$5,455,930	\$1,068,316	17.8%
13	\$0	\$24,579	\$71,322	\$105,657	\$6,725,803	\$0	\$22,438	\$80,237	\$1,321	\$81,558	\$131,740	\$6,577,917	\$147,886	2.2%	\$0	\$92,464	\$2,260	\$94,724	\$135,383	\$5,686,036	\$1,039,767	16.8%
14	\$0	\$24,579	\$72,861	\$107,938	\$6,931,181	\$0	\$22,438	\$81,969	\$1,349	\$83,318	\$134,583	\$6,795,819	\$135,362	2.0%	\$0	\$94,460	\$2,308	\$96,768	\$138,305	\$5,921,109	\$1,010,072	15.7%
15	\$0	\$24,579	\$74,401	\$110,218	\$7,140,378	\$0	\$22,438	\$83,701	\$1,378	\$85,078	\$137,427	\$7,018,324	\$122,054	1.7%	\$0	\$96,455	\$2,357	\$98,812	\$141,227	\$6,161,149	\$979,230	14.7%
16	\$0	\$24,579	\$75,940	\$112,498	\$7,353,395	\$0	\$22,438	\$85,433	\$1,406	\$86,839	\$140,270	\$7,245,433	\$107,963	1.5%	\$0	\$98,451	\$2,406	\$100,857	\$144,149	\$6,406,154	\$947,241	13.8%
17	\$0	\$24,579	\$77,479	\$114,779	\$7,570,232	\$0	\$22,438	\$87,164	\$1,435	\$88,599	\$143,113	\$7,477,145	\$93,087	1.2%	\$0	\$100,446	\$2,455	\$102,901	\$147,071	\$6,656,126	\$914,106	12.9%
18	\$0	\$24,579	\$79,019	\$117,059	\$7,790,889	\$0	\$22,438	\$88,896	\$1,463	\$90,359	\$145,957	\$7,713,461	\$77,428	1.0%	\$0	\$102,442	\$2,504	\$104,946	\$149,993	\$6,911,065	\$879,824	12.0%
19	\$0	\$24,579	\$80,558	\$119,340	\$8,015,365	\$0	\$22,438	\$90,628	\$1,492	\$92,119	\$148,800	\$7,954,380	\$60,984	0.8%	\$0	\$104,438	\$2,552	\$106,990	\$152,915	\$7,170,969	\$844,396	11.1%
20	\$0	\$24,579	\$82,097	\$121,620	\$8,243,661	\$1,086,870	\$22,438	\$92,360	\$1,520	\$93,880	\$151,643	\$9,286,774	(\$1,043,113)	-11.9%	\$656,000	\$106,433	\$2,601	\$109,034	\$155,837	\$8,091,840	\$151,820	1.9%
21	\$0	\$24,579	\$83,637	\$123,900	\$8,475,776	\$0	\$22,438	\$94,091	\$1,549	\$95,640	\$154,487	\$9,536,900	(\$1,061,124)	-11.8%	\$0	\$108,429	\$2,650	\$111,079	\$158,758	\$8,361,678	\$114,099	1.4%
22	\$0	\$24,579	\$85,176	\$126,181	\$8,711,712	\$0	\$22,438	\$95,823	\$1,577	\$97,400	\$157,330	\$9,791,631	(\$1,079,919)	-11.7%	\$0	\$110,425	\$2,699	\$113,123	\$161,680	\$8,636,481	\$75,230	0.9%
23	\$0	\$24,579	\$86,715	\$128,461	\$8,951,467	\$0	\$22,438	\$97,555	\$1,606	\$99,160	\$160,173	\$10,050,964	(\$1,099,498)	-11.6%	\$0	\$112,420	\$2,747	\$115,168	\$164,602	\$8,916,251	\$35,215	0.4%
24	\$0	\$24,579	\$88,255	\$130,741	\$9,195,041	\$0	\$22,438	\$99,286	\$1,634	\$100,921	\$163,017	\$10,314,901	(\$1,119,860)	-11.5%	\$0	\$114,416	\$2,796	\$117,212	\$167,524	\$9,200,988	(\$5,946)	-0.1%
25	\$2,609,334	\$24,579	\$89,794	\$133,022	\$12,051,770	\$2,609,334	\$22,438	\$101,018	\$1,663	\$102,681	\$165,860	\$13,192,776	(\$1,141,007)	-9.0%	\$2,825,473	\$116,411	\$2,845	\$119,256	\$170,446	\$12,316,163	(\$264,394)	-2.2%
26	\$0	\$24,579	\$91,333	\$135,302	\$12,302,984	\$0	\$22,438	\$102,750	\$1,691	\$104,441	\$168,703	\$13,465,921	(\$1,162,937)	-9.0%	\$0	\$118,407	\$2,894	\$121,301	\$173,368	\$12,610,832	(\$307,849)	-2.5%
27	\$0	\$24,579	\$92,873	\$137,583	\$12,558,017	\$0	\$22,438	\$104,482	\$1,720	\$106,201	\$171,547	\$13,743,668	(\$1,185,651)	-9.0%	\$0	\$120,403	\$2,943	\$123,345	\$176,290	\$12,910,468	(\$352,450)	-2.8%
28	\$0	\$24,579	\$94,412	\$139,863	\$12,816,871	\$0	\$22,438	\$106,213	\$1,748	\$107,962	\$174,390	\$14,026,020	(\$1,209,149)	-9.0%	\$0	\$122,398	\$2,991	\$125,390	\$179,212	\$13,215,069	(\$398,198)	-3.1%
29	\$0	\$24,579	\$95,951	\$142,143	\$13,079,544	\$0	\$22,438	\$107,945	\$1,777	\$109,722	\$177,233	\$14,312,975	(\$1,233,431)	-9.0%	\$0	\$124,394	\$3,040	\$127,434	\$182,134	\$13,524,637	(\$445,093)	-3.3%

**Figure 3: 30-Year Life Cycle Cost Analysis.** Analysis includes replacing Cooling Tower at year 20, Heat Pumps at year 20, and Boilers at year 20. The wellfield is designed to operate 50+ years without replacement. Future replacement cost includes 3% inflation.



## Giles HS - HVAC System LCC



Predictably, the geothermal system had a higher first cost, primarily due to the cost of the wellfield. However, the analysis suggested that for a 30-year lifecycle cost analysis, geothermal water source heat pumps yield the lowest lifecycle cost.

# LIFE CYCLE COST ANALYSIS: INPUTS AND ASSUMPTIONS

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## Building Square Footage:

This building is approximately 123,508 square feet.

## System First Cost:

According to CMTA historic cost data from recent projects under construction, the current installed cost for a geothermal heat pump system is about **\$35-\$45 per square foot**. A boiler / cooling tower water source heat pump system is about **\$30-\$40 per square foot**.

## System Energy Usage:

According to historical usage data collected by CMTA, standard geothermal systems prove to be the most efficient systems. Our most recent geothermal schools perform at an average energy use intensity (EUI) of approximately 20 KBTU/SF in new schools. The EUI of boiler/cooling tower water source heat pump system was estimated at 40 EUI.

## Equipment Life Expectancy/Replacement Cost:

Equipment life expectancy is a key component of the lifecycle cost analysis. The key equipment types requiring replacement within 30 years in the above options and their expected life is listed below<sup>1</sup>:

**Table 1: Expected Equipment Life**

Item	Expected Life
Heat Pumps	20-24 years
Boilers	20 years
Fan Coil Units	20 years
Cooling Tower	21 years
Air Source Chiller	15 years

## Maintenance Cost:

The *ASHRAE HVAC Applications Handbook* lists an average maintenance cost of about \$0.32 per square foot. Maintenance costs for the facility were projected around this average based upon probable maintenance costs. The most maintenance-intensive component of any system which will be consistent across all systems are the regular filter changes. The maintenance cost for the boiler / cooling tower water source heat pump system is slightly elevated because of the complexities and personnel required to work

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<sup>1</sup> Data based on *ASHRAE Owning and Operating Cost Database* and *ASHRAE Applications*.

on the systems and the intensive water treatment and hydronic components. Maintenance costs for each system have been modeled as listed in Table 2 below<sup>2</sup>:

**Table 2: Maintenance Cost**

System	Maintenance Cost
Geothermal Water Source Heat Pump	\$0.2 / ft <sup>2</sup>
Boiler / Cooling Tower Water Source Heat Pump	\$0.30 / ft <sup>2</sup>
Four Pipe Fan Coil System	\$0.25 / ft <sup>2</sup>

## LIFE CYCLE COST ANALYSIS: CONCLUSION

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All systems have their own benefits and disadvantages, and all could serve the school well. The lowest life cycle cost of the options compared is the geothermal water source heat pump system. In terms of maintenance, the geothermal water source heat pump system will be the easiest to maintain and work on while the boiler/tower WSHP system and the high efficiency four pipe fan coil system will be slightly more complex and harder to maintain. In conclusion, we believe the best system choice is geothermal water source heat pumps based on the life cycle cost and level of maintenance required to maintain the system.

# **Narrows High School**

## **LIFE CYCLE COST ANALYSIS / SYSTEM COMPARISON**

**PREPARED FOR:**  
**Giles County Public Schools**

**PREPARED BY:**

**Drew Roberts, PE**  
**August 11, 2021**



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## INTRODUCTION

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CMTA was asked by Giles County Public Schools and Crabtree, Rohrbaugh, & Associates Architects to present a life cycle cost comparison between potential HVAC system replacement/upgrade options for the mechanical systems at the existing Narrows High School in Narrows, Virginia. The systems to be compared were a geothermal water source heat pump system, a boiler/cooling-tower water source heat pump system, and a high efficiency 4-pipe system.

The following report includes a brief overview of each system, a comparison of each system which includes some of the pros and cons of each as it applies to the proposed project, and finally a full life cycle cost analysis for each system is presented. **This life cycle cost analysis is based off historical project data and actual cost of construction benchmarked in previous projects. Future cost opinions for the project will be updated when the design progresses.**

## EXISTING SYSTEMS

---

### General

The existing building is served by a 4-pipe chilled water and hot water system that primarily utilizes unit ventilators and fan coils to serve the HVAC loads of the spaces/zones. The ventilation for the educational wing of the building is provided by dedicated outside air systems (DOAS) located on the roof(s) that have DX cooling coils, hot water heating coils, and energy recovery wheels. There are some larger spaces, such as the gym, that utilize four pipe blower coils to condition the space loads and the ventilation air is provided by a rooftop DOAS unit.



*Typical Unit Ventilator - Classroom*



*Typical Blower Coil - Gymnasium*

## Central Plant Equipment

The existing central plant is made up of one 133-ton split DX air-cooled chiller and two 1,200MBH natural gas boilers. The chillers, boilers, and associated pumps are located in the lower-level main mechanical room adjacent to the gymnasium, and the split DX condensers for the chillers are located on the roof above the gym storage area. A majority of the central plant equipment is from the previous 1999/2000 HVAC renovation that replaced the old coal-fired steam boiler system and unit ventilators.



*Existing Chiller*



*Existing Gas Fired Boilers*

## Ventilation Air - Dedicated Outside Air Systems

A majority of the ventilation air for the school building is provided by dedicated rooftop outside air units that were installed during the 1999/2000 HVAC renovation. The units are custom Dectron energy recovery units that have a DX cooling coil+

and a hot water heating coil. The units are installed on exterior structural dunnage that also supports a split DX condenser and natural gas-fired heating water boiler. Each DOAS unit has its own dedicated split DX condenser and heating water boiler which is a maintenance issue which should be addressed no matter the final central plant solution that is chosen.



*Typical Built-Up DOAS*

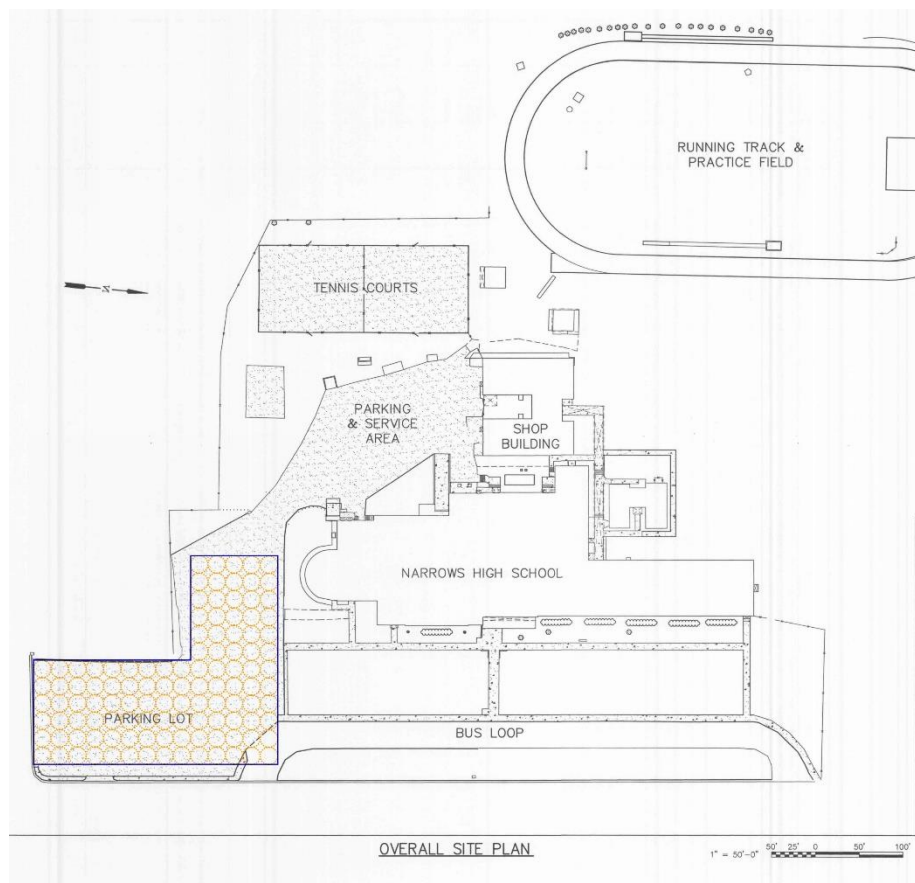


*Typical Built-Up DOAS*

## OVERVIEW OF SYSTEM REPLACEMENT OPTIONS

### Option 1 - Geothermal Water Source Heat Pump System:

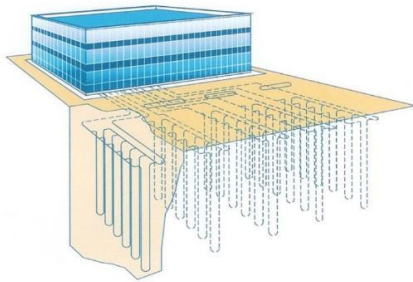
In a geothermal water-source heat pump system, conditioning equipment (typically referred to as heat pumps) heats and cools the building and absorbs or rejects this heat to water which is circulated to all the heat pumps through a two-pipe heat pump water loop. High-Efficiency water-source heat pumps with a geothermal wellfield would be utilized. Cooling EERs are typically up to 21.6 full load (using AHRI ground loop conditions) and heating COPs are up to 6.4 at full load (using AHRI ground loop conditions). Horizontal heat pumps would be located above the ceilings to serve the spaces/zone. The existing hydronic piping likely **could not** be repurposed to circulate the heat pump loop water, due to the fact that the water flows required are significantly higher than chilled water and/or heating water of the existing four pipe system, and thus new hydronic piping would be required throughout the building. The geothermal wellfield could be located under the existing student parking lot located Figure 1 below presents an example illustrating a geothermal wellfield layout that could be used at the school.



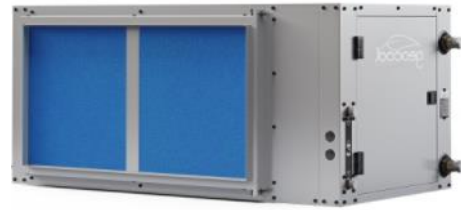
**Figure 1: Potential Wellfield Layout**



The anticipated layout would include 96 geothermal wells, 8 circuits, each 350 ft deep, spaced equally on 20 ft. centers. The wellfield would not be visible as it is entirely underground. To balance and maintain the wellfield there are typically two (2) options available to the owner: an indoor located geothermal header and a vault located outside. The header and the vault contain the same main components including valves and accessories to maintain the wellfield; the key difference is the location of each. CMTA typically recommends utilizing an indoor geothermal header if space is available, but many clients choose an exterior vault depending on space availability and preference. Currently, we anticipate there being a lower-level geothermal pump room, similar to the Graceland and Holabird schools, which will house the geothermal header and associated wellfield and building loop pumps. Refer to the Dedicated Outside Air System section for ventilation system description.



*Geothermal Wellfield*



*Horizontal Heat pump*



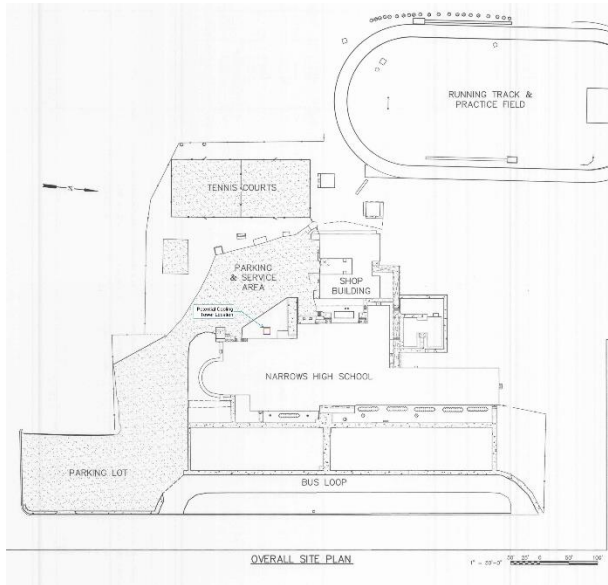
*Vertical Heat Pump*



*Console Heat Pump*

[Option 2 - Boiler / Cooling Tower Water Source Heat Pump System:](#)

In a boiler / cooling tower water-source heat pump system, conditioning equipment (referred to as heat pumps) heats and cools the building and absorbs or rejects this heat to a two-pipe heat pump loop which is then heated or cooled using the boiler or cooling tower. Cooling EERs is typically 17.0 at full-load and 19.5 at part-load (using AHRI water loop conditions). Heating COP is 5.4 at full-load and 5.2 at part-load. Heat pumps would be located and selected in three different arrangements: horizontal, vertical, and console. Careful planning of the cooling tower location would be required to lessen the impact of noise and line of sight. Figure 2 below presents an example of the estimated foot print and example location of the cooling tower – note that this location can be revised, it is just for illustrative purposes.



**Figure 2: Cooling Tower Foot Print and Example Location.**

The cooling tower would need to be carefully located to mitigate sound that is generated and lessen the line of sight.



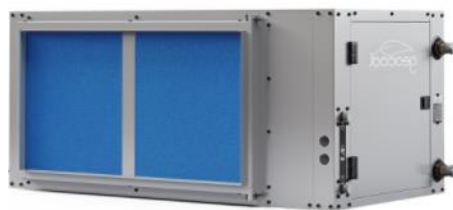
*Boiler*



*Cooling Tower*



*Vertical heat Pump*



*Horizontal Heat Pump*



*Console Heat Pump*

Refer to the Dedicated Outside Air System section for ventilation system description.

### Option 3 – High Efficiency Four Pipe Fan Coil System

This system employs an air source chiller to generate chilled water for cooling and high efficiency boilers to generate hot water for heating. The terminal units in this system are fan coils in lieu of heat pumps which do not have compressors and only consist of a fan, heating coil, and cooling coil. The compressors are centralized at the outdoor air source chiller. Rather than a common pair of pipes this system uses two pair of pipes (4-pipe system), one pair for heating and one pair for cooling. This system may also require antifreeze in the chilled water and more pumps compared to the geothermal system; a set of pumps for the heating water and a set of pumps for the chilled water. Fan coil units would be located and selected in two different arrangements: horizontal and console. Careful planning of the chiller location would be required to lessen the impact of noise and line of sight as well as any structural concerns.



*Boiler*



*Air Source Chiller*



*Horizontal Fan Coil Unit*



*Console Fan Coil Unit*

Refer to the Dedicated Outside Air System section for ventilation system description.

### Ventilation Air - Dedicated Outdoor Air Systems

As noted in the existing systems section above, we would recommend replacing the existing built-up DOAS units with new packaged DX/natural gas fired DOAS units. The system will be sized for the population of the school and the ventilation air flows will be modulated based on carbon dioxide levels in each space. This allows for the ventilation air to “follow” the occupants of the building a provide the correct air flow needed when the occupants are in each space. This approach helps to save energy by reducing

unnecessary overventilation of lightly occupied or unoccupied spaces, as well as reduce the overall size and cost of the overall ventilation system(s). The dedicated outside air system air handling unit will be provided with a total enthalpy wheel for energy recovery and a DX cooling coil with hot gas reheat for humidity control. The ventilation air will be delivered dehumidified at a room neutral temperature. The units will be located on the existing structural dunnage that is currently serving the built-up units.



*Packaged DOAS Unit*

## SYSTEM COMPARISON

---

### Geothermal Water Source Heat Pump

- **Maintainability – Excellent**
  - No Boilers or Chillers to maintain.
  - Regular maintenance includes filter changes and water treatment for heat pump water loop.
  - Wellfield life of 50+ years will extend long beyond even the service life of the heat pump system.
  - Heat Pumps located above ceiling, in mechanical rooms, and/or in classrooms if console units are selected. Filter accessible from ground thru filter grilles or available at the unit for vertical and console type heat pumps.
  - Hydronic accessories located above ceiling or in mechanical room (strainers at heat pump).
  - Wells located in field adjacent to building, but will have 20-year warranty and will last at least 50+ years.
  - No antifreeze required in water loop and no heat tracing of piping.
  - Units can be worked on and maintained by residential licensed HVAC contractor.
- **Energy Performance – Excellent**
  - Most energy efficient system. EUI (20-25)
  - Lower entering water temperatures from the ground source result in optimal heat pump performance and life.
- **Space/Aesthetic impact – Good**

- Requires mechanical room space for pumps and closets for vertical heat pumps.
- 2-pipe system.
- Units are located above ceilings for horizontal style units, in mechanical rooms for vertical style units, or in the space for console type units.
- **Cons**
  - Vertical Heat Pumps take up program/floor space.
  - Compressors and Fans located above ceilings for horizontal type units.
  - System is ducted; sheet metal must be routed and located above ceiling.
  - New piping would be required to be run to serve the heat pump water loop.

### Boiler / Cooling Tower Water Source Heat Pump

- **Maintainability – Fair**
  - Cooling Tower requires monthly and quarterly maintenance of fans/pumps/motors.
  - Regular maintenance includes filter changes and water treatment (requires ongoing contract with vendor if owner's staff is unable to perform).
- **Energy Performance – Good**
  - Good efficiency, but proven system. EUI (35 to 45).
  - Life cycle is about 15-20 years.
- **Space/Aesthetic Impact – Good to Excellent**
  - Requires mechanical room space for boilers, pumps, and water basin.
  - Screening would be required to hide cooling tower.
  - The cooling tower would need to be located strategically, preferably isolated, to lower the impact of noise that is generated.
- **Cons**
  - Vertical Heat Pumps take up program/floor space.
  - Compressors and Fans located above ceilings for horizontal type units.
  - System is ducted; sheet metal must be routed and located above ceiling.
  - More intense/involved water treatment.
  - If drain-back design cannot be achieved, a basin heater will be required to prevent the cooling tower from freezing and causing damage during winter months.
  - New piping would be required to be run to serve the heat pump water loop.

### High Efficiency Four Pipe System

- **Maintainability – Good**
  - System requires four (4) pumps.
  - System may require antifreeze.
  - Takes up additional space due to quantity of pumps and freeze protection equipment.
  - Regular maintenance includes filter changes and water treatment (requires ongoing contract with vendor if owner's staff is unable to perform maintaining of antifreeze).

- Four (4) pipes instead of two (2).
  - Compressors are centralized and located outside.
  - Fan coils with hydronic accessories and filters located above ceiling.
  - Requires the most above ceiling clear space. (Heat Pumps = 24-30 inches; Fan Coils = 18-24 inches).
  - Typical system most contractors can service.
  - Two (2) hydronic systems instead of one (1). Hot water and Chilled Water
- **Energy Performance – Fair**
    - Fair efficiency but proven system. EUI (50 to 60)
    - Chiller is least efficient means of cooling.
    - Energy penalty for use of anti-freeze due to pumping viscous fluid and heat transfer reduction.
  - **Space/Aesthetic Impact – Fair**
    - Requires most room in the mechanical room.
    - Horizontal and cassette type fan coils located above ceilings with hydronic valving.
    - Ducted system; thus, sheet metal must route above ceiling.
  - **Cons**
    - Four (4) pipes instead of two (2).
    - Least efficient but most common system.
    - May require a larger mechanical room.
    - Requires anti-freeze.
    - Fan coils located above ceiling for horizontal and cassette type units.
    - Insulation required in contrast to WSHP systems.
    - More hydronic accessories above ceiling due to additional piping systems (4 pipes compared to 2).

## LIFE CYCLE COST ANALYSIS: EXECUTIVE SUMMARY

A life cycle cost analysis by its very nature, relies upon educated assumptions about the future based upon analysis of past performance and benchmarking. Factors considered in producing this report include historical energy modeling data, historical system performance data, system first cost, energy cost, maintenance cost, inflation, equipment life expectancies, and equipment replacement costs. The tables below outline the assumptions made for each system and using these assumptions a life cycle cost analysis was developed for the three different (3) systems.

System Summary											
System Type	Overall Building EUI	HVAC EUI @ 45% of Total EUI		Building Area ft <sup>2</sup>	Yearly Energy Usage		Yearly Energy Cost		Yearly Maintenance Cost		Total \$
		kBtu/ft <sup>2</sup> -yr	kWh/ft <sup>2</sup> -yr		kWh	therms	Elec	Gas	\$/ft <sup>2</sup>	\$	
GSHP	35	16	4.6	115,500	533,155	0	\$ 47,984	\$ -	\$ 0.20	\$ 23,100	\$ 71,084
WSHP	45	20	5.9		599,799	2,924	\$ 53,982	\$ 888	\$ 0.30	\$ 34,650	\$ 88,632
HE FP	55	25	7.3		691,197	5,003	\$ 62,208	\$ 1,520	\$ 0.25	\$ 28,875	\$ 91,083

Geothermal Heat Pump System First Cost			
Component	Cost [\$/ft <sup>2</sup> ]	Total Cost [\$]	Service Life [yrs]
Heat Pumps	\$6.00	\$693,000	25
Geothermal Well Field	-	\$924,000	50
Building Mechanical Piping	\$6.00	\$693,000	35
Pumps & Hydronic Specialties	\$2.00	\$231,000	25
Chemical Treatment	-	\$10,000	-
Test & Balance	\$0.50	\$57,750	-
DOAS System	-	\$600,000	25
Insulation - Duct & Pipe	\$2.00	\$231,000	30
Ductwork	\$2.50	\$288,750	30
Registers, Grilles, & Diffusers	\$0.50	\$57,750	35
Controls	\$1.50	\$173,250	20
Condensate Piping	\$0.50	\$57,750	35
<b>Total</b>	<b>\$34.78</b>	<b>\$4,017,250</b>	

<b>Boiler/Tower WSHP System First Cost</b>			
<b>Component</b>	<b>Cost [\$/ft<sup>2</sup>]</b>	<b>Total Cost [\$]</b>	<b>Service Life [yrs]</b>
Heat Pumps	\$6.00	\$693,000	25
Cooling Tower & Boiler	\$5.50	\$635,250	20
Building Mechanical Piping	\$6.00	\$693,000	35
Pumps & Hydronic Specialties	\$2.15	\$248,325	25
Chemical Treatment	-	\$30,000	-
Test & Balance	\$0.50	\$57,750	-
DOAS System	-	\$600,000	25
Insulation - Duct & Pipe	\$2.00	\$231,000	30
Ductwork	\$2.50	\$288,750	30
Registers, Grilles, & Diffusers	\$0.50	\$57,750	35
Controls	\$1.75	\$202,125	20
Condensate Piping	\$0.50	\$57,750	35
<b>Total</b>	<b>\$32.85</b>	<b>\$3,794,700</b>	

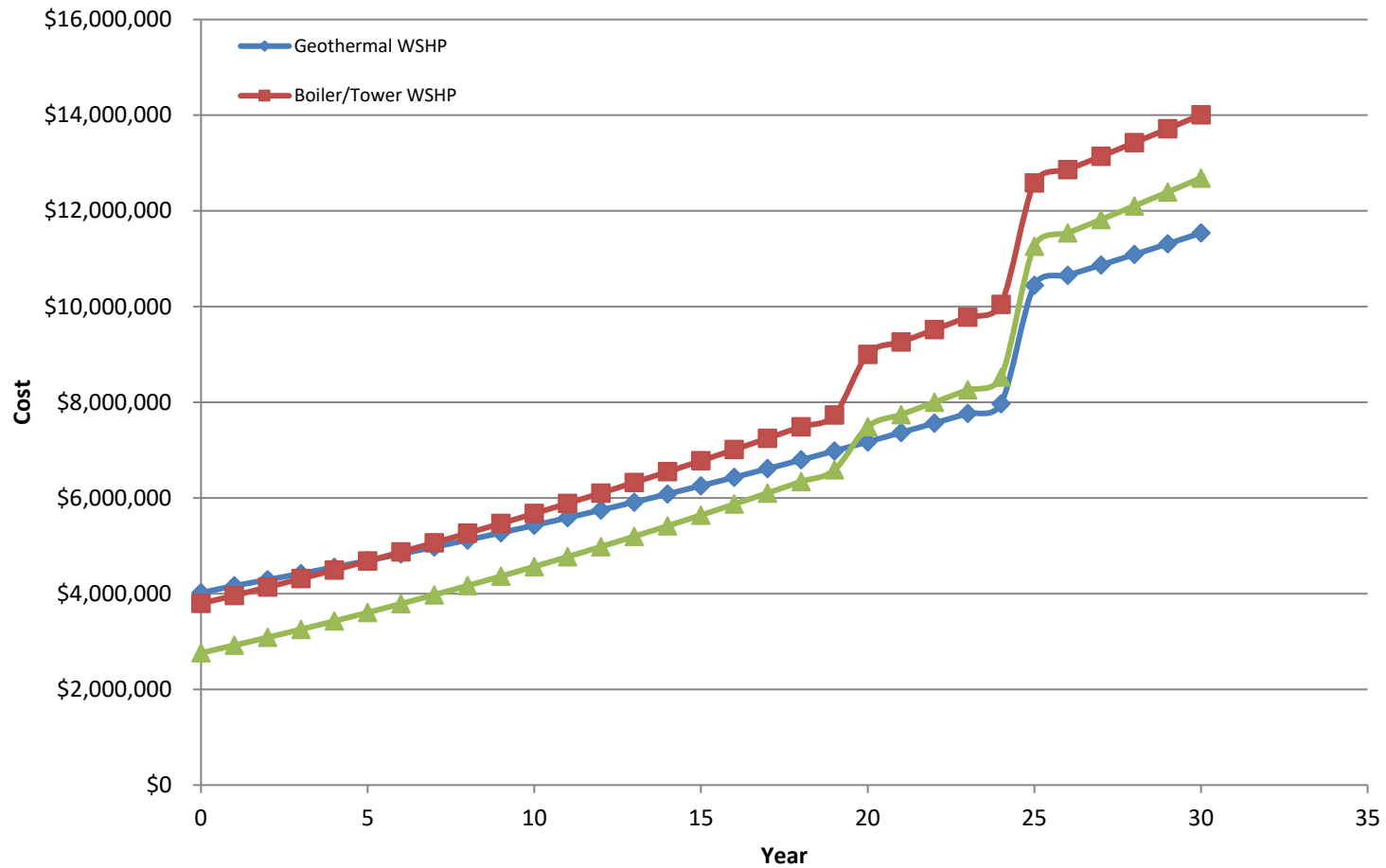
<b>High Efficiency Four Pipe System First Cost</b>			
<b>Component</b>	<b>Cost [\$/ft<sup>2</sup>]</b>	<b>Total Cost [\$]</b>	<b>Service Life [yrs]</b>
Fan Coils	\$5.00	\$577,500	25
Chiller(s)	-	\$225,000	20
Boilers	-	\$175,000	20
Refrigerant Piping	-	\$10,000	20
Mechanical Piping	\$2.00	\$231,000	35
Pumps & Hydronic Specialties	\$2.00	\$231,000	25
Chemical Treatment	-	\$20,000	-
Test & Balance	\$0.65	\$75,075	-
DOAS System	-	\$600,000	25
Insulation - Duct & Pipe	\$0.50	\$57,750	30
Ductwork	\$2.50	\$288,750	30
Registers, Grilles, & Diffusers	\$0.50	\$57,750	35
Controls	\$1.75	\$202,125	20
Condensate Piping	\$0.10	\$11,550	35
<b>Total</b>	<b>\$23.92</b>	<b>\$2,762,500</b>	



Year	Geothermal WSHP					Boiler/Tower WSHP									High Efficiency Four Pipe Fan Coil							
	GSHP Equipment Cost	GSHP Yearly Interest	GSHP Energy Costs	GSHP Maintenance Cost	GSHP Total Cost	WSHP Equipment Cost	WSHP Yearly Interest Costs	WSHP Electricity Costs	WSHP Natural Gas Costs	WSHP Energy Costs	WSHP Maintenance Costs	WSHP Total Cost	GSHP / WSHP Difference [\$]	GSHP / WSHP % Difference	HEFP Equipment Cost	HEFP Electricity Costs	HEFP Natural Gas Costs	HEFP Energy Costs	HEFP Maintenance Cost	HEFP Total Cost	GSHP / HEFP Difference [\$]	GSHP / HEFP % Difference
0	\$4,017,250	\$0	\$0	\$0	\$4,017,250	\$3,794,700	\$0	\$0	\$0	\$0	\$0	\$3,794,700	\$222,550	5.7%	\$2,762,500	\$0	\$0	\$0	\$0	\$2,762,500	\$1,254,750	37.0%
1	\$0	\$24,579	\$49,423	\$73,216	\$4,164,469	\$0	\$20,932	\$55,601	\$915	\$56,517	\$91,291	\$3,963,439	\$201,029	4.9%	\$0	\$64,074	\$1,566	\$65,640	\$93,815	\$2,921,955	\$1,242,513	35.1%
2	\$0	\$24,579	\$50,863	\$75,349	\$4,290,681	\$0	\$20,932	\$57,221	\$942	\$58,163	\$93,950	\$4,136,484	\$154,197	3.7%	\$0	\$65,940	\$1,612	\$67,552	\$96,548	\$3,086,055	\$1,204,626	32.7%
3	\$0	\$24,579	\$52,303	\$77,482	\$4,420,465	\$0	\$20,932	\$58,840	\$968	\$59,809	\$96,609	\$4,313,833	\$106,631	2.4%	\$0	\$67,806	\$1,657	\$69,464	\$99,280	\$3,254,798	\$1,165,666	30.4%
4	\$0	\$24,579	\$53,742	\$79,614	\$4,553,821	\$0	\$20,932	\$60,460	\$995	\$61,455	\$99,268	\$4,495,488	\$58,333	1.3%	\$0	\$69,673	\$1,703	\$71,375	\$102,013	\$3,428,187	\$1,125,634	28.2%
5	\$0	\$24,579	\$55,182	\$81,747	\$4,690,749	\$0	\$20,932	\$62,079	\$1,022	\$63,101	\$101,927	\$4,681,448	\$9,301	0.2%	\$0	\$71,539	\$1,748	\$73,287	\$104,745	\$3,606,219	\$1,084,530	26.1%
6	\$0	\$24,579	\$56,621	\$83,879	\$4,831,249	\$0	\$20,932	\$63,699	\$1,048	\$64,747	\$104,586	\$4,871,713	(\$40,464)	-0.8%	\$0	\$73,405	\$1,794	\$75,199	\$107,478	\$3,788,896	\$1,042,353	24.2%
7	\$0	\$24,579	\$58,061	\$86,012	\$4,975,321	\$0	\$20,932	\$65,318	\$1,075	\$66,393	\$107,245	\$5,066,282	(\$90,961)	-1.8%	\$0	\$75,271	\$1,840	\$77,111	\$110,210	\$3,976,217	\$999,104	22.3%
8	\$0	\$24,579	\$59,500	\$88,144	\$5,122,965	\$0	\$20,932	\$66,938	\$1,102	\$68,039	\$109,904	\$5,265,157	(\$142,192)	-2.7%	\$0	\$77,138	\$1,885	\$79,023	\$112,943	\$4,168,182	\$954,783	20.6%
9	\$0	\$24,579	\$60,940	\$90,277	\$5,274,181	\$0	\$20,932	\$68,557	\$1,128	\$69,685	\$112,563	\$5,468,337	(\$194,156)	-3.6%	\$0	\$79,004	\$1,931	\$80,935	\$115,675	\$4,364,792	\$909,389	18.9%
10	\$0	\$24,579	\$62,379	\$92,409	\$5,428,970	\$0	\$20,932	\$70,177	\$1,155	\$71,332	\$115,222	\$5,675,822	(\$246,853)	-4.4%	\$0	\$80,870	\$1,976	\$82,846	\$118,408	\$4,566,046	\$862,924	17.3%
11	\$0	\$24,579	\$63,819	\$94,542	\$5,587,330	\$0	\$20,932	\$71,796	\$1,182	\$72,978	\$117,880	\$5,887,613	(\$300,282)	-5.2%	\$0	\$82,736	\$2,022	\$84,758	\$121,140	\$4,771,945	\$815,386	15.7%
12	\$0	\$24,579	\$65,258	\$96,674	\$5,749,262	\$0	\$20,932	\$73,415	\$1,208	\$74,624	\$120,539	\$6,103,708	(\$354,445)	-6.0%	\$0	\$84,603	\$2,068	\$86,670	\$123,873	\$4,982,487	\$766,775	14.3%
13	\$0	\$24,579	\$66,698	\$98,807	\$5,914,767	\$0	\$20,932	\$75,035	\$1,235	\$76,270	\$123,198	\$6,324,108	(\$409,341)	-6.7%	\$0	\$86,469	\$2,113	\$88,582	\$126,605	\$5,197,674	\$717,093	12.9%
14	\$0	\$24,579	\$68,137	\$100,939	\$6,083,843	\$0	\$20,932	\$76,654	\$1,262	\$77,916	\$125,857	\$6,548,813	(\$464,970)	-7.4%	\$0	\$88,335	\$2,159	\$90,494	\$129,338	\$5,417,506	\$666,338	11.6%
15	\$0	\$24,579	\$69,577	\$103,072	\$6,256,492	\$0	\$20,932	\$78,274	\$1,288	\$79,562	\$128,516	\$6,777,824	(\$521,332)	-8.0%	\$0	\$90,201	\$2,204	\$92,406	\$132,070	\$5,641,981	\$614,510	10.3%
16	\$0	\$24,579	\$71,016	\$105,204	\$6,432,712	\$0	\$20,932	\$79,893	\$1,315	\$81,208	\$131,175	\$7,011,139	(\$578,427)	-8.6%	\$0	\$92,067	\$2,250	\$94,318	\$134,802	\$5,871,101	\$561,611	9.1%
17	\$0	\$24,579	\$72,456	\$107,337	\$6,612,505	\$0	\$20,932	\$81,513	\$1,342	\$82,854	\$133,834	\$7,248,760	(\$636,255)	-9.2%	\$0	\$93,934	\$2,296	\$96,229	\$137,535	\$6,104,866	\$507,639	8.0%
18	\$0	\$24,579	\$73,895	\$109,469	\$6,795,869	\$0	\$20,932	\$83,132	\$1,368	\$84,500	\$136,493	\$7,490,685	(\$694,816)	-9.7%	\$0	\$95,800	\$2,341	\$98,141	\$140,267	\$6,343,274	\$452,595	6.9%
19	\$0	\$24,579	\$75,335	\$111,602	\$6,982,806	\$0	\$20,932	\$84,752	\$1,395	\$86,147	\$139,152	\$7,736,916	(\$754,110)	-10.2%	\$0	\$97,666	\$2,387	\$100,053	\$143,000	\$6,586,327	\$396,479	5.8%
20	\$0	\$24,579	\$76,774	\$113,734	\$7,173,315	\$1,016,400	\$20,932	\$86,371	\$1,422	\$87,793	\$141,811	\$9,003,852	(\$1,830,537)	-22.6%	\$656,000	\$99,532	\$2,432	\$101,965	\$145,732	\$7,490,025	(\$316,710)	-4.3%
21	\$0	\$24,579	\$78,214	\$115,867	\$7,367,395	\$0	\$20,932	\$87,991	\$1,448	\$89,439	\$144,470	\$9,258,693	(\$1,891,298)	-22.8%	\$0	\$101,399	\$2,478	\$103,877	\$148,465	\$7,742,366	(\$374,971)	-5.0%
22	\$0	\$24,579	\$79,653	\$117,999	\$7,565,048	\$0	\$20,932	\$89,610	\$1,475	\$91,085	\$147,129	\$9,517,839	(\$1,952,791)	-22.9%	\$0	\$103,265	\$2,524	\$105,789	\$151,197	\$7,999,352	(\$434,304)	-5.6%
23	\$0	\$24,579	\$81,093	\$120,132	\$7,766,273	\$0	\$20,932	\$91,229	\$1,502	\$92,731	\$149,788	\$9,781,290	(\$2,015,017)	-23.0%	\$0	\$105,131	\$2,569	\$107,700	\$153,930	\$8,260,983	(\$494,710)	-6.2%
24	\$0	\$24,579	\$82,532	\$122,264	\$7,971,070	\$0	\$20,932	\$92,849	\$1,528	\$94,377	\$152,447	\$10,049,046	(\$2,077,976)	-23.1%	\$0	\$106,997	\$2,615	\$109,612	\$156,662	\$8,527,257	(\$556,188)	-6.7%
25	\$2,262,750	\$24,579	\$83,972	\$124,397	\$10,442,188	\$2,262,750	\$20,932	\$94,468	\$1,555	\$96,023	\$155,106	\$12,583,857	(\$2,141,668)	-18.6%	\$2,464,875	\$108,864	\$2,661	\$111,524	\$159,395	\$11,263,051	(\$820,863)	-7.6%
26	\$0	\$24,579	\$85,411	\$126,529	\$10,654,129	\$0	\$20,932	\$96,088	\$1,581	\$97,669	\$157,765	\$12,860,223	(\$2,206,094)	-18.8%	\$0	\$110,730	\$2,706	\$113,436	\$162,127	\$11,538,614	(\$884,485)	-8.0%
27	\$0	\$24,579	\$86,851	\$128,662	\$10,869,642	\$0	\$20,932	\$97,707	\$1,608	\$99,315	\$160,424	\$13,140,894	(\$2,271,252)	-18.9%	\$0	\$112,596	\$2,752	\$115,348	\$164,860	\$11,818,822	(\$949,180)	-8.4%
28	\$0	\$24,579	\$88,290	\$130,794	\$11,088,727	\$0	\$20,932	\$99,327	\$1,635	\$100,962	\$163,083	\$13,425,871	(\$2,337,144)	-19.1%	\$0	\$114,462	\$2,797	\$117,260	\$167,592	\$12,103,674	(\$1,014,947)	-8.8%
29	\$0	\$24,579	\$89,730	\$132,927	\$11,311,384	\$0	\$20,932	\$100,946	\$1,661	\$102,608	\$165,742	\$13,715,152	(\$2,403,768)	-19.2%	\$0	\$116,329	\$2,843	\$119,171	\$170,325	\$12,393,170	(\$1,081,786)	-9.1%
30	\$0	\$24,579	\$91,170	\$135,060	\$11,537,613	\$0	\$20,932	\$102,566	\$1,688	\$104,254	\$168,401	\$14,008,739	(\$2,471,125)	-19.3%	\$0	\$118,195	\$2,889	\$121,083	\$173,057	\$12,687,311	(\$1,149,698)	-9.5%

**Figure 3: 30-Year Life Cycle Cost Analysis.** Analysis includes replacing Cooling Tower at year 20, Heat Pumps at year 20, and Boilers at year 20. The wellfield is designed to operate 50+ years without replacement. Future replacement cost includes 3% inflation.

## Narrows HS - HVAC System LCC



Predictably, the geothermal system had a higher first cost, primarily due to the cost of the wellfield. However, the analysis suggested that for a 30-year lifecycle cost analysis, geothermal water source heat pumps yield the lowest lifecycle cost.

## LIFE CYCLE COST ANALYSIS: INPUTS AND ASSUMPTIONS

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### Building Square Footage:

This building is approximately 115,500 square feet.

### System First Cost:

According to CMTA historic cost data from recent projects under construction, the current installed cost for a geothermal heat pump system is about **\$35-\$45 per square foot**. A boiler / cooling tower water source heat pump system is about **\$30-\$40 per square foot**.

### System Energy Usage:

According to historical usage data collected by CMTA, standard geothermal systems prove to be the most efficient systems. Our most recent geothermal elementary schools perform at an average energy use intensity (EUI) of 20 KBTU/SF in new schools. The EUI of boiler/cooling tower water source heat pump system was estimated at 40 EUI.

### Equipment Life Expectancy/Replacement Cost:

Equipment life expectancy is a key component of the lifecycle cost analysis. The key equipment types requiring replacement within 30 years in the above options and their expected life is listed below<sup>1</sup>:

**Table 1: Expected Equipment Life**

Item	Expected Life
Heat Pumps	20-24 years
Boilers	20 years
Fan Coil Units	20 years
Cooling Tower	21 years
Air Source Chiller	15 years

### Maintenance Cost:

The *ASHRAE HVAC Applications Handbook* lists an average maintenance cost of about \$0.32 per square foot. Maintenance costs for the facility were projected around this average based upon probable maintenance costs. The most maintenance-intensive component of any system which will be consistent across all systems are the regular filter changes. The maintenance cost for the boiler / cooling tower water source heat pump system is slightly elevated because of the complexities and personnel required to work on the systems and the intensive water treatment and hydronic components. Maintenance costs for each system have been modeled as listed in Table 2 below<sup>2</sup>:

---

<sup>1</sup> Data based on *ASHRAE Owning and Operating Cost Database* and *ASHRAE Applications*.

**Table 2: Maintenance Cost**

<b>System</b>	<b>Maintenance Cost</b>
Geothermal Water Source Heat Pump	\$0.2 / ft <sup>2</sup>
Boiler / Cooling Tower Water Source Heat Pump	\$0.30 / ft <sup>2</sup>
Four Pipe Fan Coil System	\$0.25 / ft <sup>2</sup>

## **LIFE CYCLE COST ANALYSIS: CONCLUSION**

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All systems have their own benefits and disadvantages, and all could serve the school well. The lowest life cycle cost of the options compared is the geothermal water source heat pump system. In terms of maintenance, the geothermal water source heat pump system will be the easiest to maintain and work on while the boiler/tower WSHP system and the high efficiency four pipe fan coil system will be slightly more complex and harder to maintain. In conclusion, we believe the best system choice is geothermal water source heat pumps based on the life cycle cost and level of maintenance required to maintain the system.

# **Macy McClaughtery Elementary-Middle School**

## **LIFE CYCLE COST ANALYSIS / SYSTEM COMPARISON**

**PREPARED FOR:**  
**Giles County Public Schools**

**PREPARED BY:**

**Drew Roberts, PE**  
**August 11, 2021**



**CMTA, INC. CONSULTING ENGINEERS**  
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## INTRODUCTION

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CMTA was asked by Giles County Public Schools and Crabtree, Rohrbaugh, & Associates Architects to present a life cycle cost comparison between potential HVAC system replacement/upgrade options for the mechanical systems at the existing Macy McClauthery Elementary-Middle School in Pearisburg, Virginia. The systems to be compared were a geothermal water source heat pump system, a boiler/cooling-tower water source heat pump system, and a high efficiency 4-pipe system.

The following report includes a brief overview of each system, a comparison of each system which includes some of the pros and cons of each as it applies to the proposed project, and finally a full life cycle cost analysis for each system is presented. **This life cycle cost analysis is based off historical project data and actual cost of construction benchmarked in previous projects. Future cost opinions for the project will be updated when the design progresses.**

## EXISTING SYSTEMS

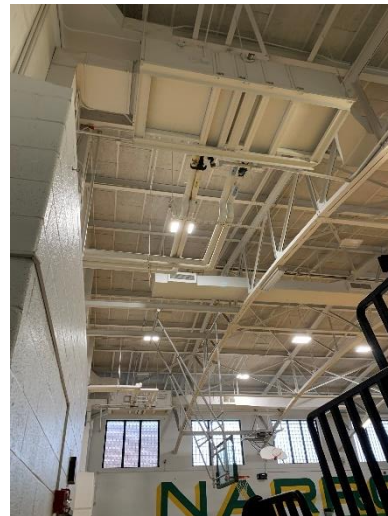
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### General

The existing building is served by a 4-pipe chilled water and hot water system that primarily utilizes fan coils to serve the HVAC loads of the spaces/zones. The ventilation for the educational wing of the building is provided by energy recovery ventilators (ERVs) located on the roof(s) that have no heating or cooling coils but rather utilize energy recovery wheels to pretreat the ventilation air that is being mixed with the return air to the fan coil units. There are some larger spaces, such as the gym, that utilize four pipe blower coils to condition the space loads and the ventilation air is provided by a rooftop DOAS unit.



*Typical Unit Ventilator - Classroom*



*Typical Blower Coil - Gymnasium*

## Central Plant Equipment

The existing central plant is made up of two 130-ton split DX air-cooled chillers and two 2,300MBH natural gas boilers. The chillers, boilers, and associated pumps are located in the lower-level main mechanical room adjacent to the gymnasium, and the split DX condensers for the chillers are located on the roof above the gym storage area. A majority of the central plant equipment is from the previous 1999/2000 HVAC renovation that replaced the old coal-fired steam boiler system and unit ventilators.



*Existing Chiller – 1 of 2*



*Existing Gas Fired Boiler – 1 of 2*

## Ventilation Air - Dedicated Outside Air Systems

A majority of the ventilation air for the school building is provided by dedicated rooftop energy recovery ventilators that were installed during a previous HVAC renovation. The units are Des Champs PVEZW units that have a total enthalpy wheel, a supply fan, and an exhaust fan. The units are installed on standard roof curbs. The ERVs cannot adequately control temperature and/or humidity as there are no active coils in the unit which could help to reduce humidity in the air, which can lead to issues within the occupied spaces and this should be addressed no matter the final central plant solution that is chosen.



*Typical ERV*



*Typical ERVs*

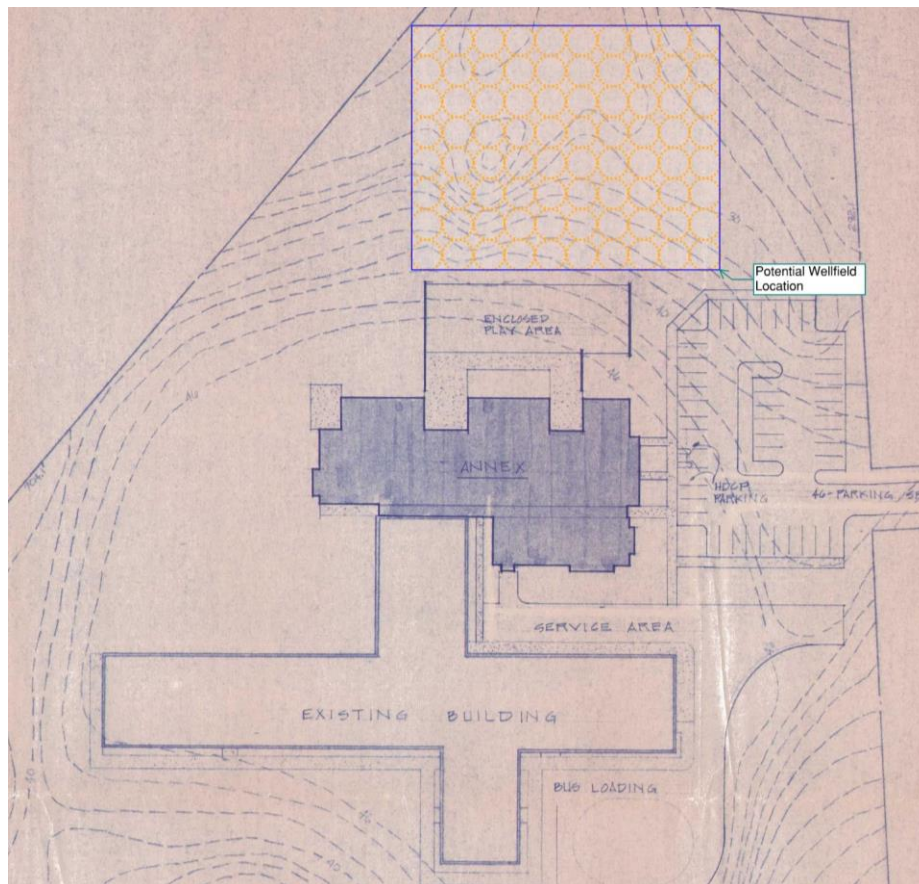


## OVERVIEW OF SYSTEM REPLACEMENT OPTIONS

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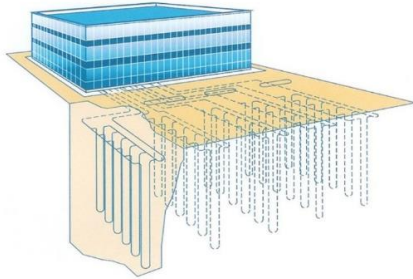
### Option 1 - Geothermal Water Source Heat Pump System:

In a geothermal water-source heat pump system, conditioning equipment (typically referred to as heat pumps) heats and cools the building and absorbs or rejects this heat to water which is circulated to all the heat pumps through a two-pipe heat pump water loop. High-Efficiency water-source heat pumps with a geothermal wellfield would be utilized. Cooling EERs are typically up to 21.6 full load (using AHRI ground loop conditions) and heating COPs are up to 6.4 at full load (using AHRI ground loop conditions). Horizontal heat pumps would be located above the ceilings to serve the spaces/zone. The existing hydronic piping likely **could not** be repurposed to circulate the heat pump loop water, due to the fact that the water flows required are significantly higher than chilled water and/or heating water of the existing four pipe system, and thus new hydronic piping would be required throughout the building. The geothermal wellfield could be located under the existing student parking lot located Figure 1 below presents an example illustrating a geothermal wellfield layout that could be used at the school.

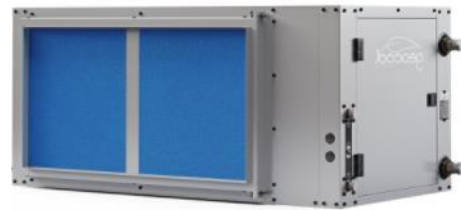


**Figure 1: Potential Wellfield Layout**

The anticipated wellfield layout would use circuits of 350'-400' ft deep wells, spaced equally on 20 ft. centers. The wellfield would not be visible as it is entirely underground. To balance and maintain the wellfield there are typically two (2) options available to the owner: an indoor located geothermal header and a vault located outside. The header and the vault contain the same main components including valves and accessories to maintain the wellfield; the key difference is the location of each. CMTA typically recommends utilizing an indoor geothermal header if space is available, but many clients choose an exterior vault depending on space availability and preference. We would anticipate there being a geothermal header located in the existing boiler room as well as the associated wellfield and building loop pumps.



*Geothermal Wellfield*



*Horizontal Heat pump*



*Vertical Heat Pump*

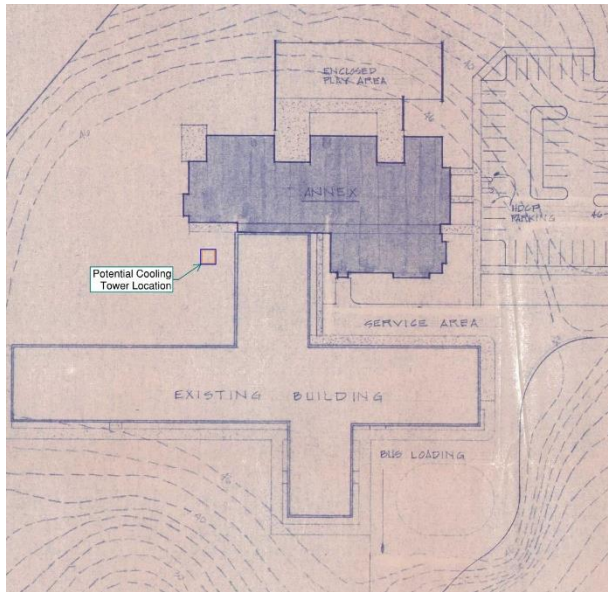


*Console Heat Pump*

Refer to the Dedicated Outside Air System section for ventilation system description.

[Option 2 - Boiler / Cooling Tower Water Source Heat Pump System:](#)

In a boiler / cooling tower water-source heat pump system, conditioning equipment (referred to as heat pumps) heats and cools the building and absorbs or rejects this heat to a two-pipe heat pump loop which is then heated or cooled using the boiler or cooling tower. Cooling EERs is typically 17.0 at full-load and 19.5 at part-load (using AHRI water loop conditions). Heating COP is 5.4 at full-load and 5.2 at part-load. Heat pumps would be located and selected in three different arrangements: horizontal, vertical, and console. Careful planning of the cooling tower location would be required to lessen the impact of noise and line of sight. Figure 2 below presents an example of the estimated foot print and example location of the cooling tower – note that this location can be revised, it is just for illustrative purposes.



**Figure 2: Cooling Tower Foot Print and Example Location.**

The cooling tower would need to be carefully located to mitigate sound that is generated and lessen the line of sight.



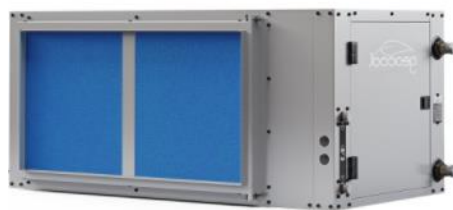
*Boiler*



*Cooling Tower*



*Vertical heat Pump*



*Horizontal Heat Pump*



*Console Heat Pump*

Refer to the Dedicated Outside Air System section for ventilation system description.

### Option 3 – High Efficiency Four Pipe Fan Coil System

This system employs an air source chiller to generate chilled water for cooling and high efficiency boilers to generate hot water for heating. The terminal units in this system are fan coils in lieu of heat pumps which do not have compressors and only consist of a fan, heating coil, and cooling coil. The compressors are centralized at the outdoor air source chiller. Rather than a common pair of pipes this system uses two pair of pipes (4-pipe system), one pair for heating and one pair for cooling. This system may also require antifreeze in the chilled water and more pumps compared to the geothermal system; a set of pumps for the heating water and a set of pumps for the chilled water. Fan coil units would be located and selected in two different arrangements: horizontal and console. Careful planning of the chiller location would be required to lessen the impact of noise and line of sight as well as any structural concerns.



*Boiler*



*Air Source Chiller*



*Horizontal Fan Coil Unit*



*Console Fan Coil Unit*

Refer to the Dedicated Outside Air System section for ventilation system description.

### Ventilation Air - Dedicated Outdoor Air Systems

As noted in the existing systems section above, we would recommend replacing the existing built-up DOAS units with new packaged DX/natural gas fired DOAS units. The system will be sized for the population of the school and the ventilation air flows will be modulated based on carbon dioxide levels in each space. This allows for the ventilation air to “follow” the occupants of the building a provide the correct air flow needed when the occupants are in each space. This approach helps to save energy by reducing

unnecessary overventilation of lightly occupied or unoccupied spaces, as well as reduce the overall size and cost of the overall ventilation system(s). The dedicated outside air system air handling unit will be provided with a total enthalpy wheel for energy recovery and a DX cooling coil with hot gas reheat for humidity control. The ventilation air will be delivered dehumidified at a room neutral temperature. The units will be located on the existing structural dunnage that is currently serving the built-up units.



*Packaged DOAS Unit*

## SYSTEM COMPARISON

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### Geothermal Water Source Heat Pump

- **Maintainability – Excellent**
  - No Boilers or Chillers to maintain.
  - Regular maintenance includes filter changes and water treatment for heat pump water loop.
  - Wellfield life of 50+ years will extend long beyond even the service life of the heat pump system.
  - Heat Pumps located above ceiling, in mechanical rooms, and/or in classrooms if console units are selected. Filter accessible from ground thru filter grilles or available at the unit for vertical and console type heat pumps.
  - Hydronic accessories located above ceiling or in mechanical room (strainers at heat pump).
  - Wells located in field adjacent to building, but will have 20-year warranty and will last at least 50+ years.
  - No antifreeze required in water loop and no heat tracing of piping.
  - Units can be worked on and maintained by residential licensed HVAC contractor.
- **Energy Performance – Excellent**
  - Most energy efficient system. EUI (20-25)
  - Lower entering water temperatures from the ground source result in optimal heat pump performance and life.
- **Space/Aesthetic impact – Good**

- Requires mechanical room space for pumps and closets for vertical heat pumps.
- 2-pipe system.
- Units are located above ceilings for horizontal style units, in mechanical rooms for vertical style units, or in the space for console type units.
- **Cons**
  - Vertical Heat Pumps take up program/floor space.
  - Compressors and Fans located above ceilings for horizontal type units.
  - System is ducted; sheet metal must be routed and located above ceiling.
  - New piping would be required to be run to serve the heat pump water loop.

### Boiler / Cooling Tower Water Source Heat Pump

- **Maintainability – Fair**
  - Cooling Tower requires monthly and quarterly maintenance of fans/pumps/motors.
  - Regular maintenance includes filter changes and water treatment (requires ongoing contract with vendor if owner's staff is unable to perform).
- **Energy Performance – Good**
  - Good efficiency, but proven system. EUI (35 to 45).
  - Life cycle is about 15-20 years.
- **Space/Aesthetic Impact – Good to Excellent**
  - Requires mechanical room space for boilers, pumps, and water basin.
  - Screening would be required to hide cooling tower.
  - The cooling tower would need to be located strategically, preferably isolated, to lower the impact of noise that is generated.
- **Cons**
  - Vertical Heat Pumps take up program/floor space.
  - Compressors and Fans located above ceilings for horizontal type units.
  - System is ducted; sheet metal must be routed and located above ceiling.
  - More intense/involved water treatment.
  - If drain-back design cannot be achieved, a basin heater will be required to prevent the cooling tower from freezing and causing damage during winter months.
  - New piping would be required to be run to serve the heat pump water loop.

### High Efficiency Four Pipe System

- **Maintainability – Good**
  - System requires four (4) pumps.
  - System may require antifreeze.
  - Takes up additional space due to quantity of pumps and freeze protection equipment.

- Regular maintenance includes filter changes and water treatment (requires ongoing contract with vendor if owner's staff is unable to perform maintaining of antifreeze).
  - Four (4) pipes instead of two (2).
  - Compressors are centralized and located outside.
  - Fan coils with hydronic accessories and filters located above ceiling.
  - Requires the most above ceiling clear space. (Heat Pumps = 24-30 inches; Fan Coils = 18-24 inches).
  - Typical system most contractors can service.
  - Two (2) hydronic systems instead of one (1). Hot water and Chilled Water
- **Energy Performance – Fair**
    - Fair efficiency but proven system. EUI (50 to 60)
    - Chiller is least efficient means of cooling.
    - Energy penalty for use of anti-freeze due to pumping viscous fluid and heat transfer reduction.
  - **Space/Aesthetic Impact – Fair**
    - Requires most room in the mechanical room.
    - Horizontal and cassette type fan coils located above ceilings with hydronic valving.
    - Ducted system; thus, sheet metal must route above ceiling.
  - **Cons**
    - Four (4) pipes instead of two (2).
    - Least efficient but most common system.
    - May require a larger mechanical room.
    - Requires anti-freeze.
    - Fan coils located above ceiling for horizontal and cassette type units.
    - Insulation required in contrast to WSHP systems.
    - More hydronic accessories above ceiling due to additional piping systems (4 pipes compared to 2).

## LIFE CYCLE COST ANALYSIS: EXECUTIVE SUMMARY

A life cycle cost analysis by its very nature, relies upon educated assumptions about the future based upon analysis of past performance and benchmarking. Factors considered in producing this report include historical energy modeling data, historical system performance data, system first cost, energy cost, maintenance cost, inflation, equipment life expectancies, and equipment replacement costs. The tables below outline the assumptions made for each system and using these assumptions a life cycle cost analysis was developed for the three different (3) systems.

System Summary											
System Type	Overall Building EUI	HVAC EUI @ 45% of Total EUI		Building Area ft <sup>2</sup>	Yearly Energy Usage		Yearly Energy Cost		Yearly Maintenance Cost		Total
		kBtu/ft <sup>2</sup> -yr	kWh/ft <sup>2</sup> -yr		kWh	therms	Elec	Gas	\$/ft <sup>2</sup>	\$	
GSHP	32	14	4.2	71,730	302,729	0	\$ 27,246	\$ -	\$ 0.20	\$ 14,346	\$ 41,592
WSHP	44	20	5.8		364,221	1,775	\$ 37,463	\$ 540	\$ 0.30	\$ 21,519	\$ 58,982
HE FP	50	23	6.6		390,237	2,824	\$ 42,571	\$ 858	\$ 0.25	\$ 17,933	\$ 60,504

Geothermal Heat Pump System First Cost			
Component	Cost [\$/ft <sup>2</sup> ]	Total Cost [\$]	Service Life [yrs]
Heat Pumps	\$6.00	\$430,380	25
Geothermal Well Field	-	\$573,840	50
Building Mechanical Piping	\$6.00	\$430,380	35
Pumps & Hydronic Specialties	\$2.00	\$143,460	25
Chemical Treatment	-	\$10,000	-
Test & Balance	\$0.50	\$35,865	-
DOAS System	-	\$475,000	25
Insulation - Duct & Pipe	\$2.00	\$143,460	30
Ductwork	\$1.25	\$89,663	30
Registers, Grilles, & Diffusers	\$0.50	\$35,865	35
Controls	\$1.50	\$107,595	20
Condensate Piping	\$0.50	\$35,865	35
<b>Total</b>	<b>\$35.01</b>	<b>\$2,511,373</b>	



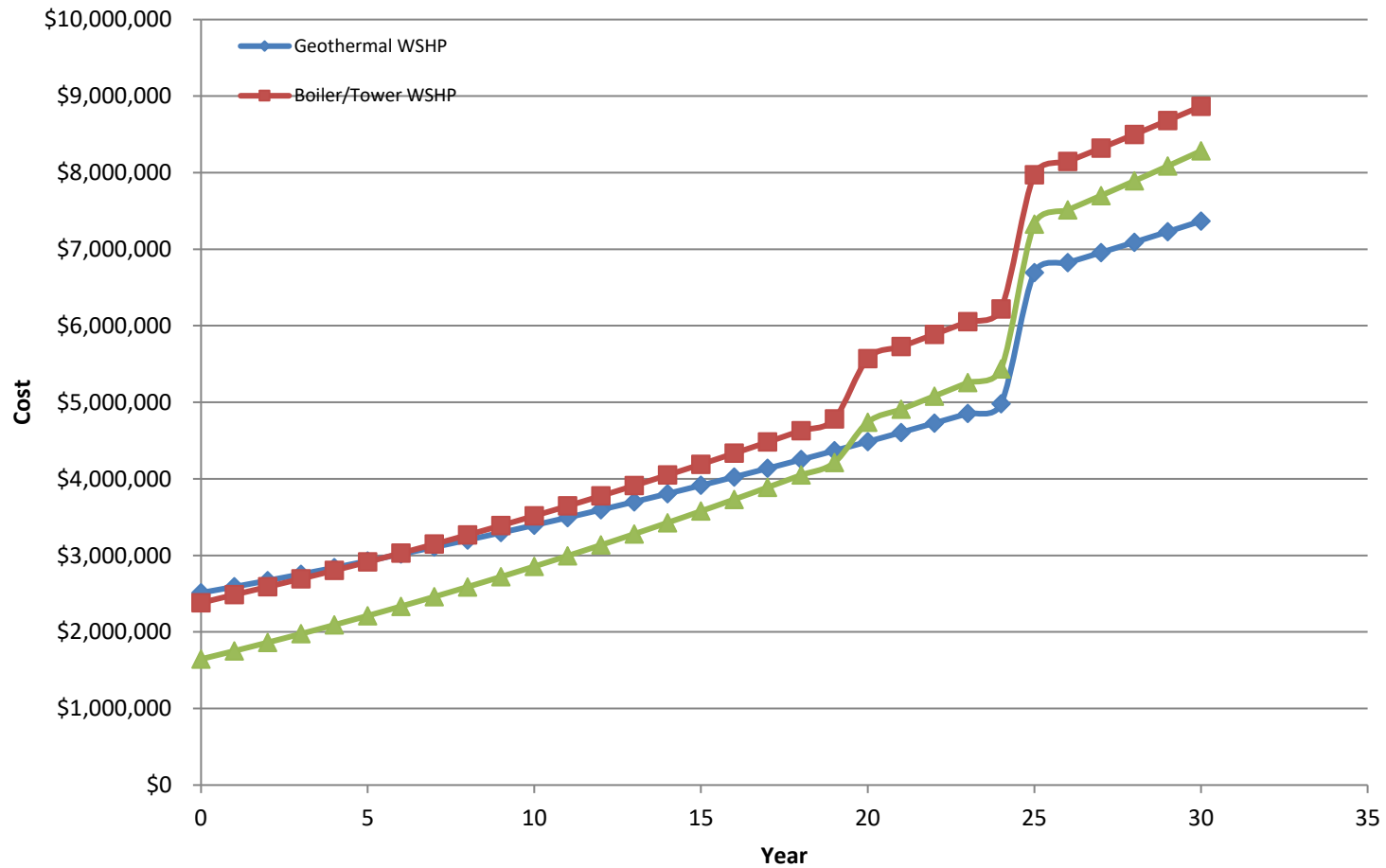
<b>Boiler/Tower WSHP System First Cost</b>			
<b>Component</b>	<b>Cost [\$/ft2]</b>	<b>Total Cost [\$]</b>	<b>Service Life [yrs]</b>
Heat Pumps	\$6.00	\$430,380	25
Cooling Tower & Boiler	\$5.50	\$394,515	20
Building Mechanical Piping	\$6.00	\$430,380	35
Pumps & Hydronic Specialties	\$2.15	\$154,220	25
Chemical Treatment	-	\$30,000	-
Test & Balance	\$0.50	\$35,865	-
DOAS System	-	\$475,000	25
Insulation - Duct & Pipe	\$2.00	\$143,460	30
Ductwork	\$1.25	\$89,663	30
Registers, Grilles, & Diffusers	\$0.50	\$35,865	35
Controls	\$1.75	\$125,528	20
Condensate Piping	\$0.50	\$35,865	35
<b>Total</b>	<b>\$33.19</b>	<b>\$2,380,740</b>	

<b>High Efficiency Four Pipe System First Cost</b>			
<b>Component</b>	<b>Cost [\$/ft2]</b>	<b>Total Cost [\$]</b>	<b>Service Life [yrs]</b>
Fan Coils	\$5.00	\$358,650	25
Chiller(s)	-	\$225,000	20
Boilers	-	\$175,000	20
Refrigerant Piping	-	\$10,000	20
Building Mechanical Piping	\$1.00	\$71,730	35
Pumps & Hydronic Specialties	\$2.00	\$143,460	25
Chemical Treatment	-	\$20,000	-
Test & Balance	\$0.65	\$46,625	-
DOAS System	-	\$475,000	25
Insulation - Duct & Pipe	\$0.50	\$35,865	30
Ductwork	\$1.00	\$71,730	30
Registers, Grilles, & Diffusers	\$0.50	\$35,865	35
Controls	\$1.75	\$125,528	20
Condensate Piping	\$0.50	\$35,865	35
<b>Total</b>	<b>\$25.52</b>	<b>\$1,830,317</b>	

	Geothermal WSHP					Boiler/Tower WSHP								High Efficiency Four Pipe Fan Coil								
Year	GSHP Equipment Cost	GSHP Financed Interest	GSHP Energy Costs	GSHP Maintenance Cost	GSHP Total Cost	WSHP Equipment Cost	WSHP Yearly Interest Costs	WSHP Electricity Costs	WSHP Natural Gas Costs	WSHP Energy Costs	WSHP Maintenance Costs	WSHP Total Cost	GSHP / WSHP Difference [\$]	GSHP / WSHP % Difference	HEFP Equipment Cost	HEFP Electricity Costs	HEFP Natural Gas Costs	HEFP Energy Costs	HEFP Maintenance Cost	HEFP Total Cost	GSHP / HEFP Difference [\$]	GSHP / HEFP % Difference
0	\$2,511,373	\$0	\$0	\$0	\$2,511,373	\$2,380,740	\$0	\$0	\$0	\$0	\$0	\$2,380,740	\$130,633	5.3%	\$1,645,317	\$0	\$0	\$0	\$0	\$1,645,317	\$866,056	41.7%
1	\$0	\$8,193	\$28,063	\$42,839	\$2,590,468	\$0	\$6,052	\$38,587	\$556	\$39,142	\$60,751	\$2,486,685	\$103,782	4.1%	\$0	\$43,848	\$884	\$44,733	\$62,319	\$1,752,368	\$838,099	38.6%
2	\$0	\$8,193	\$28,880	\$44,087	\$2,671,628	\$0	\$6,052	\$39,711	\$572	\$40,282	\$62,521	\$2,589,488	\$82,140	3.1%	\$0	\$45,126	\$910	\$46,035	\$64,134	\$1,862,538	\$809,090	35.7%
3	\$0	\$8,193	\$29,698	\$45,335	\$2,754,854	\$0	\$6,052	\$40,834	\$588	\$41,422	\$64,290	\$2,695,201	\$59,653	2.2%	\$0	\$46,403	\$936	\$47,338	\$65,949	\$1,975,825	\$779,028	32.9%
4	\$0	\$8,193	\$30,515	\$46,583	\$2,840,144	\$0	\$6,052	\$41,958	\$604	\$42,563	\$66,060	\$2,803,823	\$36,321	1.3%	\$0	\$47,680	\$961	\$48,641	\$67,764	\$2,092,231	\$747,914	30.3%
5	\$0	\$8,193	\$31,332	\$47,830	\$2,927,500	\$0	\$6,052	\$43,082	\$620	\$43,703	\$67,829	\$2,915,355	\$12,145	0.4%	\$0	\$48,957	\$987	\$49,944	\$69,579	\$2,211,754	\$715,746	27.9%
6	\$0	\$8,193	\$32,150	\$49,078	\$3,016,921	\$0	\$6,052	\$44,206	\$637	\$44,843	\$69,598	\$3,029,796	(\$12,875)	-0.4%	\$0	\$50,234	\$1,013	\$51,247	\$71,394	\$2,334,396	\$682,525	25.5%
7	\$0	\$8,193	\$32,967	\$50,326	\$3,108,407	\$0	\$6,052	\$45,330	\$653	\$45,983	\$71,368	\$3,147,146	(\$38,740)	-1.2%	\$0	\$51,511	\$1,039	\$52,550	\$73,210	\$2,460,155	\$648,252	23.3%
8	\$0	\$8,193	\$33,785	\$51,574	\$3,201,958	\$0	\$6,052	\$46,454	\$669	\$47,123	\$73,137	\$3,267,407	(\$65,449)	-2.0%	\$0	\$52,788	\$1,064	\$53,853	\$75,025	\$2,589,032	\$612,925	21.2%
9	\$0	\$8,193	\$34,602	\$52,821	\$3,297,574	\$0	\$6,052	\$47,578	\$685	\$48,263	\$74,907	\$3,390,576	(\$93,002)	-2.8%	\$0	\$54,066	\$1,090	\$55,156	\$76,840	\$2,721,028	\$576,546	19.2%
10	\$0	\$8,193	\$35,419	\$54,069	\$3,395,255	\$0	\$6,052	\$48,702	\$701	\$49,403	\$76,676	\$3,516,655	(\$121,400)	-3.5%	\$0	\$55,343	\$1,116	\$56,459	\$78,655	\$2,856,141	\$539,114	17.2%
11	\$0	\$8,193	\$36,237	\$55,317	\$3,495,002	\$0	\$6,052	\$49,825	\$718	\$50,543	\$78,446	\$3,645,644	(\$150,642)	-4.2%	\$0	\$56,620	\$1,142	\$57,761	\$80,470	\$2,994,373	\$500,629	15.4%
12	\$0	\$8,193	\$37,054	\$56,565	\$3,596,813	\$0	\$6,052	\$50,949	\$734	\$51,683	\$80,215	\$3,777,542	(\$180,729)	-4.9%	\$0	\$57,897	\$1,167	\$59,064	\$82,285	\$3,135,722	\$461,091	13.7%
13	\$0	\$8,193	\$37,871	\$57,812	\$3,700,690	\$0	\$6,052	\$52,073	\$750	\$52,823	\$81,985	\$3,912,350	(\$211,660)	-5.6%	\$0	\$59,174	\$1,193	\$60,367	\$84,100	\$3,280,190	\$420,500	12.0%
14	\$0	\$8,193	\$38,689	\$59,060	\$3,806,632	\$0	\$6,052	\$53,197	\$766	\$53,963	\$83,754	\$4,050,067	(\$243,436)	-6.2%	\$0	\$60,451	\$1,219	\$61,670	\$85,915	\$3,427,775	\$378,857	10.5%
15	\$0	\$8,193	\$39,506	\$60,308	\$3,914,639	\$0	\$6,052	\$54,321	\$782	\$55,103	\$85,524	\$4,190,694	(\$276,056)	-6.8%	\$0	\$61,728	\$1,245	\$62,973	\$87,730	\$3,578,478	\$336,160	9.0%
16	\$0	\$8,193	\$40,324	\$61,556	\$4,024,711	\$0	\$6,052	\$55,445	\$798	\$56,243	\$87,293	\$4,334,230	(\$309,520)	-7.4%	\$0	\$63,006	\$1,270	\$64,276	\$89,546	\$3,732,300	\$292,411	7.5%
17	\$0	\$8,193	\$41,141	\$62,803	\$4,136,848	\$0	\$6,052	\$56,569	\$815	\$57,383	\$89,062	\$4,480,676	(\$343,829)	-8.0%	\$0	\$64,283	\$1,296	\$65,579	\$91,361	\$3,889,239	\$247,608	6.2%
18	\$0	\$8,193	\$41,958	\$64,051	\$4,251,050	\$0	\$6,052	\$57,693	\$831	\$58,523	\$90,832	\$4,630,032	(\$378,982)	-8.5%	\$0	\$65,560	\$1,322	\$66,882	\$93,176	\$4,049,297	\$201,753	4.9%
19	\$0	\$8,193	\$42,776	\$65,299	\$4,367,317	\$0	\$6,052	\$58,816	\$847	\$59,664	\$92,601	\$4,782,297	(\$414,979)	-9.1%	\$0	\$66,837	\$1,348	\$68,185	\$94,991	\$4,212,472	\$154,845	3.6%
20	\$0	\$8,193	\$43,593	\$66,547	\$4,485,650	\$631,224	\$6,052	\$59,940	\$863	\$60,804	\$94,371	\$5,568,695	(\$1,083,045)	-21.5%	\$360,000	\$68,114	\$1,373	\$69,487	\$96,806	\$4,738,766	(\$253,116)	-5.5%
21	\$0	\$8,193	\$44,410	\$67,794	\$4,606,047	\$0	\$6,052	\$61,064	\$879	\$61,944	\$96,140	\$5,726,779	(\$1,120,731)	-21.7%	\$0	\$69,391	\$1,399	\$70,790	\$98,621	\$4,908,177	(\$302,130)	-6.4%
22	\$0	\$8,193	\$45,228	\$69,042	\$4,728,510	\$0	\$6,052	\$62,188	\$896	\$63,084	\$97,910	\$5,887,772	(\$1,159,262)	-21.8%	\$0	\$70,668	\$1,425	\$72,093	\$100,436	\$5,080,707	(\$352,197)	-7.2%
23	\$0	\$8,193	\$46,045	\$70,290	\$4,853,038	\$0	\$6,052	\$63,312	\$912	\$64,224	\$99,679	\$6,051,675	(\$1,198,637)	-22.0%	\$0	\$71,945	\$1,451	\$73,396	\$102,251	\$5,256,354	(\$403,316)	-8.0%
24	\$0	\$8,193	\$46,862	\$71,538	\$4,979,631	\$0	\$6,052	\$64,436	\$928	\$65,364	\$101,449	\$6,218,488	(\$1,238,857)	-22.1%	\$0	\$73,223	\$1,476	\$74,699	\$104,067	\$5,435,120	(\$455,489)	-8.7%
25	\$1,584,415	\$8,193	\$47,680	\$72,785	\$6,692,704	\$1,584,415	\$6,052	\$65,560	\$944	\$66,504	\$103,218	\$7,972,625	(\$1,279,921)	-17.5%	\$1,709,943	\$74,500	\$1,502	\$76,002	\$105,882	\$7,326,946	(\$634,242)	-9.0%
26	\$0	\$8,193	\$48,497	\$74,033	\$6,823,427	\$0	\$6,052	\$66,684	\$960	\$67,644	\$104,987	\$8,145,256	(\$1,321,829)	-17.7%	\$0	\$75,777	\$1,528	\$77,305	\$107,697	\$7,511,947	(\$688,520)	-9.6%
27	\$0	\$8,193	\$49,315	\$75,281	\$6,956,215	\$0	\$6,052	\$67,808	\$977	\$68,784	\$106,757	\$8,320,797	(\$1,364,582)	-17.9%	\$0	\$77,054	\$1,554	\$78,608	\$109,512	\$7,700,066	(\$743,851)	-10.2%
28	\$0	\$8,193	\$50,132	\$76,529	\$7,091,069	\$0	\$6,052	\$68,931	\$993	\$69,924	\$108,526	\$8,499,248	(\$1,408,179)	-18.1%	\$0	\$78,331	\$1,579	\$79,910	\$111,327	\$7,891,304	(\$800,235)	-10.7%
29	\$0	\$8,193	\$50,949	\$77,776	\$7,227,987	\$0	\$6,052	\$70,055	\$1,009	\$71,064	\$110,296	\$8,680,608	(\$1,452,620)	-18.3%	\$0	\$79,608	\$1,605	\$81,213	\$113,142	\$8,085,659	(\$857,672)	-11.2%
30	\$0	\$8,193	\$51,767	\$79,024	\$7,366,971	\$0	\$6,052	\$71,179	\$1,025	\$72,204	\$112,065	\$8,864,877	(\$1,497,906)	-18.5%	\$0	\$80,885	\$1,631	\$82,516	\$114,957	\$8,283,133	(\$916,162)	-11.7%

**Figure 3: 30-Year Life Cycle Cost Analysis.** Analysis includes replacing Cooling Tower at year 20, Heat Pumps at year 20, and Boilers at year 20. The wellfield is designed to operate 50+ years without replacement. Future replacement cost includes 3% inflation.

## Macy McClaughtery - HVAC System LCC



Predictably, the geothermal system had a higher first cost, primarily due to the cost of the wellfield. However, the analysis suggested that for a 30-year lifecycle cost analysis, geothermal water source heat pumps yield the lowest lifecycle cost.

# LIFE CYCLE COST ANALYSIS: INPUTS AND ASSUMPTIONS

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## Building Square Footage:

This building is approximately 115,500 square feet.

## System First Cost:

According to CMTA historic cost data from recent projects under construction, the current installed cost for a geothermal heat pump system is about **\$35-\$45 per square foot**. A boiler / cooling tower water source heat pump system is about **\$30-\$40 per square foot**.

## System Energy Usage:

According to historical usage data collected by CMTA, standard geothermal systems prove to be the most efficient systems. Our most recent geothermal elementary schools perform at an average energy use intensity (EUI) of 20 KBTU/SF in new schools. The EUI of boiler/cooling tower water source heat pump system was estimated at 40 EUI.

## Equipment Life Expectancy/Replacement Cost:

Equipment life expectancy is a key component of the lifecycle cost analysis. The key equipment types requiring replacement within 30 years in the above options and their expected life is listed below<sup>1</sup>:

**Table 1: Expected Equipment Life**

Item	Expected Life
Heat Pumps	20-24 years
Boilers	20 years
Fan Coil Units	20 years
Cooling Tower	21 years
Air Source Chiller	15 years

## Maintenance Cost:

The *ASHRAE HVAC Applications Handbook* lists an average maintenance cost of about \$0.32 per square foot. Maintenance costs for the facility were projected around this average based upon probable maintenance costs. The most maintenance-intensive component of any system which will be consistent across all systems are the regular filter changes. The maintenance cost for the boiler / cooling tower water source heat pump system is slightly elevated because of the complexities and personnel required to work

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<sup>1</sup> Data based on *ASHRAE Owning and Operating Cost Database* and *ASHRAE Applications*.

on the systems and the intensive water treatment and hydronic components. Maintenance costs for each system have been modeled as listed in Table 2 below<sup>2</sup>:

**Table 2: Maintenance Cost**

<b>System</b>	<b>Maintenance Cost</b>
Geothermal Water Source Heat Pump	\$0.2 / ft <sup>2</sup>
Boiler / Cooling Tower Water Source Heat Pump	\$0.30 / ft <sup>2</sup>
Four Pipe Fan Coil System	\$0.25 / ft <sup>2</sup>

## LIFE CYCLE COST ANALYSIS: CONCLUSION

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All systems have their own benefits and disadvantages, and all could serve the school well. The lowest life cycle cost of the options compared is the geothermal water source heat pump system. In terms of maintenance, the geothermal water source heat pump system will be the easiest to maintain and work on while the boiler/tower WSHP system and the high efficiency four pipe fan coil system will be slightly more complex and harder to maintain. In conclusion, we believe the best system choice is geothermal water source heat pumps based on the life cycle cost and level of maintenance required to maintain the system.



## Educational Space observations and recommendations

### **Eastern Elementary / Middle School**

Grades Pre K – 7<sup>th</sup>

Current Enrollment (November 2021) 388 students – three (3) classes per grade

Typically 13-15 students per classroom

Educational Spaces - Pre K through 7<sup>th</sup> grade

#### General

Administration not directly connected to entrance door. Recommend modifying location of administration suite or relocating secure entrance door.

#### Standard Classrooms

There is one (1) Pre K classroom in this building. The classroom is located in modular classrooms with reasonable storage and adjacent toilet rooms. The Kindergarten classroom is adequately sized with reasonable storage and adjacent toilet rooms. 1<sup>st</sup> grade classrooms are adequately sized with adjacent toilet rooms. 2<sup>nd</sup> – 7<sup>th</sup> grade classrooms are adequately sized. Storage within the classroom is adequate, but grade level storage would be beneficial. Each classroom is equipped with a projector and two (2) classrooms have a smart TV screen. Each classroom has reasonable marker and tack boards for instructional use. The classroom telephone that doubles as a public address system. The classrooms below grade do not have any daylight/views from a window. Some classrooms have a connecting door. Grades Kindergarten through 5<sup>th</sup> have cubbies and hooks for the students belongings. Grades 6<sup>th</sup> and 7<sup>th</sup> have lockers for their belongings. The HVAC system is noisy in the classrooms and makes it challenging for teachers to raise their speaking volume so the students can hear. Lighting is adequate for teaching, but dimming would be preferred.

#### Special Classrooms

The music classroom is the stage located adjacent to the gymnasium and separated with a partition wall. While the space is adequate, sound does transfer from the gym to the Music Classroom and it is difficult to utilize as a stage since its set as a classroom. There is no Art classroom. The building goal is to convert one of the computer labs into an Art Classroom. There are no Science Classrooms. The goal is to convert one of the computer labs into a Science Lab. Library is functional and adequately sized for the schools needs. The cafeteria is adequately sized for student dining with two (2) serving lines.

#### **Recommendations:**

1. Relocate secure vestibule or administrative suite
2. Regrade exterior to install windows for daylighting in classrooms below grade
3. Upgrade / replace HVAC to reduce noise in classrooms and improve comfort
4. Add dimming ability for lighting in classrooms
5. Replace folding partition between gym and music classroom to reduce noise transmittance
6. Convert one unused Computer Classroom into an Art Classroom
7. Convert one unused Computer Classroom into a Science Lab



## Educational Space observations and recommendations

### **Macy McGlaugherty Elementary/Middle School**

Grades Pre K – 7<sup>th</sup>

Current Enrollment (November 2021) 457 students – three (3) – four (4) classes per grade  
Typically 18-20 students per classroom

#### Educational Spaces

K through 7<sup>th</sup> grade

#### General

Administration suite is undersized. The conference room is converted into an office and a part time Counselor is located in a file room. Additional conference room, offices, file space and storage is needed. Nurse is located in the 3<sup>rd</sup> grade corridor. Nurse could utilize additional storage and adding a shower in the toilet room.

#### Standard Classrooms

HVAC is loud in the classrooms. Kindergarten classroom is part of the original building. The room has an adjacent toilet room, good storage and is sized appropriately. First grade area was originally an open pod concept with metal partitions separating the spaces. There is a concern over noise transmission between the classrooms. Each pod has a group of shared toilet rooms and storage. 2<sup>nd</sup> grade classrooms are adequately size. Grades 2 and up change classrooms throughout the day. Grades 3-5 classrooms are adequately sized. There is a request to add one 3<sup>rd</sup> grade classroom to assist with capacity issues. Each classroom is equipped with a projector. Each classroom has reasonable marker and tack boards for instructional use. Classrooms do not have phone, but there is a PA in each classroom to reach the office. Classrooms have limited lighting control. There is a request for additional electric outlets in the classrooms. The middle school is located on the second floor. There is a request to add a Science Lab for grades 6-7. The 6-7 grades utilize lockers in the corridor.

#### Special Classrooms

Library is adequate and recently renovated with new interior finishes. Gymnasium is adequately sized with adjacent toilet rooms. Folding bleachers to not appear to be ADA compliant. There is a mobile classroom utilized by ESCE and 5<sup>th</sup> grade resource. Request space for OT/PT. STEM and Art are not located in classrooms and utilize a cart system. Request space for STEM and Art.

#### **Recommendations:**

1. Upgrade / replace HVAC to reduce noise in classrooms and improve comfort
2. Add dimming ability for lighting in classrooms
3. Convert space into an Art Classroom
4. Convert space into a Science Lab
5. Convert space into a STEM Lab
6. Convert space into an OT/PT space.
7. Add outlets in classrooms
8. Replace metal partitions with higher sound resistant partitions
9. Request Special Education space in each pod.



## Educational Space observations and recommendations

### **Narrows Elementary/Middle School**

Grades Pre K – 7<sup>th</sup>

Current Enrollment (November 2021) 477 students – three (3) – four (4) classes per grade  
Typically 18-20 students per classroom

#### Educational Spaces

Pre K through 7<sup>th</sup> grade

#### General

There is no direct access from the secure vestibule to the administrative suite. Nurse has only one cot and a small toilet with no shower. There does not appear to be any additional property for growth if the school needs to expand in the future.

#### Standard Classrooms

HVAC is loud in the classrooms. The Pre K classroom is a former Kindergarten Classroom with a toilet and storage. 3 of the 4 Kindergarten classrooms are adequate sized and have toilet rooms and storage. The fourth Kindergarten classroom is a little smaller and does not have a toilet. 1st through 3rd grade classrooms are adequate sized. Grades Pre K – 5<sup>th</sup> utilize cubbies in the classroom. Classrooms do not have phones, but they do have a PA system to connect to the main office. Classrooms have limited ability to control lighting. 4<sup>th</sup> grade through 7<sup>th</sup> grade are barely adequate in size for the larger students with desks. Most classrooms have projectors, and adequate marker board/tack board space. There are a few 7<sup>th</sup> grade classrooms without windows. 4<sup>th</sup> and 5<sup>th</sup> grade have modified Science Labs.

#### Special Classrooms

Media center is adequate sized. A portion of the media center is dedicated to special education. The elevator is located in the media center. Music lab is undersized for the program needs. Cafeteria is adequately sized, but there is limited/no technology for educational use. Gym is adequately sized and includes stage with folding separation partition. Art has no dedicated classroom and is on a cart.

#### **Recommendations:**

1. Upgrade / replace HVAC to reduce noise in classrooms and improve comfort
2. Add dimming ability for lighting in classrooms
3. Convert space into an Art Classroom
4. Convert space into a Science Lab





## Educational Space observations and recommendations

### **Giles High School**

Grades 8<sup>th</sup> – 12<sup>th</sup>

Current Enrollment (November 2021) 547 students

Typically 20-25 students per classroom

#### Educational Spaces

8<sup>th</sup> grade through 12<sup>th</sup> grade

#### General

The administration suite is adjacent, but a visitor does not go directly into the lobby from the secure vestibule. The nurse suite is limited in size and could be expanded for multiple students to visit at one time.

#### Standard Classrooms

Classrooms (grades 8-12) appear to meet VDOE standards. Furniture is no consistent moving throughout the building with some classrooms having different age desks and tables. Most classrooms have less than 25 students. There appears to be an adequate number of classrooms for each subject throughout the building. Most classrooms have a projector and adequate marker board/tack board surface.

#### Special Classrooms

Gymnasium appears to be adequately sized with appropriate equipment for physical education and athletics. The locker and team rooms for boys and girls appear to be in good condition. Future improvements could be to increase accessible toilet renovations and conversion of the multi-person showers into individual showers. The auditorium is sized appropriately for the student population and the stage is adequate for its use. Science classrooms appear to be appropriately sized for function and have the needed storage and accouterments for lab use. Media Center is adequately sized.

#### Tech Center

Space was renovated approximately 10 years ago. The center serves approximately 180 students with a two year program.

#### Standard Labs

Each lab has a classroom, storage and changing rooms. Welding lab could have better vision from the classroom into the lab. Drafting Lab, Building Trades, Machining Lab, Auto Mechanics has a large lab with good vision from the classroom to lab, meeting the minimum requirements. Nursing lab has 6 beds and requests an additional 4 beds. Nursing has a separate computer lab and classroom space. Cosmetology has good vision from Office to Lab, but poor vision from Classroom to Lab space. Computer Tech & Cyber have adequate Lab space and good vision from the Classroom to Lab space.

#### **Recommendations:**

1. Upgrade / replace HVAC to reduce noise in classrooms and improve comfort
2. Add dimming ability for lighting in classrooms
3. Improve direct access from secure vestibule to office lobby
4. Add 4 beds in the nursing lab



## Educational Space observations and recommendations

### **Narrows High School**

Grades 8<sup>th</sup> – 12<sup>th</sup>

Current Enrollment (November 2021) 286 students

Typically 18-20 students per classroom

Educational Spaces

8<sup>th</sup> grade through 12<sup>th</sup> grade

#### General

The administration suite is adjacent, but a visitor does not go directly into the lobby from the secure vestibule. The nurse suite is limited in size and could be expanded for multiple students to visit at one time. There is no elevator to access the second floor.

#### Standard Classrooms

Classrooms (grades 8-12) appear to meet VDOE standards. Furniture is no consistent moving throughout the building with some classrooms having different age desks and tables. Most desks are too small for the students. Most classrooms have less than 25 students. There appears to be an adequate number of classrooms for each subject throughout the building. Most classrooms have a projector and adequate marker board/tack board surface.

#### Special Classrooms

Gymnasium appears to be adequately sized with appropriate equipment for physical education and athletics. The locker and team rooms for boys and girls appear to be in good condition. Future improvements could be to increase accessible toilet renovations and conversion of the multi-person showers into individual showers. The auditorium is sized appropriately for the student population and the stage is adequate for its use. A request for epoxy tables was stated during the walkthrough. Media Center is adequately sized. Electronics/Robotics lab appears to be adequately size for the program. Agricultural lab is adequately sized with a max. of 14 students. No direct vision access from the Classroom to the Lab space. Request for more electric outlets in the lab.

#### **Recommendations:**

1. Upgrade / replace HVAC to reduce noise in classrooms and improve comfort
2. Add dimming ability for lighting in classrooms
3. Improve direct access from secure vestibule to office lobby
4. Add 4 beds in the nursing lab
5. Improve vision in Ag lab from the classroom to the lab.
6. Renovate the locker/team rooms to increase accessibility and improve privacy.
7. Renovate Science Labs to include epoxy tables.
8. Replace the classroom furniture with newer furniture is appropriately sized.

Option 1 - Maintain Existing Facilities through a capital improvement program								
Maintain all facilities and grade alignment as they are currently configured. All facilities will be maintained through a capital improvement program. Redistricting may be required in the future based on area growth.								
CURRENT ALIGNMENT				FUTURE ALIGNMENT				ACTIONS
School	Grades	Building Capacity	Enrollment	School	Grades	Building Capacity	Enrollment	
Eastern Elem / Middle School	Pre K - 7	579	388	Eastern Elem / Middle School	Pre K - 7	579	388	Maintain with Capital Program
Macy McClauthery Elem / Middle School	Pre K - 7	572	457	Macy McClauthery Elem / Middle School	Pre K - 7	572	457	Maintain with Capital Program
Narrows Elem / Middle School	Pre K - 7	684	477	Narrows Elem / Middle School	Pre K - 7	684	477	Maintain with Capital Program
Giles High School	8-12	880	547	Giles High School	8-12	880	547	Maintain with Capital Program
Giles Tech Center	10-12	incl. w/GHS & NHS	incl. w/GHS & NHS	Giles Tech Center	10-12	incl. w/GHS & NHS	incl. w/GHS & NHS	Maintain with Capital Program
Narrows High School	8-12	645	286	Narrows High School	8-12	645	286	Maintain with Capital Program
		3360	2155			3360	2155	Potential Costs Option 1

*SELECT EITHER OPTION A (ALL PROJECTS COMPLETED IN 2022-24) OR OPTION B (PROJECTS COMPLETED OVER A 20 YEAR PERIOD)									
Probable Costs Option 1	PROBABLE COSTS A			PROBABLE COSTS B				NOTES/COMMENTS	
	2022-2024	2022-2024		2022-2024	2025-2028	2029 - 2032	2033 - 2037		2038 - 2042
School	Existing Const.	New Const.							
Eastern Elem / Middle School	\$7,389,135			\$0	\$451,242	\$5,275,349	\$3,476,810	\$152,000	
Macy McClauthery Elem / Middle School	\$8,058,905			\$4,094,905	\$1,212,640	\$1,510,400	\$1,218,000	\$1,212,000	
Narrows Elem / Middle School	\$4,662,400			\$0	\$2,550,572	\$1,648,460	\$209,090	\$1,144,000	
Giles High School	\$14,992,640			\$0	\$4,412,250	\$11,127,565	\$290,000	\$1,920,000	
Giles Tech Center	incl. w/GHS & NHS			-	-	-	-	-	
Narrows High School	\$11,187,145			\$0	\$3,099,440	\$8,334,511	\$0	\$1,920,000	
				<b>\$46,290,225</b>	<b>\$4,094,905</b>	<b>\$11,726,144</b>	<b>\$27,896,285</b>	<b>\$5,193,900</b>	<b>\$6,348,000</b>

**Option 1**

Maintain all facilities with the current grade alignment and a capital improvement program.

The grade alignment of Pre K – 7 (3 schools) and 8-12 (2 schools) will remain as it currently stands. The schools function educationally as they are designed and utilized. The concern may be with future capacity of Macy McClauthery Elementary/Middle School and Narrows Elementary/Middle School. GCPS may have to review options to realign the elementary schools to address future capacity issues.

The Division would operate on a capital improvement plan utilizing the Facility Condition Index to create a 10, 15 and 20 year plan. GCPS should share this plan with the County Supervisors to help establish a yearly budget for capital improvements. Costs over twenty years could range from \$33 million - \$63 million

- Pros: Short term lower cost for construction activities  
Retain current schools and grade alignment

- Cons: Does not address the potential future capacity issues at elementary schools

**Phasing**

The majority of capital projects may be completed over the summer or winter breaks. We would recommend that summer projects be designed/scoped over the fall of the previous year and bid no later than the December/January timeframe for the following summer. This process may obtain the greatest number of contractors, the best pricing and permit the contractors enough time to procure the materials/equipment for the project. Larger projects may require summer break and work during the school year. This may result in relocation of classrooms within the building, modular classrooms, and/or shifting to open space in another school.



Option 2 - Close Narrows High School and combine with Giles High School								
All elementary schools will be maintained through a capital improvement program. Elementary grade alignment will remain as it is currently configured. Narrows High School will be closed. Students will join with Giles High School with the current 8-12 grade alignment. A small classroom addition is recommended to accommodate for academic program. Redistricting may be required in the future based on area growth.								
CURRENT ALIGNMENT				FUTURE ALIGNMENT				ACTIONS
School	Grades	Building Capacity	Enrollment	School	Grades	Building Capacity	Enrollment	
Eastern Elem / Middle School	Pre K - 7	579	388	Eastern Elem / Middle School	Pre K - 7	579	388	Maintain with Capital Program
Macy McClaughtery Elem / Middle School	Pre K - 7	572	457	Macy McClaughtery Elem / Middle School	Pre K - 7	572	457	Maintain with Capital Program
Narrows Elem / Middle School	Pre K - 7	684	477	Narrows Elem / Middle School	Pre K - 7	684	477	Maintain with Capital Program
Giles High School	8-12	880	547	Giles High School	8-12	880	833	Consolidate with Narrows High School - Add/Renov.
Giles Tech Center	10-12	incl. w/GHS & NHS	incl. w/GHS & NHS	Giles Tech Center	10-12	incl. w/GHS & NHS	incl. w/GHS & NHS	Maintain with Capital Program
Narrows High School	8-12	645	286	Narrows High School	Close	645	Close	Close Narrows High School
		3360	2155			3360	2155	Potential Costs Option 2

*SELECT EITHER OPTION A (ALL PROJECTS COMPLETED IN 2022-24) OR OPTION B (PROJECTS COMPLETED OVER A 20 YEAR PERIOD)								
Probable Costs Option 2	The probable costs below are if ALL construction and capital projects occur in 2022-2024 - Utilizing the high costs from FCI		The probable costs below reflect the 2022 cost estimates from the Facility Condition Index, plus a 3% increase per year for the work to be completed. This estimate anticipates the work being completed in the last year of the range. Probable Costs B utilizes the high costs from FCI					NOTES/COMMENTS
	PROBABLE COSTS A		PROBABLE COSTS B					
School	2022-2024	2022-2024	2022-2024	2025-2028	2029 - 2032	2033 - 2037	2038 - 2042	
	Existing Const.		New Const.					
Eastern Elem / Middle School	\$7,389,135		\$0	\$451,242	\$5,275,349	\$3,476,810	\$152,000	
Macy McClaughtery Elem / Middle School	\$8,058,905		\$4,094,905	\$1,212,640	\$1,510,400	\$1,218,000	\$1,212,000	
Narrows Elem / Middle School	\$4,662,400		\$0	\$2,550,572	\$1,648,460	\$209,090	\$1,144,000	
Giles High School	\$16,522,919	\$13,600,000	\$30,122,919	-	-	-	-	The cost includes the capital improvement scope
Giles Tech Center	incl. w/GHS & NHS		-	-	-	-	-	
Narrows High School (close)	-		-	-	-	-	-	
	\$50,233,359		\$34,217,824	\$4,214,454	\$8,434,209	\$4,903,900	\$2,508,000	

**Option 2**

Maintain Elementary facilities with a capital improvement plan. Close Narrows High School and combine with Giles High School. This option will require an addition to Giles High School and include the recommended capital improvements. The elementary schools function educationally as they are designed and utilized. The concern may be with future capacity of Macy McClaughtery Elementary/Middle School and Narrows Elementary/Middle School. GCPS may have to review options to realign the elementary schools to address future capacity issues.

The grade alignment of Pre K – 7 (3 schools) and 8-12 (2 schools) would change to Pre K – 7 (3 schools) and 8-12 (1 school). The schools function educationally as they are designed and utilized. The concern may be with future capacity of Macy McClaughtery Elementary/Middle School and Narrows Elementary/Middle School. GCPS may have to review options to realign the elementary schools to address future capacity issues. Closing Narrows High School and combining the High Schools should review all the challenges of combining the schools including, but not limited to: sports, performing arts, academics, and staff/teacher/administration overlap. While the building capacity is adequate in reviewing the number of students, the program and schedule should be reviewed prior to combining the two High Schools. Our projections would recommend to construct an addition to potentially include: (5) math classrooms, (1) alt ed classroom, (1) art lab, (1) biology lab, (1) chemistry lab, (1) earth science lab, (1) physical science lab, (1) digital applications lab, (1) ecology lab, (1) econ classroom, (4) English classrooms, (1) life skills lab, (1) into to tech lab, (1) leadership development classroom, (3) history/geography classrooms, (1) tech robot design lab, and (1) theatre arts classroom. The size of the addition could range from 30,000sf – 38,000sf.

- Pros: Reduce overall capital improvement costs
  - Combine the two high schools to potentially observe operation cost efficiencies
- Cons: Closing of Narrows High School could potentially lose some community identity
  - County will demolish, repurpose or sell building
  - Students in notable positions may not be able to maintain the same position in combined high School

**Phasing**

The majority of capital projects may be completed over the summer or winter breaks. We would recommend that summer projects be designed/scoped over the fall of the previous year and bid no later than the December/January timeframe for the following summer. This process may obtain the greatest number of contractors, the best pricing and permit the contractors enough time to procure the materials/equipment for the project. Larger projects may require summer break and work during the school year. This may result in relocation of classrooms within the building, modular classrooms, and/or shifting to open space in another school. The combining of Narrows and Giles High School is recommended to occur over the summer break so permit teachers and staff to have the needed time to pack items for movement to and within Giles High School. Some minor renovation may need to occur to accommodate the class schedule for the following year. This may occur over the summer preceding the combining of schools. The addition at Giles High School should be completed prior to closing Narrows High School.



Option 3 - Shift grade 7 from Elem / Middle to High School								
Shift grade 7 from the Elementary / Middle School to the High School. The new grade alignment will be Pre K - 6 and 7-12. This option will provide some capacity in the elementary schools and create a "school within a school" at the middle / high school.								
CURRENT ALIGNMENT				FUTURE ALIGNMENT				ACTIONS
School	Grades	Building Capacity	Enrollment	School	Grades	Building Capacity	Enrollment	
Eastern Elem / Middle School	Pre K - 7	579	388	Eastern Elementary School	Pre K -6	579	339	Maintain with Capital Program
Macy McClaughtery Elem / Middle School	Pre K - 7	572	457	Macy McClaughtery Elementary School	Pre K -6	572	403	Maintain with Capital Program
Narrows Elem / Middle School	Pre K - 7	684	477	Narrows Elementary School	Pre K -6	684	416	Maintain with Capital Program
Giles High School	8-12	880	547	Giles High School	7-12	880	629	Convert to Middle/High School - Add/Renov
Giles Tech Center	10-12	incl. w/GHS & NHS	incl. w/GHS & NHS	Giles Tech Center	10-12	incl. w/GHS & NHS	incl. w/GHS & NHS	Maintain with Capital Program
Narrows High School	8-12	645	286	Narrows High School	7-12	645	368	Convert to Middle/High School - Add/Renov
		3360	2155			3360	2155	Potential Costs Option 3

*SELECT EITHER OPTION A (ALL PROJECTS COMPLETED IN 2022-24) OR OPTION B (PROJECTS COMPLETED OVER A 20 YEAR PERIOD)							
Probable Costs Option 3	PROBABLE COSTS A		PROBABLE COSTS B				NOTES/COMMENTS
	2022-2024	2022-2024	2022-2024	2025-2028	2029 - 2032	2033 - 2037	
	Existing Const.	New Const.					
Eastern Elem / Middle School	\$7,389,135		\$0	\$451,242	\$5,275,349	\$3,476,810	\$152,000
Macy McClaughtery Elem / Middle School	\$8,058,905		\$4,094,905	\$1,212,640	\$1,510,400	\$1,218,000	\$1,212,000
Narrows Elem / Middle School	\$4,662,400		\$0	\$2,550,572	\$1,648,460	\$209,090	\$1,144,000
Giles Middle/High School	\$21,601,362	\$15,600,000	\$37,201,362	-	-	-	-
Giles Tech Center	incl. w/GHS & NHS		-	-	-	-	-
Narrows Middle/High School	\$21,474,465	\$10,000,000	\$31,474,465	-	-	-	-
		\$88,786,267	\$72,770,732	\$4,214,454	\$8,434,209	\$4,903,900	\$2,508,000

**Option 3**

Maintain all buildings in the Division. Realign the grades by shifting 7<sup>th</sup> grade from the Elementary/Middle Schools to the High School. The new alignment would be Pre K – 6 (3 buildings) and 7-12 (2 buildings). The elementary schools function educationally as they are designed and utilized. The concern may be with future capacity of Macy McClaughtery Elementary/Middle School and Narrows Elementary/Middle School. GCPS may have to review options to realign the elementary schools to address future capacity issues. This shift may provide the needed additional building capacity in the Elementary Schools. Additionally the shift could make the High Schools a Middle/High School, providing the 8<sup>th</sup> grade with a grade partner for academics and recreational activities.

This option is similar to Options 1 and 2 in that the Elementary Schools are maintained through a capital improvement plan. While no interaction between the Middle and High School students are not reasonable, modifications to the school would help reduce the interaction during the majority of the school day. Renovation and/or addition will be needed at the Giles High School to add 7<sup>th</sup> grade and create a school within a school. An addition may include the following to separate 7<sup>th</sup> and 8<sup>th</sup> grade from 9-12: (2) math classrooms, (2) reading classrooms, (2) english classrooms, (2) history/civics classrooms, (2) science labs, (1) art classroom, (1) music classroom, and an auxiliary gymnasium. The size of the addition could range from 36,000sf – 42,000sf. This option will most likely include a comprehensive renovation of portions of GHS to support a “school within a school” design. Renovation and/or addition will be needed at the Narrows High School to add 7<sup>th</sup> grade and create a school within a school. An addition may include the following to separate 7<sup>th</sup> and 8<sup>th</sup> grade from 9-12: (1) math classroom, (1) reading classroom, (1) english classroom, (1) history/civics classrooms, (1) science lab, (1) art classroom, (1) music classroom and an auxiliary gymnasium. The size of the addition could range from 20,000sf – 30,000sf. This option will most likely include a comprehensive renovation of portions of NHS to support a “school within a school” design. Additions at both GHS and NHS would include a separate administration, nurse and guidance spaces for the 7-8 portion of the school.

- Pros: Shifting 7<sup>th</sup> grade would assist in providing needed capacity in the Elementary Schools
- Shifting 7<sup>th</sup> grade would provide an academics and recreational partner for the 8<sup>th</sup> grade
- Cons: A more substantial renovation/addition may need to occur at the High Schools to create a “school within a school” concept.

**Phasing**

The majority of capital projects may be completed over the summer or winter breaks. Larger projects may require summer break and work during the school year. This may result in relocation of classrooms within the building, modular classrooms, and/or shifting to open space in another school. We would recommend to complete the construction renovations and/or additions to accommodate the 7<sup>th</sup>/8<sup>th</sup> Grade “School within a school” separation prior to moving the 7<sup>th</sup> grade from the Elementary/Middle Schools. Once 7<sup>th</sup> grade is moved out of the (3) three schools, movement can happen within the (3) Elementary schools to provide more permanent space for permanent Art, Music and Technology classrooms.



**Option 3A - Shift grade 6-7 from Elem / Middle to High School**

Shift grade 6-7 from the Elementary / Middle School to the High School. The new grade alignment will be Pre K - 5 and 6-12. This option will provide some capacity in the elementary schools and create a "school within a school" at the middle / high school.

CURRENT ALIGNMENT				FUTURE ALIGNMENT				ACTIONS
School	Grades	Building Capacity	Enrollment	School	Grades	Building Capacity	Enrollment	
Eastern Elem / Middle School	Pre K - 7	579	388	Eastern Elementary School	Pre K - 5	579	298	Maintain with Capital Program
Macy McClaugherty Elem / Middle School	Pre K - 7	572	457	Macy McClaugherty Elementary School	Pre K - 5	572	342	Maintain with Capital Program
Narrows Elem / Middle School	Pre K - 7	684	477	Narrows Elementary School	Pre K - 5	684	361	Maintain with Capital Program
Giles High School	8-12	880	547	Giles High School	6-12	880	707	Convert to Middle/High School - Add/Renov
Giles Tech Center	10-12	incl. w/GHS & NHS	incl. w/GHS & NHS	Giles Tech Center	10-12	incl. w/GHS & NHS	incl. w/GHS & NHS	Maintain with Capital Program
Narrows High School	8-12	645	286	Narrows High School	6-12	645	447	Convert to Middle/High School - Add/Renov
		3360	2155			3360	2155	Potential Costs Option 3A

*SELECT EITHER OPTION A (ALL PROJECTS COMPLETED IN 2022-24) OR OPTION B (PROJECTS COMPLETED OVER A 20 YEAR PERIOD)								
Probable Costs Option 3A	PROBABLE COSTS A		PROBABLE COSTS B				NOTES/COMMENTS	
School	2022-2024	2022-2024	2022-2024	2025-2028	2029 - 2032	2033 - 2037	2038 - 2042	
	Existing Const.	New Const.						
Eastern Elem / Middle School	\$7,389,135		\$0	\$451,242	\$5,275,349	\$3,476,810	\$152,000	
Macy McClaugherty Elem / Middle School	\$8,058,905		\$4,094,905	\$1,212,640	\$1,510,400	\$1,218,000	\$1,212,000	
Narrows Elem / Middle School	\$4,662,400		\$0	\$2,550,572	\$1,648,460	\$209,090	\$1,144,000	
Giles Middle/High School	\$21,524,162	\$17,600,000	\$39,124,162	-	-	-	-	The cost includes the capital improvement scope
Giles Tech Center	incl. w/GHS & NHS		-	-	-	-	-	
Narrows Middle/High School	\$23,638,127	\$11,600,000	\$35,238,127	-	-	-	-	The cost includes the capital improvement scope
		<b>\$94,472,729</b>	<b>\$78,457,194</b>	<b>\$4,214,454</b>	<b>\$8,434,209</b>	<b>\$4,903,900</b>	<b>\$2,508,000</b>	

**Option 3A**

Maintain all buildings in the Division. Realign the grades by shifting 6<sup>th</sup> and 7<sup>th</sup> grade from the Elementary/Middle Schools to the High Schools. The new alignment would be Pre K – 5 (3 buildings) and 6-12 (2 buildings). This shift may provide the needed additional building capacity in the Elementary Schools. The concern may be with future capacity of Macy McClaugherty Elementary/Middle School and Narrows elementary /Middle School. GCPS may have to review options to realign the elementary schools to address future capacity issues. Additionally, the shift could make the High Schools a Middle/High School, providing the 8<sup>th</sup> grade with a grade partner for academics and recreational activities.

This option is similar to Options 1, 2, and 3 in that the Elementary Schools are maintained through a capital improvement plan. While no interaction between the Middle and High School students are not reasonable, modifications to the school would help reduce the interaction during the majority of the school day. Renovation and/or addition will be needed at the Giles High School to add 6<sup>th</sup>/7<sup>th</sup> grade and create a school within a school. An addition may include the following to separate 6-8 grade from 9-12: (3) math classrooms, (3) reading classrooms, (3) english classrooms, (2) history/civics classrooms, (3) science labs, (1) art classroom, (1) music classroom and an auxiliary gymnasium. The size of the addition could range from 40,000sf – 48,000sf. This option will most likely include a comprehensive renovation of portions of GHS to support a “school within a school” design. Renovation and/or addition will be needed at the Narrows High School to add 6<sup>th</sup>/7<sup>th</sup> grade and create a school within a school. An addition may include the following to separate 6-8 grade from 9-12: (2) math classrooms, (2) reading classrooms, (2) english classrooms, (1) history/civics classrooms, (2) science labs, (1) art classroom, (1) music classroom and an auxiliary gymnasium. The size of the addition could range from 26,000sf – 32,000sf. This option will most likely include a comprehensive renovation of portions of NHS to support a “school within a school” design. Additions at both GHS and NHS would include a separate administration, nurse and guidance spaces for the 6-8 portion of the school.

- Pros: Shifting 6<sup>th</sup> and 7<sup>th</sup> grade would assist in providing needed capacity in the Elementary Schools  
Shifting 6<sup>th</sup> and 7<sup>th</sup> grade would provide an academics and recreational partner for the 8<sup>th</sup> grade
- Cons: A more substantial renovation/addition may need to occur at the High Schools to create a “school within a school” concept. This would most likely create most disruption to the school during construction and cost more in overall dollars spent by the County.

**Phasing**

The majority of capital projects may be completed over the summer or winter breaks. Larger projects may require summer break and work during the school year. This may result in relocation of classrooms within the building, modular classrooms, and/or shifting to open space in another school. We would recommend to complete the construction renovations and/or additions to accommodate the 6<sup>th</sup>/7<sup>th</sup>/8<sup>th</sup> Grade “School within a school” separation prior to moving the 7<sup>th</sup> grade from the Elementary/Middle Schools. Once 6<sup>th</sup> and 7<sup>th</sup> grade are moved out of the (3) three schools, movement can happen within the (3) Elementary schools to provide more permanent space for permanent Art, Music and Technology classrooms.



Option 4 - Shift grade 6-7 from Elem / Middle to Middle School + shift grade 8 from High School to Middle School + Convert NHS to a Middle School									
Shift grades 6-7 from the Elementary / Middle School and convert Narrows High School to a Middle School. Shift 8th grade from the High School to the Middle School. The new grade alignment will be Pre K - 5, 6-8 and 9-12. This option will provide some capacity in the elementary schools and create grade groupings. This option will combine Giles and Narrows High Schools into one High School at Giles High School.									
CURRENT ALIGNMENT				FUTURE ALIGNMENT				ACTIONS	
School	Grades	Building Capacity	Enrollment	School	Grades	Building Capacity	Enrollment		
Eastern Elem / Middle School	Pre K - 7	579	388	Eastern Elementary School	Pre K - 5	579	298	Maintain with Capital Program	
Macy McClauthery Elem / Middle School	Pre K - 7	572	457	Macy McClauthery Elementary School	Pre K - 5	572	342	Maintain with Capital Program	
Narrows Elem / Middle School	Pre K - 7	684	477	Narrows Elementary School	Pre K - 5	684	361	Maintain with Capital Program	
Giles High School	8-12	880	547	Giles High School	9-12	880	662	Combine with NHS	
Giles Tech Center	10-12	incl. w/GHS & NHS	incl. w/GHS & NHS	Giles Tech Center	10-12	incl. w/GHS & NHS	incl. w/GHS & NHS	Maintain with Capital Program	
Narrows High School	8-12	645	286	Giles Middle School	6-8	645	492	Convert NHS to Middle School	
		3360	2155			3360	2155	Potential Costs Option 4	

*SELECT EITHER OPTION A (ALL PROJECTS COMPLETED IN 2022-24) OR OPTION B (PROJECTS COMPLETED OVER A 20 YEAR PERIOD)								
Probable Costs Option 4	PROBABLE COSTS A			PROBABLE COSTS B				NOTES/COMMENTS
	2022-2024	2022-2024	2022-2024	2025-2028	2029 - 2032	2033 - 2037	2038 - 2042	
School	Existing Const.	New Const.						
Eastern Elem / Middle School	\$7,389,135		\$0	\$451,242	\$5,275,349	\$3,476,810	\$152,000	
Macy McClauthery Elem / Middle School	\$8,058,905		\$4,094,905	\$1,212,640	\$1,510,400	\$1,218,000	\$1,212,000	
Narrows Elem / Middle School	\$4,662,400		\$0	\$2,550,572	\$1,648,460	\$209,090	\$1,144,000	
Giles High School	\$16,522,919	\$10,650,000	27,172,919	-	-	-	-	The cost includes the capital improvement scope
Giles Tech Center	incl. w/GHS & NHS		-	-	-	-	-	
Giles Middle School	\$11,187,145		\$0	\$3,099,440	\$8,334,511	\$0	\$1,920,000	
			<b>\$47,820,504</b>	<b>\$31,267,824</b>	<b>\$7,313,894</b>	<b>\$16,768,720</b>	<b>\$4,903,900</b>	<b>\$4,428,000</b>

**Option 4**  
 Maintain all buildings in the Division. This option would make a major shift in the current grade alignment. This option would close Narrows High School and convert it into a 6-8 Middle School. Narrows High School grades 9-12 would combine with Giles High School. The three (3) Elementary/Middle Schools would become Elementary Schools housing grades Pre K – 5. The new grade alignment would be Pre K – 5 (3 Elementary School buildings), grades 6<sup>th</sup> – 8<sup>th</sup> (1 Middle School building) and grades 9<sup>th</sup> – 12<sup>th</sup> (1 High School building). This option would create the needed capacity in the elementary school buildings and provide a clear separation of middle and high school and utilize all the existing owned educational buildings.

This option is similar to Options 1, 2, 3 and 3A in that the Elementary Schools are maintained through a capital improvement plan. Some renovation may be at Narrows High School to convert this to a Middle School, but it appears that the building has the capacity to accommodate grades 6-8. Additionally some renovations may be needed to combine Narrows High School students into Giles High School, but removing 8<sup>th</sup> grade and increasing classroom enrollment may permit the building to accommodate the additional students.

- Pros: Shifting 6<sup>th</sup> and 7<sup>th</sup> grade would assist in providing needed capacity in the Elementary Schools  
 Shifting 6<sup>th</sup>, 7<sup>th</sup> and 8<sup>th</sup> grade would create a physical and academic Middle School model  
 Shifting to a 9-12 grade alignment may permit the High Schools to be combined with only limited renovations.  
 Combing the high schools at Giles High School would place all 9-12 students by the CTE building
- Students would combine into one “class” starting in 6<sup>th</sup> grade
- Cons: Closing of Narrows High School could potentially lose some community identity  
 County will demolish, repurpose or sell building  
 Students in notable positions may not be able to maintain the same position in combined high School  
 This option could have a significant impact on the current bus runs and additional costs

**Phasing**  
 The majority of capital projects may be completed over the summer or winter breaks. Larger projects may require summer break and work during the school year. This may result in relocation of classrooms within the building, modular classrooms, and/or shifting to open space in another school. We would recommend to complete the construction renovations and/or additions to accommodate the 6<sup>th</sup>/7<sup>th</sup>/8<sup>th</sup> Grade into the newly converted Middle School from Narrows High School. Once 6<sup>th</sup> and 7<sup>th</sup> grade are moved out of the (3) three schools, movement can happen within the (3) Elementary schools to provide more permanent space for permanent Art, Music and Technology classrooms.





Option 5 - Construct a new consolidated Middle School and High School. Close Narrows and Giles High School.								
Construct a New Consolidated Middle School and a New Consolidate High School on a site to be determined. This option would close both Narrows and Giles High Schools.								
CURRENT ALIGNMENT				FUTURE ALIGNMENT				ACTIONS
School	Grades	Building Capacity	Enrollment	School	Grades	Building Capacity	Enrollment	
Eastern Elem / Middle School	Pre K - 7	579	388	Eastern Elementary School	Pre K - 5	579	298	Maintain with Capital Program
Macy McClauthery Elem / Middle School	Pre K - 7	572	457	Macy McClauthery Elementary School	Pre K - 5	572	342	Maintain with Capital Program
Narrows Elem / Middle School	Pre K - 7	684	477	Narrows Elementary School	Pre K - 5	684	361	Maintain with Capital Program
Giles High School	8-12	880	547	Giles High School	Close	-	-	Close
Giles Tech Center	10-12	incl. w/GHS & NHS	incl. w/GHS & NHS	Giles Tech Center	10-12	Incl. w./ High School	Incl. w./ High School	Maintain with Capital Program
Narrows High School	8-12	645	286	Narrows High School	Close	-	-	Close
		2715	1869	New Consolidated Middle School	6-8	600	492	New Middle School - costs do not include land purchase
				New Consolidated High School	9-12	800	662	New High School - costs do not include land purchase
						3235	2155	Potential Costs Option 5

*SELECT EITHER OPTION A (ALL PROJECTS COMPLETED IN 2022-24) OR OPTION B (PROJECTS COMPLETED OVER A 20 YEAR PERIOD)								
Probable Costs Option 5	The probable costs below are if ALL construction and capital projects occur in 2022-2024 - Utilizing the high costs from FCI		The probable costs below reflect the 2022 cost estimates from the Facility Condition Index, plus a 3% increase per year for the work to be completed. This estimate anticipates the work being completed in the last year of the range. Probable Costs B utilizes the high costs from FCI					
	PROBABLE COSTS A		PROBABLE COSTS B					NOTES/COMMENTS
School	2022-2024 Existing Const.	2022-2024 New Const.	2022-2024	2025-2028	2029 - 2032	2033 - 2037	2038 - 2042	
Eastern Elem / Middle School	\$7,389,135		\$0	\$451,242	\$5,275,349	\$3,476,810	\$152,000	
Macy McClauthery Elem / Middle School	\$8,058,905		\$4,094,905	\$1,212,640	\$1,510,400	\$1,218,000	\$1,212,000	
Narrows Elem / Middle School	\$4,662,400		\$0	\$2,550,572	\$1,648,460	\$209,090	\$1,144,000	
Giles Tech Center			-	-	-	-	-	
Giles Middle School		\$46,950,300	\$46,950,300	-	-	-	-	
Giles High School		\$60,250,000	\$60,250,000	-	-	-	-	
		\$127,310,740	\$111,295,205	\$4,214,454	\$8,434,209	\$4,903,900	\$2,508,000	

**Option 5**

This option would construct a new combined (6-12 grade) Middle/High School, relocate 6<sup>th</sup> and 7<sup>th</sup> grades from the Elementary/Middle Schools and close both Narrows and Giles High Schools. The newly aligned grade structure would have three (3) Pre K – 5 elementary schools and one (1) combined 6<sup>th</sup> – 12<sup>th</sup> grade Middle/High School. This option would provide the needed capacity at the Elementary Schools.

This option is similar to Options 1, 2, 3, 3A and 4 in that the Elementary Schools are maintained though a capital improvement plan. A site would need to be selected from the currently owned School Division sites or the Division would need to procure a site that is not currently owned. A few factors for site consideration would be access to public water and sewer, access to 3 phase electricity, road access for buses, cars and truck delivery, size of the site to accommodate the Middle/High School, drives and parking and the CTE classroom/lab space. The closed buildings would either be repurposed or returned to the County for their use.

- Pros:
- Shifting 6<sup>th</sup> and 7<sup>th</sup> grade would assist in providing needed capacity in the Elementary Schools
  - Shifting 6<sup>th</sup>, 7<sup>th</sup> and 8<sup>th</sup> grade would create a physical and academic Middle School model
  - A new High School building may offer the best opportunity to create a “new identity” for the High School students in lieu of the perception that students are losing their identity to the join with the other High School.
  - Combing the high schools at Giles High School would place all 9-12 students by the CTE buildings
  - This option should have a limited affect on the current bus runs
  - Students would combine into one “class” starting in 6<sup>th</sup> grade
  - Middle School students may be able to take limited High School classes early to begin obtaining credits.
  - A new school may offer the least amount of disruption to the educational program.
  - A new school may permit the greatest opportunity to create academic spaces that are designed for today’s learners.

- Cons:
- Closing of Narrows and Giles High School could potentially lose some community identity
  - County will demolish, repurpose or sell buildings
  - Students in notable positions may not be able to maintain the same position in combined high School
  - This may be the most expensive option.

**Phasing**

The majority of capital projects may be completed over the summer or winter breaks. If the construction of the new school occurs at one of the existing Division owned properties, this will have a greater impact on the operations of the current site and some demolition may need to occur over a summer.