PART 9: BUILDING DESIGN

- Code Analysis
- Basis of Design
- Life Cycle Cost Analysis
- LEED Documentation
- 3-Dimensional Classroom Model
- 3-Dimensional Building & Contextual Models
- Schematic Floor Plans

CODE ANALYSIS

HASTINGS CONSULTING

Building, Fire &Access Codes • Fire Protection Engineering

Hastings Elementary School

Lexington, Massachusetts

Code Report

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Introduction

This project involves the construction of a new 3 story elementary school in Lexington, Massachusetts. This code summary is based on the proposed architectural floor plans dated May 8, 2017. The following is a list of applicable codes:

Code Type	Applicable Code (Model Code Basis)
Building	780 CMR: Massachusetts State Building Code, 9th Edition[A] (2015 International Building Code)
Fire Prevention	527 CMR: Massachusetts Fire Prevention Regulations (2012 NFPA 1) M.G.L. Chapter 148 Section 26G – Sprinkler Protection
Accessibility	521 CMR: Massachusetts Architectural Access Board Regulations
Electrical	527 CMR 12.00: Massachusetts Electrical Code (2017 National Electrical Code)
Elevators	524 CMR: Massachusetts Elevator Code (2004 ASME A17.1)
Mechanical	2015 International Mechanical Code (IMC)
Plumbing	248 CMR: Massachusetts Plumbing Code
Energy Conservation	2015 International Energy Conservation Code & Stretch Energy Code

A. The 9th Edition of the MA Building Code (based on the 2015 international Codes) is expected to take effect in July of 2017 and become mandatory in January of 2018. The Code Report is based on the 9th Edition since this project will seek a building permit in 2018.

1. Occupancy Classification:

Separated mixed uses

- Use Group E (School)
- Use Group A-3 (Gymnasium Non-School Function)
- Use Group A-2 (Cafeteria Non-School Function)

For the purposes of this report it has been assumed that the Gymnasium and Cafeteria could be used for non-school events and therefore are treated as Use Group A-3 and A-2 occupancies (780 CMR 303.1.3).

2. Min. Construction Type:

- Type IIB Construction (noncombustible, unprotected)

3. Height and Area Limitations:

The following table summarizes the height and area limitations for Use Group E and A-2/A-3 based on Type IIB construction.

Code Reference	Type IIB – Use Group A-2 & A-3		Type IIB – Use Group E	
	Height	**Area**	**Height**	**Area**
780 CMR Tables 504.3, 504.4 & 506.2: Tabular Value	3 St. (75 ft)	28,500 ft^2	3 St. (75 ft)	43,500 ft^2
780 CMR Section 506.2 Frontage Increase (88% Open, 63% Increase)	-	+5,985 ft^2	-	+9,135 ft^2
Height, Footprint Area	**3 St. (75 ft)**	**34,485 ft^2**	**3 St. (75 ft)**	**52,635 ft^2**
Actual # Stories & Footprint Area	**3 St. 45,225 ft^2**			

The building does not comply with the area limitation for Use Group A-3 & A-2 Occupancies for construction type IIB, therefore it cannot be treated as a non-separated mixed use occupancy. It must be designed as a separated use occupancy in order to comply with the area limitations (780 CMR 508.4.2). According to 780 CMR Table 508.4, Use Groups E, A-2 & A-3 are not required to have a fire resistance rated separation even when treated as separated occupancies. However the building area must be such that the sum of the ratios of the floor area of each use group divided by the allowable area for each use group does not exceed one. This calculation is shown below:

Separated Use Calculations

1st Floor

	Use Group A-2		Use Group E	
Actual Area:	5,547 ft^2	+	39,678 ft^2	= 0.91 < 1
Allowed Area:	34,485 ft^2		52,635 ft^2	

2nd Floor

	Use Group A-3		Use Group E	
Actual Area:	6,046 ft^2	+	36,090 ft^2	= 0.86 < 1
Allowed Area:	34,485 ft^2		52,635 ft^2	

4. Fire Department Access:

Fire department vehicle access must be provided in accordance with 527 CMR Section 18.2, which includes the following requirements for the access roads:

- Must extend to within 50' of an exterior door that can be opened from the outside and provide access to the interior of the building.
- No portion of the facility or exterior wall on the first story of a building is greater than 250' from fire department access roads measured along an approved route.
- Unobstructed minimum width of 20 feet unless constructed boulevard-style which a 10' minimum width is permitted.

- Unobstructed vertical clearance of 13'-6".
- Maximum dead-end distance of 150 feet without turn around space
- Minimum turning radius of 25' or larger if required based on the local fire departments largest vehicle size

Based on the proposed site plan it appears the Hastings School will be provided with fire department vehicle access in accordance with these requirements, assuming the access road to the South of the school will be provided with a designated area for a fire department vehicle to turn around. Note that an analysis and evaluation of fire apparatus maneuvers throughout the access roads created by swept path analysis and turn simulation software must be submitted to the fire department for approval.

5. Fire Resistance Ratings:

The following fire resistance ratings are required in accordance with 780 CMR Table 601 and various sections of the code.

Building Element	Fire Resistance Rating (Hours)
Primary Structural Frame	0[A]
Exterior Bearing Walls	0
Interior Bearing Walls	0[A]
Exterior Non-Bearing Walls	0 Based on FSD
Interior Non-Bearing Walls	0
Floor Construction	0[A]
Roof Construction	0

A. Not less than the fire rating of any assemblies supported (i.e. shaft enclosures) (780 CMR 707.5.1, 708.4. and 711.2.3).

Building Element	Fire Resistance Rating (Hours)	Opening Protectives (Hours)
Exit Access Corridors (780 CMR Table 1020.1)	0	0
Exit Stair Shafts, connecting 3 stories (780 CMR 1023.2)	1[D]	1
Exit Access Stairs, connecting 2 stories (780 CMR 1019.3)	0	0
Other Shafts, connecting 3 stories or less (780 CMR 713.4)	1[A]	1

Fire Pump Room (if required) (780 CMR 913.2.1)		1[B]	¾
Elevator Machine Room (780 CMR 3005.4)		1[E]	¾
Emergency Electrical Room (527 CMR 12.00 700-10(D)(2))		2[C]	1½
Electrical Rooms	With Sprinklers	0	
	Without Sprinklers (NFPA 13)	2	

A. In lieu of rated shaft enclosure, if the duct connects not more than two stories, the annular space around the penetrating duct may be protected by approved noncombustible material that resists the passage of flames and smoke. If the duct connects not more than three stories, the duct also must also have fire dampers installed at each floor line (780 CMR 717.6.1).
B. Location and access to the fire pump room shall be pre-planned with the fire department (NFPA 20 Section 4.12.2.1).
C. No rating is required for the room when fully sprinklered, however a 2-hr rating is still required for the emergency feeder-circuit wiring and rooms containing an emergency generator (NFPA 110 Section 7.2.1.1).
D. If exterior walls expose the stair at an angle of less than 180 degrees either the stair wall or adjacent wall must be 1 hour rated with 3/4 hour opening protectives for a distance of 10 feet from the stair wall. Otherwise the exterior walls of the stairs do not require a fire rating (780 CMR Section 1023.7).
E. 780 CMR Section 3005.4 Exception 2 does not require a rating for elevator machine room or control rooms where they do not abut and have no openings to the hoistway enclosure.

Incidental Accessory Occupancies (780 CMR Table 509)	
Room or Area	**Separation and/or Protection**
Furnace room where any piece of equipment is over 400,000 Btu per hour input	Smoke Resistant*
Rooms with boilers where the largest piece of equipment is over 15 psi and 10 horsepower	Smoke Resistant*
Laboratories and vocational shops	Smoke Resistant*
Waste and linen collection rooms over 100 square feet.	Smoke Resistant*

*Must be separated from the remainder of the building by construction capable of resisting the passage of smoke and doors shall be self- or automatic-closing upon detection of smoke.

Fire walls, fire barriers, fire partitions, smoke barriers, and smoke partitions, or any other wall required to have protected openings or penetrations must be identified with signs or stenciling within accessible concealed spaces (i.e. floor-ceiling, attic spaces) at 30 ft intervals (780 CMR 703.7).

6. Exterior Wall Openings & Fire Resistance Rating:

The exterior wall rating requirements and opening limitations are based on the fire separation distance for each wall. The fire separation distance is measured perpendicular to the exterior wall to the centerline of a public street, an interior lot line, or an imaginary lot line between two buildings on the same lot (780 CMR 702.0). Where the fire separation distance is more than 10 ft the wall is not required to be rated and the allowable area of openings is not limited (780 CMR Table 602 and Section 705.8.1 Exception 2).

Based on the proposed site plan it appears all exterior walls will have a fire separation distance of greater than 10 feet and therefore do not require a fire rating and openings are not limited. D. **Only the exterior walls adjacent to the 3-story enclosed exit stairs require a fire rating where they expose the stair at an angle of less than 180 degrees. Either the stair wall or adjacent wall must be 1 hour rated with 3/4 hour opening protectives for a distance of 10 feet from the stair wall (780 CMR Section 1023.7).**

7. Vertical Floor Openings

Vertical openings are required to comply with 780 CMR 712. All vertical openings appear to be enclosed based on the plans reviewed, with the exception of an unenclosed stair connecting the first and second levels in the Gym/Cafeteria/Library area. This unenclosed stair is permitted per 780 CMR 712.1.12 and 1019.3(1) without any additional protection.

8. Finishes:

Interior Finish
The interior finish of walls and ceilings must comply with the table below.

Walls & Ceilings (IBC Table 803.11)

Building Component	Use Groups A-2 / A-3	Use Group E
Exit Enclosures and Passageways	Class B	Class B
Corridors & Exit Access Stairs	Class B	Class C
Rooms & Enclosed Spaces	Class C	Class C

Note that where exit stairs and exit access corridors serve all use groups, the most restrictive interior finish is required.

New Floor Finishes
Since the building will be equipped with an automatic sprinkler system, traditional floor coverings such as wood, vinyl and other resilient floor coverings as well as carpeting passing the DOC FF-1 pill test are allowed throughout the building, including all exits, exit passageways and exit access corridors (780 CMR Section 804.4.2).

Exterior Finish
Exterior wall finishes must fully comply with the requirements of 780 CMR 14. Combustible materials are permitted to be used as an exterior wall finish for this building in accordance

with 780 CMR Section 1406.0; however, all exterior wall finishes and architectural trim located greater than 40 feet above grade plane must be constructed of approved noncombustible materials and must be secured to the wall with metal or other approved noncombustible brackets (780 CMR Section 1406.2.2). Additionally, combustible exterior wall finish is limited to 10% of the exterior wall surface area where the fire separation distance is 5 ft or less.

The use of plastic materials as part of the exterior wall assembly (i.e. foam plastic insulation, exterior coatings and facings) must comply with 780 CMR 26 (780 CMR 1404.8). The wall assembly must be tested in accordance with NFPA 285 (780 CMR 2603.5.5). Note that this test standard is a full scale assembly test. Alternatively, the exterior wall may comply with one of the standards listed in 780 CMR Section 2604.1.

The draft MA amendments to the IBC include an exception stating that buildings providing sprinkler protection in accordance with NFPA 13 do not have to comply with NFPA 285 if a fire flow analysis is performed (without sprinkler decrease allowance) and it shows adequate water is available (780 CMR 2603.5.5 Exception 3). This analysis can require a significant water supply to the site and often it cannot be achieved. Therefore this analysis should be conducted early in the project if foam plastic insulation is proposed.

9. Means of Egress:

The calculated occupant load for the proposed floor plans, the corresponding required number of exits, the provided number of exits, and the provided egress capacity are summarized below (780 CMR Table 1004.1.2, Table 1006.3.1, and Section 1005.3).

Number of Exits

Floor	Occupant Load (Persons)	Number of Exits	
		Required	Provided
First	1,459	4	6[A]
Second	1,077	4	4
Third	675	3	3

A. Not including exterior doors from individual rooms that also provide additional available exits for those spaces.

First Floor Egress Capacity

Means of Egress	Clear Width (inches)	Egress Capacity Factor (inches per occupant)	Egress Capacity
West Stair	64	0.15	426
Center-North Stair	64	0.15	426
Center-South Stair	64	0.15	426
Main Entrance	128	0.15	853
Cafeteria Exit	64	0.15	426
Admin. Exit	32	0.15	213
1st Floor Total (1,459 occupant load) =			**2,770**

Second Floor Egress Capacity

Means of Egress	Clear Width (inches)	Egress Capacity Factor (inches per occupant)	Egress Capacity
West Stair	56 (stair) 64 (door)	0.2 0.15	**280** 426
Center-North Stair	56 (stair) 64 (door)	0.2 0.15	**280** 426
Center-South Stair	56 (stair) 64 (door)	0.2 0.15	**280** 426
Main Entrance Stair	54 (stair)	0.2	**270**
2nd Floor Total (1,077 occupant load) **=**			**1,110**

Third Floor Egress Capacity

Means of Egress	Clear Width (inches)	Egress Capacity Factor (inches per occupant)	Egress Capacity
West Stair	56 (stair) 64 (door)	0.2 0.15	**280** 426
Center-North Stair	56 (stair) 64 (door)	0.2 0.15	**280** 426
Center-South Stair	56 (stair) 64 (door)	0.2 0.15	**280** 426
2nd Floor Total (675 occupant load) **=**			**840**

As shown in the tables above the building is provided with adequate egress capacity for the calculated occupant load.

General Egress Requirements:

- Maximum exit access travel distance must not exceed 250 feet in this fully sprinklered buildings (780 CMR Table 1017.2):

  The actual maximum travel distance appears to be less than 150 feet throughout the building.

- Maximum dead-end corridor length must be less than 20 ft or 2.5 times the least width of space (up to 50 ft is permitted in Use Group E areas) (780 CMR 1020.4).

  The current plans do not include dead-end corridors longer than the maximum lengths allowed.

- All rooms or spaces with an occupant load greater than 49 people or a common path of travel distance over 75 ft must be provided with two egress doors swinging in the direction of egress and illuminated exit signs at each exit (780 CMR Table 1006.2.1 & Sections 1010.1.2.1 & 1013.1). Boiler rooms require two means of egress if the room is greater than 500 sqft. and includes individual fuel-fired equipment greater than 400,000 Btuh input capacity. If required one of the two required exit access routes from the boiler room is permitted to be a fixed ladder or alternating tread device (780 CMR Section 1006.2.2.1).

- Doors serving rooms with more than 49 people and doors along the path of egress travel from such rooms must be provided with panic hardware (780 CMR 1010.1.10). Doors from main electrical rooms with equipment rated 1,200 amps and over 6 feet wide must swing in the direction of egress with panic hardware (780 CMR 1010.1.10).

- All means of egress lighting and exit signs throughout the building must be provided with an emergency power supply to assure continued illumination for not less than 1.5 hours in case of primary power loss (780 CMR 1008.2 & 1008.3.4).

- Remote means of egress must be separated by ⅓ of the diagonal dimension of the room or space they serve (780 CMR 1007.1.1). The distance between exits may be measured along 1-hour fire resistance rated corridors complying with 780 CMR 1018 but must otherwise be measured in a straight line between exit doors.

  The proposed means of egress from each floor and from spaces requiring two means of egress are remotely located as required.

- Roofs and penthouses containing elevator equipment that must be accessed for maintenance are required to be accessed by a stairway (780 CMR 1011.12.1). Permanent means of access to any roof containing mechanical equipment must be provided in accordance with the Mechanical Code.

- All exits must discharge to the exterior of the building except that a maximum of 50% of the number and capacity of the exit enclosures are allowed to exit through areas on the level of discharge if the exit enclosures discharge to a free and unobstructed path of travel to an exterior exit that is readily visible from the discharge of the exit enclosure (780 CMR 1028.1).

  All of the enclosed exit stairs currently discharge directly to the exterior.

- A two-way communication system is required outside the elevator on the 2nd and 3rd Floors (780 CMR 1009.8).

- The elevator must be sized to accommodate the loading and transportation of an ambulance gurney or stretcher sized 24” wide by 84” long with 5” radius corners (524 CMR 17.40(1)).

10. Required Fire Protection Systems:

- NFPA 13 sprinkler system (780 CMR Table 903.2 & M.G.L. c148 s26G)
- Voice/alarm communication system (780 CMR 907.2.3)
- A standpipe system is required if the 3rd Floor elevation is more than 30 feet above the lowest level of fire department access (780 CMR 905.3.1)
- Fire extinguishers (*527 CMR 1, Table 13.6.2(a) &* 780 CMR 906.1).

Fire extinguishers must be located throughout the building so that the maximum travel distance to an extinguisher is less than 75 feet (780 CMR 906.3).

- Carbon monoxide detection in accordance with 780 CMR 915.
- Emergency responder radio coverage (780 CMR 916)

11. Energy Code Provisions

The project is subject to the provisions of the 2015 International Energy Conservation Code or ANSI/ASHRAE/IESNA 90.1 with Massachusetts Amendments (Massachusetts Energy Code). Lexington has also adopted the Stretch Energy Code which applies to this project since it is over 100,000 gross ft^2 in floor area (780 CMR Appendix AA). The Stretch Code requires the building demonstrate energy use per square foot at least 10% below the energy requirements of ANSI/ASHRAE/IESNA 90.1 APPENDIX G Performance Rating Method on either a site or source energy basis.

12. Accessibility for Persons with Disabilities

Massachusetts Architectural Access Board Regulations
All administrative spaces, instructional spaces, and areas open to students or the general public are required to comply with the requirements of the Massachusetts Architectural Access Board (521 CMR). This includes the following major provisions:

- All public entrances must be accessible (521 CMR 25.1).
- All public and common use areas must be accessible and provided with an accessible route thereto (521 CMR Section 12.2.2 and 20.1).
- Accessible toilet rooms must be provided (521 CMR 30.1).
- At least 5% of each type of sink, counter, or other work areas in classrooms must be accessible (521 CMR 12.4).

American's with Disabilities Act
The ADA Guidelines are not enforced by the Commonwealth of Massachusetts, they can only be enforced through a civil lawsuit or complaint filed with the U.S. Department of Justice. Although the provisions of the MAAB do not apply to employee only areas, the ADAAG requires that employee only work spaces must be designed to allow employees to approach, enter, and exit the work area. However, the work areas are not required be provided with accessible features (i.e. shelves, etc.).

BASIS OF DESIGN

Methodology

The narrative is organized according Uniformat II, Level 3 Elements, to correlate to the structure of the Schematic Design cost estimate in outline specification form. The narrative is based upon the schematic design drawings and outline specifications dated 08 May 2017.

The narrative is also based upon the Room Data Sheets which are in SECTION 7 – Program Design.

Sustainable Design Elements

The narrative format describes “Sustainable Elements” which are summarized here.

Building Envelope

The exterior cavity wall system consists of veneer masonry and metal wall panels over a metal stud back up system. The wall system has three inches of rigid wall insulation (R 19.5 min) in the cavity over the air and vapor barrier and sheathing, plus one inch (R-6) of spray foam insulation over the back of the sheathing between the studs. Windows have high performance “low e” glazing. The roof system includes a highly reflective (“cool roof”) PVC membrane (solar ready) adhered to rigid tapered insulation having an average thickness of seven inches. Solar awnings protect southern window areas. These elements in total result in a building envelope with high thermal performance and which maximizes daylighting.

Interior Finishes

Interior finishes were selected with long life and low maintenance a paramount consideration. Corridors, classrooms and the cafeteria are linoleum tiles, a low maintenance “green” product that also improves acoustics. Glazed porcelain tile units are used as a wall wainscot in the main corridors, stairs and cafeteria (over metal stud and drywall partitions) which results in a wall finish that will last the life of the building. High traffic/high abuse areas such as the kitchen and gym have walls of painted concrete block, and student toilet rooms have ceramic tile floors and walls.

MEP Systems

Ultra low flow plumbing fixtures are anticipated to reduce water use by over 35%, and the plumbing system will be equipped with water metering for LEED WE Credit 4. The HVAC system will employ multiple air handling units with energy recovery (which allow for multiple zones for off-hour use), induction systems (active chilled beams) in classrooms and fan coil units in the corridors. Plant heating and cooling will be provided by a closed loop geothermal system with two high efficiency (90%±) condensing type boilers providing back-up heating. Lighting is highly efficient (.70 W/square foot) LED with most areas using pendant direct / indirect fixtures. All perimeter spaces will include “daylight harvesting” controls, which dim lighting to take advantage of available daylight, in addition to occupancy sensors and building wide computerized lighting controls.

INTRODUCTION

Foley Buhl Roberts & Associates, Inc. (FBRA) is collaborating with DiNisco Design, Inc. (DDI) in the design of the new Hastings Elementary School for the Town of Lexington, Massachusetts.

The purpose of this narrative is to summarize the basis of the structural design, describe the primary structural systems and provide structural quantities to be used in the preparation of the Schematic Design cost estimate. Preliminary Structural Drawings and Outline Structural Specifications (at the end of this Narrative) have also been prepared. The New Elementary School will be designed and constructed under the provisions of the Massachusetts State Building Code (780 CMR – Eighth Edition). The Schematic Design Structural documents should be used in conjunction with the Schematic Design Architectural documents and those of the other disciplines.

STRUCTURAL – GENERAL DESCRIPTION

The proposed new three-story Hastings Elementary School will be constructed on a generally level site, located at 7 Crosby Road in Lexington.

The total area of the new building is approximately 110,000 square feet (gross); the building footprint is nearly 45,300 square feet.

The building will be steel framed, for reasons of economy, performance, flexibility and speed of construction. Typical floor construction will be a concrete slab on composite steel deck, supported by composite structural steel beams. Typical flat roof areas will be framed with steel roof deck supported by structural steel beams. A concrete slab on composite steel floor deck (supported by composite steel beams) will be provided below the central rooftop equipment area. Screens surrounding this area will be structured with horizontal and vertical, galvanized HSS members, braced down to the main roof structure. The roof of the Gymnasium will be framed with acoustical steel roof deck, supported by structural steel purlins, which span to custom steel trusses. The new steel framed construction will be classified as Type IIB (Noncombustible, Unprotected); floor and roof construction typically do not require fire protection, except those members which support fire rated enclosures/shafts. Typical floor and roof steel framing will be surface prepped and be left unpainted, except exposed steel in the Gymnasium, which will receive one shop coat of primer, compatible with the finish paint. All roof areas have been designed to support future photovoltaics (PVs).

Typical columns will be rectangular hollow steel tube (HSS) sections. Lateral stability for wind and seismic loads will be provided by steel bracing in each direction.

Foundations are expected to be conventional, shallow spread footing construction, per the May 1, 2017 Geotechnical Engineering Report prepared by Terracon Consultants, Inc. New footings will typically bear on natural soils or on compacted structural fill. First Floor construction will be a concrete slab on grade.

Exterior wall construction will be a mixture of glazing, architectural wall panels with a steel stud backup and steel stud cavity wall construction with a masonry veneer. Galvanized steel loose lintels will be provided at the heads of typical, punched window openings in the masonry veneer.

Galvanized relieving angles will be required at larger and/or multiple, minimally separated window openings. A hung relieving angle will be provided at limited locations at the Third Floor, where the height of the veneer exceeds 30 feet.

BASIS OF STRUCTURAL DESIGN

Codes and Design Standards:

Building Code:	Massachusetts State Building Code (780 CMR) – 8th Edition (Note that the 9th Edition of the MSBC is expected to be promulgated in 2017)
Materials:	ASTM; applicable standards
Concrete:	ACI 318 and ACI 301; latest editions.
Structural Steel:	AISC, "Specification for Structural Steel Buildings" and AISC "Code of Standard Practice"; latest edition.
Steel Deck:	SDI Standards and Specifications; latest editions.

Design Loads/Parameters:

Live Loads:	
Classrooms (with 15 PSF partition allowance):	65 PSF
Corridors:	80 PSF
Flexible, Open Plan Areas (Including the Gymnasium):	100 PSF
Stairs:	100 PSF
Mechanical Equipment Rooms:	150 PSF
Roof Garden Areas:	100 PSF
Snow Loads:	
Basic Ground Snow Load (Lexington):	31 PSF
Wind Loads:	
Basic Wind Speed (Lexington):	105 MPH
Seismic Parameters:	
Short Period Spectral Response Acceleration (Ss):	0.290
1.0 Sec. Spectral Response Acceleration (S1):	0.070
Seismic Use Group:	III
Seismic Design Category:	B
Site Class:	C
Structural System:	Building Frame System
Lateral Load Resisting System:	Concentrically Braced Frames (Not Specifically Detailed for Seismic Resistance)
Response Modification Factor (R):	3.0
System Overstrength Factor (Ω0):	3.0
Deflection Amplification Factor (Cd):	3.0

Foundations:

The preliminary foundation design is based on an assumed allowable bearing capacity of 6.0 kips per square foot (3.0 TSF) on natural (glacial till) soils or on compacted structural fill, per the referenced Geotechnical Engineering Report. The natural soils are not subject to liquefaction.

Construction Classification:

The new school will be classified as Type IIB Construction (Noncombustible, Unprotected). Typical floor and roof steel framing does not require fire protection, except those members supporting fire rated enclosures (stairway enclosures, etc.).

Sustainable Design Considerations:

Sustainable design considerations will be incorporated into the building design; it is intended that the project will be designed to LEED Silver standards.

A SUBSTRUCTURE (Refer to Schematic Design Structural Drawings)

A10 Foundations:

In February 2017, Terracon Consultants conducted a subsurface exploration program, consisting of six (6) borings and nine (9) test pits. Soil conditions at the site typically consist of topsoil and subsoil to depths of 0.5 to 3 feet, underlain by natural glacial till soils. Auger refusal (likely bedrock) was encountered in all borings, at depths varying from 4.5 feet to 13 feet below the existing grade. Groundwater was encountered at a depth of 6 to 10 feet below the ground surface; however, groundwater elevations will fluctuate seasonally.

Prior to placing footings or compacted structural fill, all organic soils will be removed and the glacial till layer will be proof-rolled. Any soft/unsuitable areas will be removed and replaced with compacted structural fill. If subgrades become wet, unstable and/or difficult to proof-roll, a layer of crushed stone, underlain by a geotextile separation fabric, may be necessary.

Temporary dewatering may be required during construction when foundation and/or utility excavations extend below the water table.

No Basement areas are planned; accordingly, perimeter foundation drains and underslab drains will not be required.

Foundations for the new school will consist of individual spread footings (at columns) and continuous strip footings (at walls). All foundation walls and footings will be cast-in-place, reinforced concrete. The preliminary foundation design is based on an allowable bearing capacity of 6.0 kips per square foot (3.0 TSF) on natural (glacial till) soils or on structural fill. Refer to the referenced, Geotechnical Engineering Report for additional subsurface soils information and comments and recommendations relating to foundation construction.

A1010 Standard Foundations:

- Typical perimeter frost wall: *12" (at curtainwall and architectural panel conditions) or 16" thick, with an 8" wide masonry shelf (at masonry veneer conditions) with horizontal and vertical reinforcing each face (4.5+/- psf). The outside surface of perimeter foundation walls will receive a troweled-on bituminous mastic.*
- Typical perimeter frost wall continuous footing: *2'- 2" wide, by 12" deep, with continuous reinforcing bars, plus dowels to the foundation wall (10.0+/- plf). The bottom of the footing will be placed 4'- 0" minimum below the exterior finish grade for frost protection.*
- Typical, average interior column footings:
  Community Wing: *7'-0" x 7'-0" x 22" thick with 240 pounds of reinforcing.*
  Academic Wing: *6'-0" x 6'-0" x 20" thick with 200 pounds of reinforcing.*
- Typical, average perimeter column footing:
  Community Wing: 6'-0" x 6'-0" x 20" thick with 200 pounds of reinforcing.
  Academic Wing: 5'-0" x 5'-0" x 18" thick with 150 pounds of reinforcing.
- Typical Piers/pilasters at interior/perimeter columns: *24 inches square, reinforced concrete with 45 plf reinforcing.*
- Typical grade beams interconnecting footings in bracing bays (See Foundation Plan for bracing locations; grade beams not shown): *2'-0" wide by 2'-6" deep with 50 pounds per linear feet of reinforcing.*
- Foundation Wall Dampproofing: *ASTM D1227 Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing; Type II, Class I, non-asbestos fibers.*
- Anchor Bolts: Anchor bolts at column base plates shall conform to ASTM F1554 – Grade 36 and shall be headed type. Provide a minimum of four (4), ¾" diameter anchor bolts at all columns; additional bolts and/or larger diameter bolts will be required at bracing locations.
- Elevator pits: Elevator pit construction will consist of 12" thick, reinforced concrete walls and a 24" thick, reinforced concrete foundation mat, with an integral sump pit. Waterstops will be provided at all construction joints and all interior surfaces of the elevator pit will be waterproofed. Elevator shaft walls will be 100% solid grouted, reinforced CMU construction (8" thick).

A1020 Slab On Grade:

First Floor Construction will typically be a 5" thick concrete slab on grade, reinforced with welded wire fabric. The slab will be underlain by a heavy duty (15 mil.) vapor barrier, R-10 rigid insulation and 12" of compacted gravel fill. Saw cut control joints (1.25" deep) will be provided in each direction at each column line. Full depth isolation joints will be constructed around columns. Mechanical Rooms and the Recycling/Receiving area will be similar construction, with a 6" thick concrete slab on grade. Depressions (approximately 8" deep) will be required at Coolers in the Kitchen. Elsewhere, depressions will be required at Entries and at First Floor Toilet Rooms. Floor finishing will be coordinated with flooring requirements.

B Shell (Refer to Schematic Design Structural Drawings)

B10 Superstructure:

Columns: Typical columns will be rectangular steel tube (HSS) sections.

Lateral Force Resisting System: Lateral (wind and seismic) forces will be resisted by steel bracing, for reasons of economy, stiffness, reduced structural depth and smaller column sizes. Bracing members will be square or rectangular HSS sections. Brace configurations may include chevrons, inverted chevrons ("V"), or single diagonals in short bays, as required by architectural considerations.

Expansion (Seismic) Joints: One expansion joint is proposed between the Academic Wing and Community Wing. Refer to Schematic Design Drawings.

Fire Protection: As previously noted, building is classified at Type IIB Construction (Noncombustible, Unprotected). The building will be fully sprinklered. Typical floor and roof steel framing does not require fire protection, except those members supporting fire rated enclosures (stairway enclosures, etc.).

B1010 Floor Construction:

Typical Second Floor and Third Floor Construction consists of a 3½" (minimum) thick, normal weight concrete topping slab with welded wire fabric on 2" deep, 18 gauge galvanized composite steel deck (5½" minimum total slab thickness), supported by composite steel beams, spaced at 7+/- feet to 8+/- feet o.c. Beams are supported by composite wide flange steel girders. Steel girders span to HSS (tubular) steel columns. Topping slabs on steel deck will be placed at the required elevation, adding concrete to compensate for the deflection of the (unshored) steel framing (approximately ¾" average additional concrete in each structural bay). Floor finishing will be coordinated with flooring requirements. In areas where noise/vibration is a special concern (e.g. the Gymnasium floor construction over the First Floor Library/Media Center and the Art and Music classrooms over the Cafeteria), the Second Floor concrete topping for slab on deck will be increased to 6 ½". In addition, the floor framing in the Gymnasium will be depressed (approximately 9 ½"), to accommodate an acoustic, "floating" floor system and wood flooring. In all areas, composite action between the steel beams/girders and the concrete slab on steel deck will be achieved by field welding ¾" diameter headed shear connectors to the top flanges.

Structural Materials/Estimates:

- Welded wire fabric for slabs on steel deck: *6x6-W2.9xW2.9.*
- The estimated total weight of structural steel for the Second and Third Floor levels of the new building; including beams, columns, bracing, plates, relieving angles, miscellaneous frames, connections, etc., but excluding, entry canopies, loose lintels, mechanical screens, etc. is as follows:

  Estimated Weight of Structural Steel: ***450 Tons***

B1020 Roof Construction:

Typical Roof Construction consists of a 1½" deep, 18 gauge, Type WR, galvanized steel roof deck, supported by steel beams spaced at 5+/- feet o.c. Steel beams span to wide flange steel girders. The steel girders, in turn, are supported by HSS (tubular) steel columns. Pitch to roof drains will be achieved by the use of tapered insulation.

Roof Construction below Rooftop Mechanical Units consists of a 3" (minimum) deep, regular weight concrete topping slab on a 2" deep, 18 gauge, composite type galvanized steel floor deck (5" minimum total slab thickness) spanning ± 7'-0" to composite, wide flange steel beams. Steel beams will span to composite, wide flange steel girders. Composite action between the steel beams/girders and the concrete slab on steel deck will be achieved by field welding ¾" diameter, 3½" long headed shear connectors to the top flanges. Acoustical screens will be provided around all roof top mechanical units.

Roof Construction at Roof Garden Areas consists of a 3½" (minimum) thick, normal weight concrete topping slab with welded wire fabric on 2" deep, 18 gauge galvanized composite steel deck (5½" minimum total slab thickness), supported by composite steel beams, spaced at 7+/- feet to 8+/- feet o.c. Beams are supported by composite wide flange steel girders. Steel girders span to HSS (tubular) steel columns. Topping slabs on steel deck will be placed at the required elevation, adding concrete to compensate for the deflection of the (unshored) steel framing (approximately ¾" average additional concrete in each structural bay).

Gymnasium Roof Construction consists of a 3" deep, 20/20 gauge, galvanized, cellular acoustic deck, spanning ± 7'-0" to structural steel purlins. Steel purlins span ± 20'-0" to structural steel trusses (approximately 5'-0" deep). The trusses clear span the Gymnasium floor below and are supported by HSS steel columns. Exposed steel roof framing in the Gymnasium will be Exposed to View Structural Steel (E.V.S.S.).

Structural Materials/Estimates:

- Welded wire fabric for slabs on composite steel deck: *6x6-W2.9xW2.9.*
- The estimated total weight of structural steel for the various roof areas of the new building; including beams, columns, trusses, bracing, plates, angles, miscellaneous frames, connections, etc., but excluding entry canopies, loose lintels, etc. is as follows:

  Structural Steel Beams and HSS Columns: ***250 Tons***

  Structural Steel Trusses and Bracing: ***20 Tons***

  Galvanized Equipment Screens: ***130 plf***

OUTLINE SPECIFICATION

Concrete

- All concrete shall be normal weight, 4,000 psi at 28 days, except foundation walls and footings, which shall be normal weight, 3,000 psi and exterior (exposed) concrete (paving) which shall be normal weight, 4,500 psi.
- Portland Cement: ASTM C150, Type I or II.
- Fly Ash: ASTM C618, Class F. Replacement of cement content with fly ash is limited to 20% (by weight). Fly ash is not permitted in exterior, exposed concrete, slabs on grade or slabs on steel deck.
- All concrete shall be proportioned with ¾" maximum aggregate, ASTM C 33, except 3/8" maximum aggregate shall be used at toppings less than 2" thick (e.g. metal pan stairs).
- All reinforcing shall be ASTM A615 deformed bars, Grade 60.
- All welded wire fabric shall conform to ASTM A185.
- Reinforcing bars, steel wire, welded wire fabric, and miscellaneous steel accessories shall contain a minimum of 25% (combined) post-industrial/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Certification of recycled content shall be in accordance with Submittal Requirements.
- Concrete products manufactured within 500 miles (by air) of the project site shall be documented in accordance with Submittal Requirements.
- Cure all concrete by moisture retention methods, approved by Architect; curing compounds shall not be used.

Reinforced Concrete Masonry (Elevator Shaft)

- Masonry construction shall conform to ACI 530/ASCE 5/TMS 402 "Building Code Requirements for Masonry Structures", latest edition.
- Masonry strength, f'm shall not be less than 1350 psi.
- Requirements for load bearing block strength shall be as required for specified masonry strength (f'm) but shall not be less than 2000 psi on the net area of the block.
- Grout shall conform to ASTM C476, Type Fine, and shall be of strength required for specified masonry strength (f'm) but not less than 3000 psi.
- Mortar for reinforced masonry shall conform to ASTM C270 Type S and shall be of strength required for specified masonry strength (f'm) but not less than 1800 psi.
- Reinforcing bars shall conform to ASTM A615, Grade 60 deformed bars. Lap all continuous bars 48 diameters and provide bar positioners. Assume No. 5 bars at 2'-8" o.c. vertically and horizontal bond beams with 2 – No. 5 continuous at 4'-0" o.c.
- Joint reinforcing shall be 9 gauge Ladder Type conforming to ASTM A82. Provide prefabricated corners and tees. Walls shall be reinforced horizontally with joint reinforcing at 16 inches on centers unless otherwise noted.

- Reinforcing bars, steel wire, and miscellaneous accessories shall contain a minimum of 25% (combined) post-industrial/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Certification of recycled content shall be in accordance with Submittal Requirements.
- Elevator shaft walls shall be 100% solid grouted (all cores); low lift grouting.
- Masonry products manufactured within 500 miles (by air) of the project site shall be documented in accordance with Submittal Requirements.

Structural Steel

- Structural steel shapes shall conform to ASTM A992, Fy = 50 ksi.
- Steel tubes (HSS) shall conform to ASTM A500, Grade C, Fy=50 ksi.
- Structural steel plates and bars shall conform to ASTM A36, Fy = 36 ksi.
- Steel members shall contain a minimum of 25% (combined) post-industrial/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Certification of recycled content shall be in accordance with the Submittal Requirements.
- Steel manufactured within 500 miles (by air) of the project site shall be documented in accordance with the Submittal Requirements.
- Anchor Bolts: Anchor bolts at column base plates shall conform to ASTM F1554 – Grade 36 and shall be headed type. Provide a minimum of four (4), ¾" diameter anchor bolts at all columns; additional bolts and/or larger diameter will be required at bracing locations.
- Bolted connections shall be ASTM A325, Type N (bearing) bolts, except slip-critical bolts shall be used at lateral brace beam connections.
- Shear connectors shall be ¾" diameter, 4" long, headed Nelson studs conforming to ASTM A108.
- Shop and field welding shall be AWS D1.1 E70XX electrodes.
- Surface treatment for typical structural steel: SSPC Surface Preparation No. 3 (Power Tool Cleaning). Structural steel shall be left unprimed.
- Surface treatment for Exposed to View Structural Steel in the Gymnasium (E.V.S.S.) shall be SSPC Surface Preparation No. 6 (Commercial Blast Cleaning). Structural steel shall receive one coat of shop primer that is compatible with the finish paint.
- All exterior, exposed structural steel shall be hot-dipped galvanized.

Steel Deck

- Typical steel roof deck shall be 1½" deep, 18 gauge, Type WR, conforming to ASTM A653, Grade 33 (minimum), galvanized in accordance with ASTM A 653, coating class G60.

- Acoustic steel roof deck (Gymnasium) shall be 3" deep, 20/20 gauge cellular type, conforming to ASTM A653, Grade 33 (minimum), galvanized in accordance with ASTM A653, coating class G60. Acoustic steel deck shall be shop treated and painted with a primer that is compatible with the finish paint.
- Composite steel floor deck shall be 2" deep, 18 Gauge, composite type, conforming to ASTM A653, Grade 40, galvanized in accordance with ASTM A 653, coating class G60.
- All steel floor deck and roof deck accessories (pour stops, finish strips, closures, etc.) shall be the same finish as the deck; 18 gauge minimum.
- Steel deck shall contain a minimum of 25% (combined) post-industrial/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Certification of recycled content shall be in accordance with the Submittal Requirements.
- Steel deck manufactured within 500 miles (by air) of the project site shall be documented in accordance with the Submittal Requirements.
- Provide 14 gauge sump pans at roof drains.

B20 Exterior Enclosure:

B2010 Exterior Walls:

Exterior wall construction will be a mixture of glazing, architectural wall panels with a steel stud backup and steel stud cavity wall construction with a masonry veneer. Galvanized steel loose lintels will be provided at the heads of typical, punched window openings in the masonry veneer. Galvanized relieving angles will be required at larger and/or multiple, minimally separated window openings. At limited locations where the height of veneer exceeds 30 feet, a galvanized hung relieving angle will be provided at the Third Floor.

Horizontal steel girts (HSS sections) will be provided at one intermediate level between the Gymnasium floor and roof, to reduce the span of the exterior wall steel stud backup.

The steel stud backup will be 8" deep, 16 gauge minimum studs, designed for an H/600 deflection limitation. Vertical slip joints will be provided in the metal stud backup system at each level. Ties to the masonry veneer will be installed at 16" o.c. horizontally and vertically.

Gymnasium Walls:

Exterior wall backup for masonry veneer (see elevations) is 8 inch metal studs at 16" on center with 3" semi-rigid wall insulation over a continuous peel-and-stick A&VB system on ½" DensGlass sheathing. Stud spaces shall receive 1" of spray foam insulation on back side of sheathing. At interior, from floor to approximately 14' AFF, wall finish is 7 5/8 x 15 5/8 x 3 5/8 inch thick ground face CMU over ½" gypsum wallboard on the stud backup. From 14' AFF to sill of clerestory / underside of roof deck, interior finish is 2" thick fibrous wood panels ("Tectum") over the metal stud backup.

Stairs (Typical):

8" metal stud framing 16" o.c. with ½" DensGlass sheathing, continuous A&VB with 3" rigid wall insulation and one inch air space in cavity, and 3 5/8" exterior masonry veneer. Stud spaces to receive 1" spray foam on room side of sheathing, typical. Interior finish is ceramic tile on cement backerboard to 5' AFF (following stair stringers and landings) with epoxy painted abuse resistant GWB above. Stairs will also have at least one wall that is approximately 50% window wall system (See elevations and B2020 – Exterior Windows for more information).

Typical Exterior Walls:

8" metal studs at 16" o.c. with ½" DensGlass sheathing, continuous A&VB, 3" rigid wall insulation and one inch air space in cavity with 3 5/8" exterior masonry veneer. Stud spaces to receive 1" spray foam insulation on room side of sheathing, typical. Interior finish is 5/8" GWB, painted, typical.

A masonry veneer base consisting of alternating courses of 3 5/8" modular brick (color A.1) from grade to approximately 32" above first floor finished floor.

Masonry veneer will be modular face brick conforming to ASTM C216, Grade SW, type FBA (Glen-Gery, Caroline Ceramics, Endicott, or equal) with decorative reveals as noted on the elevations. Windowsills shall be precast concrete (see elevations). Masonry veneer will be comprised of patterns of recessed courses and alternate colors (color A.2 and A.3).

Prefinished Aluminum Panel Systems:

Composite Panel System Type E: as shown on the elevations, rout-and-return type laminated composite panels with prefinished aluminum faces installed as a ventilated rain screen, as manufactured by Alucobond, Alcoa, Centria or equal. Panels installed on horizontal and vertical grillage of G90 galvanized "zee" girts applied over the exterior wall stud backup system.

Stud Backup System:

Typical for all exterior wall construction, 8 inch metal stud framing 16" o.c. with ½" DensGlass sheathing, continuous peel and stick A&VB membrane with 3" rigid wall insulation in cavity and 1" spray foam insulation applied between the studs on the back of the gypsum sheathing.

Porcelain Panel System:

24"x48" Full-body colored porcelain panels installed on cementitious substrate with horizontal and vertical grillage of G90 galvanized steel "zee" girts applied over the exterior stud backup system. Lamiera panels by Garden State Tile or equal by ProSpec, DalTile.

Equipment Screens:

Galvanized structural tube columns with horizontal tube sections at top of screen wall and 18" above the roof surface; with zee girts installed vertically at 4'-0" o.c. between top and bottom structural tubes. Exterior screen panels shall be .050 prefinished concealed fastener 1 ½" thick aluminum panel with 12" face (Centria "Econolap", or equal by Morin and Fabral). Back (equipment) side of screen to be prefinished aluminum, 1/8" perforated 40% open staggered hole with sound dampening insulation exposed fastener system. Top of screen wall to extend to top of HVAC equipment – assume 10 feet above roof elevation.

Sun Control Devices (south facing classroom windows):

Shade: EFCO E-Shade 36" rectangular with 7" airfoil blades, 6063-T6 aluminum prefinished, Aluminum with screw spline construction.

Exterior Soffits:

Roof Overhang: Flush panel 1" deep and 12" panel width, 16 ga. prefinished aluminum (where noted) 20 year Kylar 500 finish (Centria, Morin, Fabral).

Main Entry & Cafeteria Canopy: Exterior metal suspended panel system – Armstrong Metalworks Linear Planks, 6" unperforated "Woodlooks" (Chicago, USG).

Exterior Fascias, Copings, Parapet Caps (16 ga.) and Misc. Flashings (18 ga.) Prefinished Aluminum: Kynar finish 20-year warranty.

B2020 Exterior Windows / Window Walls

All window systems shall be thermally broken prefinished aluminum with glazing as noted below (EFCO, ModuLine, Architectural Metal Products, Wausau Metal Products).

Glass Types:

Type A: Standard 1" insulating glass: 2 panes of ¼" thickness with ½" air space (Community Wing: Gym, Library, Admin, Kitchen, 2nd Floor Specialist Offices)

Type A1: Laminated 1" thick insulating glass: first pane 9/32" laminated glass, ½" air space, second pane ¼" float glass (Cafeteria)

Type B: Special 1 ¾" thick laminated insulating glass: first pane 17/32" laminated glass, 1" air space, second pane ¼" float glass (2nd Floor: Art, Music, OT/PT, Classroom Wing Floors 1-3 except west of Gridline 3)

Type C: As in Type B, except with an interior pane of ¼" flat glass spaced at least 2" from the special IGU (Classroom Wing Floors 1-3 west of Gridline 3).

Security Glazing: The first floor curtainwalls and windows located in the Community Wing shall have clear safety-and-security film (LLumar, Global, Madico, 3M) applied to the interior surface of all glass panels having a horizontal edge within 4 feet of grade.

Gym Clerestory

Strip clerestory at the north elevation, 6' high, constructed of 7 1/2" deep curtainwall system (EFCO 5600 series) having 1" insulated low E glass. Assume prefinished aluminum trim panning at interior.

The Gym Clerestory curtainwall system wraps around to the east elevation, having 1" insulated translucent glass panels along this orientation.

Cafeteria, East (Main) Entry, Stairs B, C and D Exterior Window Walls:

7 1/2" curtainwall system (EFCO 5600 series) with inserted 4 1/2" operable windows at Cafeteria only; all with 1" low E glass. Vertical glass panel joints shall be butt glazed with clear silicone. Horizontal accents shall be deep snap trim.

Classroom Wing Windows + Vents in Curtainwall

4 1/2" deep window system (EFCO 450X series) with fixed and operable lights, low E glass. Vents project out via roto operators. Operable windows fitted with insect screens on interior side of window.

South and North Stair and Main Entry Curtainwall

7 1/2" curtainwall system (EFCO 5600 series). At south and north stair curtainwall is glazed with 1 inch insulated low E glass. At north curtainwall and at occupied interior spaces adjacent to the south stair, 4 1/2" operable windows with1 inch insulated low E glass are installed into the curtainwall, with opaque exterior wall areas glazed with 1 inch insulated spandrel glass units (Viracon Viraspan, PPG Spandrelite, Insulite Glass Co.).

Opaque areas of curtainwall at occupied spaces are backed by 8" metal stud framing with an air barrier and ½" DensGlass sheets at the cavity and 1 inch spray foam insulation on the back side of the sheathing.

B2030 Exterior Doors

Entry Doors:	Doors at vestibules and exterior exit doors wide stile 2" thick with tempered insulated glass, thermally broken, EFCO Thermastile D502 or equal.
Service Doors:	14 gauge galvanized welded steel frames and galvanized insulated fully welded doors. Galvanizing shall meet ASTM A525. Doors and frames shall be factory primed and field painted.

B3010 Roof Coverings

Low Slope Roof Areas: Highly reflective "cool roof" PVC roof system (Sarnafil, Johns Mansville, Durolast) with 7" average thickness polyiso roof insulation (tapered at concrete roof decks) and vapor barrier (loose laid on metal decks and peel-and-stick on concrete decks).

All roof edge flashings shall be PVC coated metal compatible with welded roof membrane joints. Fascias, soffits and trim shall be prefinished aluminum.

Green Roof Garden System over Cafeteria roof, south of Music and Art Classrooms: Shall consist of precast walkway pavers (24"x24" x 2" th.) with drainage flutes at underside of paver, polyester reinforced membrane protection under precast concrete pavers, modular self-contained planting blocks (24"x24"x4" dp) anodized aluminum, pre-planted with drought resistant perennials in light weight growth media.

B3020 Roof Openings

Smoke Vent – For the top of the elevator shaft, assume a 4' x 2' motorized control damper activated by the fire alarm system. Vent shaft construction to be 8' x 4' x 6' high 1-hour rated shaft wall construction with PVC roof membrane cladding.

C INTERIORS

Interior finishes are selected with long life, low maintenance and acoustical performance as prime considerations.

Interior Construction by Room

1. Gym:	Floors - C3020	Grade 1 hardwood (Maple) athletic flooring system, 2 1/4" overall thickness, 15/32" maple on 2 layers 15/32" plywood with resilient pads over vapor barrier. With main and cross court basketball lines and volleyball court lines. Vented rubber base. For acoustic isolation, wood floor installed over "floating" 5" normal weight concrete topping slab on steel springs with a 2" air space over structural floor construction . (See B1010 for floor construction). Floating slab system to be Kinetics LSM jack-up system; acceptable manufacturers include Mason Industries and VMC Group.
	Walls – C1010 C3010	4" ground face CMU to 14' AFF. 2" fibrous wood panels ("Tectum") painted (no VOC), on 8" metal studs with batt insulation (at interior walls) from 14' AFF up to underside of deck/clerestory sill.
	Ceiling C3030	Steel tube trusses and WF purlins & acoustic roof deck, painted. Underside of deck 25' AFF.

2. Cafeteria	Floors C3020	LCT - Heavy duty linoleum tile with field installed pattern (Forbo Marmoleum Modular, 2.5 mm thick), rubber cove base.
	Walls C1010 C3010	5/8" GWB, painted (no VOC), 6" metal studs (at interior walls). Wainscot 84" high, porcelain tile on ½" cement board with continuous metal trim at top and bottom edges and vertical edges.
	Ceiling C3030	24 X 60 inch wet-formed mineral fiber, bevel edged tegular panels, NRC .70 (Armstrong "Ultima") in 9/16" grid (Armstrong "Suprafine XL") in suspended clouds with Axiom Knife Edge trim, ceiling height varies from 10-'6" to 12'-0" AFF. 24" x 24" fiberglass tegular panels with attenuation backing (Armstrong "Optima") .90 NRC in 9/16 grid (Armstrong "Suprafine XL") at outer perimeter of cafeteria, ceiling height 13'-0" AFF.
3. Kitchen Area	Floors C3020	Resinous seamless flooring (epoxy) with 6" integral base. Staff toilet: 2"x2" ceramic mosaic tile, mudset with matching 2"x2" cove base (4" high) Office and dry food storage: Heavy duty linoleum tile with field installed pattern (Forbo Marmoleum Modular, 2.5 mm thick), rubber cove base.
	Walls C1010 C3010	8" CMU with epoxy paint (no VOC).
	Ceiling C3030	ATC, 24 x 24 inch with scrubbable face (Armstrong "Clean Room VC") in 15/16" hot dip galvanized grid (Armstrong "Prelude XL Fire Guard"). Ceiling height 9'-4" AFF (kitchen & toilet room). ATC, 2 x 2 tegular edged lay-in, Armstrong "Cortega" mineral board (NRC .55) in 9/16" grid (Armstrong "Suprafine XL"). Ceiling height 9'-0" AFF (office)

4. Platform	Floors C3020	Wood dance flooring system: 2 1/4" overall thickness, 25/32" maple on 2 layers 15/32" plywood on resilient pads over vapor barrier. Sub floor construction: Concrete slab on grade. Risers consisting of solid maple 18" deep treads and 6" high risers (two treads & three risers) over solid pourd in place substrate.
	Walls C1010 C3010	5/8" GWB and 6 inch metal studs with acoustic insulation, painted (no VOC). Proscenium opening and surround red oak veneer (rift cut) paneling and Lyptus hardwood trim furred on metal stud back-up, with ceramic tile accent.
	Ceiling C3030	Exposed structure, painted, with floating perforated wood ceiling panel "clouds" installed on rigid fiberglass acoustic board and suspended metal furring 24" o.c., ceiling height 10'-0" AFF. ALTERNATE: Armstrong Custom Woodworks Radial suspended ceiling system.
5. Music/Practice rooms	Floors C3020	LCT - Heavy duty linoleum tile with field installed pattern – 3 colors (Forbo Marmoleum Modular, 2.5 mm thick), rubber cove base.
	Walls C1010 C3010	5/8" GWB painted (no VOC), both sides acoustic stud chase wall (two rows 3 5/8" metal studs @ 16 in. o.c. with acoustic insulators by Mason Industries installed between every fourth stud (4'-0" o.c.) at 48" o.c. vertically) with acoustic batt insulation.
	Ceiling C3030	24 X 24 inch fiberglass tegular panels (Armstrong "Optima") .90 NRC in 9/16 grid (Armstrong "Suprafine XL").
6. Library	Floors C3020	Low VOC carpet (Tandus "Effervescent" #03479 with Powerbond ethos backing 24"x24") with 4" rubber base.
	Walls C1010 C3010	5/8" GWB both sides 8" metal studs @ 16" o.c. with acoustic installation, painted (no VOC).
	Ceiling C3030	24 x 60 inch ATC tegular edged fiberglass panels, NRC .90 (Armstrong "Optima") for 50% coverage. 24 x 24 metal tile (Armstrong "Metalworks Tegular Effects") in 9/16" reveal grid (Armstrong "Silhouette XL 9/16" ¼" Reveal"). GWB soffits and coves (painted, no VOC) separating "high" and "low" ceiling areas. Ceiling height varies from 9'-4" to 11'-4" AFF.

7. Toilet Rooms	Floors C3020	2”x2” ceramic mosaic tile (American Olean, DalTile), mud set, pitched to drains, over WP membrane, all with matching 2”x2” CT base (4” high).
	Walls C1010 C3010	1/2” plywood over studs to 4” above ceiling. 8”x20” ceramic tile full height on cement backer board at wet walls and 60” a.f.f. wainscot at remaining walls. Three 2” high courses of glass tile mosaic accent bands on full height walls and one 2” high course of glass tile mosaic walls with 60” h. tile. 1/2” moisture resistant GWB from wainscot to underside of deck, painted (no VOC).
	Ceiling C3030	ATC, 2 x 2 tegular edged lay-in, Armstrong “Cortega” mineral board (NRC .55) in 9/16” grid (Armstrong “Suprafine XL”).
8. Stairs	Stair Construction C2010 C2020	Steel stringers (C-Channels) and concrete filled steel pans. Guards fabricated from 2 1/2” x 1/2” barstock with 9-gauge wire mesh infill. 1 1/2” dia stainless steel pipe handrails two each side of stair, mounted on guards and on walls at 2’-10” and 1’-10” above nosings.
	Floors C2020	Rubber tile at landings (Noraplan Environcare with smooth texture and smooth back) and rubber riser/step treads on stairs (Norament with inlaid strip of contrasting color rubber at nosings) with rubber base at walls (no base at steel stringers) and landings. Heavy duty linoleum tile with field installed pattern – 3 colors (Forbo Marmoleum Modular, 2.5 mm thick), at main floor landings . Walk off mat at all first floor areas.
	Walls C2020	5/8” abuse resistant GWB on 6” metal studs at 16” o.c. with epoxy paint (no VOC). 60” high wainscot of 8”x20” ceramic tile on 5/8” cement backer board with 25% accent tiles.
	Ceilings C3030	At main landings and top of stair, ATC, 2 x 2 tegular edged lay-in, Armstrong “Cortega” mineral board (NRC .55) in 9/16” grid (Armstrong “Suprafine XL”). Ceiling height 9’-0” AFF.At underside of stairs, including intermediate landings, 5/8” GWB on metal studs with epoxy paint (no VOC).

9. Corridors	Floors C3020	LCT - Heavy duty linoleum tile with field installed pattern – 5 colors (Forbo Marmoleum Modular, 2.5 mm thick), rubber cove base.
	Walls C1010 C3010	5/8" abuse resistant GWB with paint (no VOC) on 6" metal studs @ 16" o.c. with acoustic insulation. Wood veneer panels and porcelain tile where noted (see drawings).
	Ceiling C3030	ATC, 2 x 2 tegular edged lay-in, Armstrong "Cortega" mineral board (NRC .55) in 9/16" grid (Armstrong "Suprafine XL") with painted GWB soffits. Ceiling heights vary.
10. Classrooms (including Lextended Day & SPED Classrooms)	Floors C3020	LCT - Heavy duty linoleum tile with field installed pattern – 3 colors (Forbo Marmoleum Modular, 2.5 mm thick), rubber cove base.
	Walls C1010 C3010	5/8" GWB on 8" metal studs at 16" o.c. (at exterior wall), painted (no VOC). 5/8" GWB both sides 8" metal studs at 16" o.c. with acoustic batts, low VOC painted.
	Ceilings C3030	24" x 24" wet-formed mineral fiber, bevel edged tegular panels, NRC .70 (Armstrong "Ultima") in 9/16" grid (Armstrong "Suprafine XL"). Ceiling height 10'-6" AFF.
11. Teacher Work Room, Staff Lunch	Floors C3020	LCT - Heavy duty linoleum tile with field installed pattern – 1 color (Forbo Marmoleum Modular, 2.5 mm thick), rubber cove base.
	Walls C1010 C3010	5/8" GWB on 6-inch metal studs at 16" o.c with acoustic insulation, painted (no VOC).
	Ceilings C3030	24" x 24" wet-formed mineral fiber, bevel edged tegular panels, NRC .70 (Armstrong "Ultima") in 9/16" grid (Armstrong "Suprafine XL"). Ceiling height 10'-6" AFF.

12. Project Areas	Floors C3020	LCT - Heavy duty linoleum tile with field installed pattern – 5 colors (Forbo Marmoleum Modular, 2.5 mm thick), rubber cove base.
	Walls C1010 C3010	5/8" GWB on 6 inch metal studs at 16" o.c with acoustic insulation, painted (no VOC) (partial height at corridor).
	Ceilings C3030	24" x 24" wet-formed mineral fiber, bevel edged tegular panels, NRC .75 (Armstrong "Ultima") in 9/16" grid (Armstrong "Suprafine XL"). Ceiling height 11'-0" AFF. Approximately 115 LF x 12" deep GWB/metal stud curved perimeter soffit, painted (no VOC) with LED cove lighting (9'-6" AFF) and 6" high curved ceiling trim (Armstrong "Axiom") over each pair of Project Areas (6 locations). Provide ceiling clouds at each project area: Armstrong Formations Cloud Kits with 6" Axiom Vector Trim – 4 clouds in each project area (2 @ 3' dia., 2 @ 4' dia.) with 24" x 24" bevel edged tegular panels, NRC .75 (Armstrong "Ultima") in 9/16" grid (Armstrong "Suprafine XL"). (12 locations).
13. Administration (Offices, Conference)	Floors C3020	Offices, Conference Rooms: Low VOC carpet (Tandus "Divide" #03863 with Powerbond ethos backing 24"x24") with 4" rubber base.
		Teacher Work Rooms & Staff Lunch Rooms: LCT - Heavy duty linoleum tile – 1 color (Forbo Marmoleum Modular, 2.5 mm thick), rubber cove base.
	Walls C1010 C3010	5/8" GWB both sides 6" metal studs @ 16" o.c. with acoustic installation, painted (no VOC).
	Ceiling C3030	24" x 24" wet-formed mineral fiber, bevel edged tegular panels, NRC .70 (Armstrong "Ultima") in 9/16" grid (Armstrong "Suprafine XL"). Ceiling height 10'-0" AFF.

14. Nurse's Suite	Floors C3020	LCT - Heavy duty linoleum tile – 1 color (Forbo Marmoleum Modular, 2.5 mm thick), rubber cove base.
	Walls C1010 C3010	5/8" GWB on 8" metal studs (exterior wall), painted (no VOC). 5/8" GWB both sides, 6" metal studs @ 16" o.c. with acoustic insulation, painted (no VOC).
	Ceiling C3030	24" x 24" wet-formed mineral fiber, bevel edged tegular panels, NRC .70 (Armstrong "Ultima") in 9/16" grid (Armstrong "Suprafine XL"). Ceiling height 10'-0" AFF.
15. Janitor Closet Staff Toilet Rooms	Floors C3020	Ceramic mosaic tiles, thin set with CT base.
	Walls C1010 C3001	5/8" GWB both sides, 6" metal studs @ 16" o.c. with acoustic insulation, painted (no VOC). Janitor Closet only: Ceramic mosaic tile full height on 5/8" cement backer board on wet walls. FRP panels to 60" AFF on remaining walls (over 5/8" GWB on metal studs with no VOC paint).
	Ceiling C3030	24 x 24 inch ATC with scrubbable surface (Armstrong "Clean Room VL") in 15/16" hot dip galvanized grid (Armstrong "Prelude XL"). Ceiling height 8'-0".
16. Mech/Elec Rooms/ Receiving/ Custodian Elevator Machine Room	Floors C3010	Concrete with no VOC epoxy paint. VCT with rubber base (office only)
	Walls C1010 C3010	8" CMU with epoxy paint (No VOC).
	Ceilings C3030	ATC, 2 x 2 tegular edged lay-in, Armstrong "Cortega" mineral board (NRC .55) in 9/16" grid (Armstrong "Suprafine XL"). Ceiling height 9'-0" AFF. (Custodian Office only). 1 hour rated GWB, painted (Elevator Controls Room), All others: underside deck and structure, painted (no VOC).

17. Main Entry Vestibule	Floors C3010	Entry grate
	Ceiling C3030	"Wood Look" suspended acoustical tile panel system – Armstrong Metalworks Linear Planks, 6" extra microperforated (M3) with black acoustical fleece backing.
	Walls C1010 C3010	5/8" abuse resistant GWB on 8" metal studs at 16" o.c. with no VOC paint. Full height wall of porcelain tile on 5/8" cement backer board and wood panel (see finish schedule)
18. Entry Lobby	Floors C3010	Walk-off mat
	Walls C1010 C3010	5/8" abuse resistant GWB on 6" metal studs at 16" o.c. with no VOC paint. full height wall of porcelain tile on 5/8" cement backer board and hardwood panels (see interior elevations)
	Ceiling C3030	"Wood Look" suspended acoustical tile panel system – Armstrong Metalworks Linear Planks, 6" extra microperforated (M3) with black acoustical fleece backing.

19. Gym Storage, Electrical and Data Closets	Floors C3020	Epoxy painted (No VOC) concrete.
	Walls C1010 C3010	8" CMU, painted (No VOC), when adjacent major space has CMU partitions.
	Ceiling C3030	Underside floor deck and structure, painted (No VOC). (Underside deck @ 13'-6" AFF).
20. Art Classrooms	Floors C3020	LCT - Heavy duty linoleum tile with field installed pattern – 3 colors (Forbo Marmoleum Modular, 2.5 mm thick), rubber cove base.
	Walls C1010 C3010	5/8" GWB on 8" metal studs (exterior walls), painted (No VOC) 5/8" GWB both sides on 6" metal studs @ 16" o.c. with acoustic insulation, no VOC paint.
	Ceiling C3030	24" x 24" wet-formed mineral fiber, bevel edged tegular panels, NRC .70 (Armstrong "Ultima") in 9/16" grid (Armstrong "Suprafine XL"). Ceiling height 10'-6" AFF.

GENERAL

C1010 Partitions

All wall construction full height to underside deck above. Smoke and fire seal all penetrations.

All GWB at corridors and stairs to be 5/8" abuse resistant GWB except where finished material of tile or wood panel is applied.

All GWB in toilet rooms to be 5/8" moisture resistant GWB.

All paint to be no VOC.

C1020 Interior Doors and Frames

Doors and Frames:

16-gauge hollow metal welded frames (galvanized per ASTM 525 at toilet rooms and kitchen), factory primed for field paint, with typical 3'x7' solid core hardwood doors (VT Industries) with low-VOC natural finish. Allowance for sidelights and safety glass in doors.

Hardware: Generally, "Sargent Signature Series", Schlage, or Best mortised door locks with large format IC cores both sides (to accommodate the Best "Peaks A1" core used for lockdown); Sargent, Von Duprin, or Precision exit devices; Sargent, LCN, or Norton door closers.

Interior aluminum vestibule doors – EFCO "D502" with safety and security 1" insulated glass.

Interior aluminum doors and windows (main lobby, cafeteria, break out rooms) – EFCO 402-NT prefinished aluminum Kynar 500 with 3/8" tempered glazing.

Specialty Doors:

At cafeteria serving line, electrically operated coiling door extending from ceiling to floor, with factory finished flat steel slats, model ESC10 by Cornell Iron Works or equal by Overhead Door Company and Cookson.

All convenience doors between classrooms are to be acoustical pre-hung doors in acoustical frames, STC-40.

C1030 Fittings

Millwork:

a. Solid Hardwood Built in Benches at Entry Lobby, Cafeteria, First Floor Academic wing

b. Column covers at Library

c. Custom Desks: Reception, Library (Circulation), Classroom Storage Walls

d. Countertops:

1) Recycled glass and resin countertops at Main Office Reception and Media Center Circulation Desk counters (Curava, IceStone, GEOS)

2) Plastic laminate countertops with solid hardwood edge at all other areas.

e. Hardwood Species: Lyptus and Red Oak (Quarter sawn & rift cut)

Toilet Accessories: Stainless Steel grab bars, sanitary napkin dispensers and receptacles, and mirrors and recessed mounted baby changing station (in all Kindergarten toilet rooms and in one unisex toilet room on the first and second floor of the Community Wing). Electric hand dryers are to be provided in all gang toilet rooms – 2 per toilet room.

Toilet Accessories to be provided by Owner and installed by CM: Toilet paper dispensers, soap dispensers and paper towel dispensers (except at gang toilet rooms where electric hand dryers are provided).

Building Signage: Exterior building canopy mounted signage (assume 24" high cast aluminum letters).

Interior Column Covers: Stromberg, GRG high quality glass fiber gypsum reinforced covers ready for field finish.

Interior Signage: Vandal resistant frame and sign with raised vinyl lettering, integral raster Braille (raised) and removable vinyl insert.

Classroom Flags: Flag/pole mounting on wall adjacent to markerboard/tackboard, pole and wall bracket with 18' x 28" flag. Coordinate with FF&E.

OT/PT Swing Support: Ceiling grid support for hanging equipment, 10' x 12' steel support channels, hung from structure above.

Markerboards & Tackboards: Painted Steel writing surface on hardboard backing with extruded aluminum frames and chalk tray (Claridge Products, Best-Rite Manufacturing, Polyvision Corp). Tackboards with linoleum cork (i.e. Forbo "bulletin board") covering on hardboard backing (no vinyl covered tackboards for IAQ reasons).

Toilet Partitions: Recycled solid plastic headrail braced toilet partitions & urinal screens (General Partitions Mfg. Corp., Ampco Products, Sontana Products).

Reception Desk Pocketing Glass Panels: Aluminum framed folding door (Nanawall System, Lanai Doors, Hufcor)

Lockers:

a. Project Area Student Lockers: Single tier, 12" wide x 15" deep x 48" high with hat and coat hooks, hat/book shelf and numbers, installed in millwork recessed cabinetry.

b. Kitchen (5 required): Single tier, 12" wide x 15" deep x 72" high (not including base) with hat and coat hooks, hat shelf, number, base and sloped tops.

c. Receiving (5 required): Single tier, 12" wide x 15" deep x 72" high (not including base) with hat and coat hooks, hat shelf, number, base and sloped tops.

Operable Partitions at Resource Rooms and SPL on floors 1, 2 and 3: 3" nominal thickness with STC 50 rating. Panels are approximately 48" w. x 96" h. (6 panels each assembly). Panel finish shall be reinforced vinyl with woven backing except 3 center panels at each assembly shall have markerboard finish on both sides.

Building-mounted Greenhouse Structure

C3010 Wall Finishes

Wood running trim and panels to be 40% Lyptus and 60% red oak, quarter sawn

Hardwood plywood veneer to be 40% Lyptus and 60% red oak, rift cut with hardwood edging, typical.

Ceramic Tile: Daltile Natural Hues at Corridors, Garden State Design Positive at Toilet Rooms

Porcelain Tile: Garden State Lamiera (acceptable manufacturers include ProSpec and DalTile)

C3020 Floors Finishes

Mats & Grates:

Interior Mats: Cut pile reinforced with resilient monofilament fiber strips with vinyl back, “Coral Brush Activ” by Forbo.

Vestibule Grilles: Aluminum scraper bars with wiper strip inserts “Nuway Tuftiguard” by Forbo.

D SERVICES

D10 Conveying

D1010 Elevators & Lifts

MLR traction passenger elevator (no machine room required), 3,500 lb., three floor stops, 150 fpm (Kone EcoSpace). Stainless steel doors, frame, and plastic laminate cab interior. Shaft shall be 1 hour reinforced CMU.

D20 Plumbing

D2010 Plumbing Fixtures

Number of plumbing fixtures will be added in the facility to accommodate the projected population of 645 students and shall be in accordance with 248 CMR Paragraph 10.10, Table 1. See the fixture schedule on the plumbing drawings for manufacturer and model.

Plumbing fixtures will be equipped with the following water conserving features (for indoor water use reduction-LEED v4- WE Credit 2 & 4) Water closets and urinals will be commercial vitreous china, wall hung (ADA compliant). Lavs will be self-rimming counter mounted china. Each floor includes a janitor’s closet with a corner mop service basin. Toilet cores on each floor will include a drinking water fountain with high-low handicapped accessible configuration and with bottle filling station. Toilet and mechanical room will have a floor drain with trap primer.

All classrooms will have self-rimming stainless steel sink with 0.5 gpm gooseneck type faucets with aerator. Plumbing connecting and faucets will be provided to each kitchen appliances requiring plumbing work. An exterior non-freeze wall hydrants will be provided on outside and inside the loading dock and on roof.

D2020 Domestic Water Distribution

New 4" domestic water supply line will enter into the mechanical room. Reduced Pressure Backflow Preventer will be provided to the main domestic water supply to protect the service (per the DEP regulation 310 CMR 22). The domestic water distribution will incorporate water meter at main line and few branch piping to monitor the water usage on various levels such as kitchen area, boiler room, water heater and at least 80% of indoor fixtures. Boiler water feed and make-up, and any other mechanical take-Offs will branch off through a reduced pressure-principle backflow preventer and a separate submeter per LEED Water Efficiency Credit 4. Additionally, domestic hot water shall be submetered under the same Credit.

The domestic cold water piping inside the building will be distributed in "L" type copper tube with wrought or cast copper fittings. Potable water will meet both the NSF 61 and NSF 372 standards for lead free safe drinking water Act. The piping will be insulated to prevent condensation.

Domestic hot water heater will be an electric 200-gallon water heater. The water heater will meet the thermal efficiency and standby loss requirements of the U.S Dept. of energy and current addition of ASHRAE/ IESNA 90.1.3. A heat pump from the geothermal system will circulate through a heat exchanger. The heat exchanger will preheat the water supplying the water heater. The backup gas boilers will also run to the exchanger and supply the water heater in case of emergency. Controls, pumps etc… will be provided. The hot water heating system shall be on the BMS controls.

The acceptable manufacturer of hot water heaters are A.O Smith, Rheem, Bradford white or equal.

The water heater will be manifold together to supply hot water distribution to classroom fixtures and kitchen appliances. The domestic hot water distribution system will be in re-circulating system to the fixtures. There will be 2 different hot water supply / recirculation systems in the building. One system will operate at 140°F and will serve the kitchen dishwasher (future) and 3 compartment sink. The other system will operate at 120°F and will serve the other kitchen sinks and appliances, as well as the custodian room sinks, lavatories and classroom sinks. At the lavatories, the faucets will reduce the temperature to 110°F at the lavatories.

Domestic hot water will be distributed in "L" type copper tube with wrought or cast copper fittings. The hot water (HW), and re-circulating (HWC) piping will be insulated for energy savings. No HW or HWC piping will be concealed beneath the slab.

D2030 Sanitary Waste

An 8" sanitary main will exit the building and connect to the sewer system.

A dedicated 4" grease waste line will be installed to collect grease laden waste water from the new Kitchen appliances and fixtures. The grease line will exit the building and be connected to an exterior grease trap outside the building. For culinary sink or prep sinks grease trap will be provided at the source. The indoor grease interceptor will be electric self-cleaning grease recovery unit that will skim fat automatically from the tank. The acceptable manufacturers for the self-cleaning grease interceptor are Highland Tank, Thermaco- Big Dipper, Rockford, MIFAB or approved equal

Above ground sanitary drainage and will be piped in cast iron with “no-hub” joints (3” or larger) . Piping smaller than 3 inch will be piped in copper. Piping below floor shall be weight cast iron hub and spigot type.

D2040 Rain Water Discharge

Roof Drain system will carry rainwater away from the flat roof of the new building with conventional primary roof drains. The existing building with sloped roof will be drained through a new metal lines gutters and downspouts. The surface of the new roof deck will be drained with dual level promenade drains (a minimum of two) with the lower drain bodies flashed into the waterproofing membrane. RW piping and the system will be sized to handle a rainfall rate of 4 inches per hour, with a total runoff from the main roof and the roof deck of just under 1 cubic foot per second. The storm system will be installed in cast iron piping with all horizontal piping insulated to prevent condensation. The storm system will exit along the side of the building and connect to the site storm water collection system. There shall be an overflow roof drain system in conjunction with the standard roof drain system.

See G3030 – Storm Sewer for a description of the exterior storm drain system.

D2090 Fuel

New gas service entering into the mechanical room will be reviewed for new building load. The gas pressure will be regulated to low pressure (11” W.C) inside the building. The exterior pressure regulator will be by the gas utility The new gas supply inside the building will be piped to the backup heating boilers. A gas line from the gas meter shall run underground to the new emergency generator.

The gas piping will be distributed in ASTM A53 schedule 40 black steel pipe.

D30 HVAC

Sustainable Design Elements - HVAC

The HVAC system will employ multiple air handling units with energy recovery (which allow for multiple zones for off-hour use), induction systems (active chilled beams) in classrooms, which reduces both installation and operation costs. System chilled and hot water will be achieved through the use of a closed-well geothermal system utilizing water-to-water heat pumps. The system will also contain high efficiency (90%+) condensing type gas boilers for backup heat.

All systems will be designed to comply with 2015 IECC.

A. The following are the assumptions used to prepare the design to accomplish the design intent:

1. Outdoor Design Conditions (per ASHRAE Table 1A):
   a. Summer: 1% for Cooling, 87°F db/ 74°F wb
   b. Winter: 99.5% for Heating, 7°F
2. Indoor Design Conditions:
   a. Summer: 76°F/50%RH.

b. Winter: 70°F/ no humidification.

3. Indoor System Design Conditions

a. Classrooms:

1) Each typical classroom will be served by 2-pipe ceiling induction units (aka active chilled beam) fed from 4-pipe system to maintain 76F/50% cooling and 70F heating set points, which will provide individual space zone controls. Four pipe distribution runs along the classroom corridor, taps off and enters each classroom, where the pipes join in a valve station that will feed 2-pipe induction units. The reason for this is to utilize the full coil for heating duty due to the low water heating temperatures provided by the geothermal system. Each classroom will be provided with a temperature and humidity sensor to continuously monitor the dewpoint of the space and shut off chilled water flow to prevent codensation in case a window is left open during summer.

2) Corridors will be served by four pipe fan coil units.

3) Unoccupied summer will have all HVAC equipment shut off, unoccupied winter heating setback set point will be 55°F with ERU's on 100% recirculation mode and its fans cycled at 80% of its VFD speed.

b. Remaining Areas:

1) Offices- which may be used outside the normal school hours will be provided with packaged rooftop HVAC units. Occupied summer cooling set point will be 76°F/50%RH with no dehumidification controls, occupied winter heating set point will be 70°F with no humidification. Unoccupied summer will have all HVAC equipments shut off, unoccupied winter heating set point will be 55F.

2) Library- occupied summer cooling set point will be 76°F/50%RH with no dehumidification controls, occupied winter heating set point will be 70°F with no humidification. Unoccupied summer will have all HVAC equipments shut off, unoccupied winter heating set point will be 55°F.

3) Cafeteria- occupied summer cooling set point will be 76°F/50%RH with no dehumidification controls, occupied winter heating set point will be 70°F with no humidification. Unoccupied summer will have all HVAC equipments shut off, unoccupied winter heating set point will be 55°F.

4) Kitchen- occupied summer cooling set point will be 76°F/50%RH with no dehumidification controls, occupied winter heating set point will be 70°F with no humidification. Unoccupied summer will have all HVAC equipments shut off, unoccupied winter heating set point will be 55°F.

5) Gym- occupied summer period will have full air conditioning with occupied period set point of 76°F/50%RH. Occupied heating set point will be 70F. Unoccupied summer period will have all HVAC equipment shut off, unoccupied winter heating set point will be 55°F.

6) Utility Spaces- summer 104°F, winter 60°F.

3. Minimum Outdoor Air Criteria (2009 IMC Section 403).

a. Classes - 10 CFM/person + 0.12 CFM/SF.

b. Music - 10 CFM/person + 0.06 CFM/SF.

c. Offices - 5 CFM/person + 0.06 CFM/SF.

d. Kitchen - 0.7 CFM/SF exhaust.

e. Cafeteria - 7.5 CFM/person + 0.18 CFM/SF.

f. Gym - 0.3 CFM/SF.

g. Bathrooms - 50 CFM per toilet or urinal continuous.

h. Corridor - 0.06 CFM/SF.

D3010 Energy Supply

1. Heating and cooling energy shall be provided by electricity, utilizing water-to-water heat pumps in conjunction with a closed-well geothermal system.

2. Backup heating energy for the school shall be provided by natural gas.

D3020 Heat Generating Systems

1. Twelve (12) nominal 28-ton capacity water-to-water heat pumps will provide space heating hot water to energy recovery units (ERU), roof mounted air handling units and various terminal units throughout the building.

2. One (1) additional nominal 28-ton capacity water-to-water heat pump will be dedicated for domestic hot water preheat.

3. Heat injection will be provided by a 100-bore closed-well geothermal system that will be used for heating, which will be sized to provide 3,000 MBH of heat.

4. Hot water is distributed throughout the building by two base mounted end suction secondary pumps (one is a full size spare), each controlled by a variable frequency drive (VFD).

5. Heating plant will be on stand-by electric power.

6. The heating system will be filled with 30% inhibitor type propylene glycol anti-freeze solution.

7. The geothermal system will be filled with 20% inhibitor type propylene glycol anti-freeze solution.

8. Freeze protection of 100% OA kitchen makeup air system shall be accomplished through the use of a freeze protection pump.

9. The backup space heating plant will consist of two 1,500 MBH gas fired high efficiency condensing hot water boilers each equipped with a variable flow primary pump. A heat exchanger will be provided for DHW preheat.

D3030 Cooling Generating Systems

1. Chilled water will be provided by the same water-to water system that provides space heating hot water, as described above. (12) separate modules will allow for the production of both hot and chilled water based on the building's demand, to create a 4-pipe system.
2. Heat rejection will be provided by the same 100-bore closed-well geothermal system, as described above, and will be sized to provide 300-tons of cooling.
3. Chilled water is distributed throughout the building by two base mounted end suction secondary pumps (one is a full size spare), each controlled by a variable frequency drive (VFD).
2. The chilled water system will be filled with 30% inhibitor type propylene glycol anti-freeze solution.
3. A 3-way valve will create a secondary pure water tempered chilled water loop for the chilled beams. Pumping for this loop will be by a duplex variable flow system (one is a full size spare), each controlled by a variable frequency drive (VFD).
4. Offices will be cooled by a packaged DX unit to allow for an operating schedule which differs from the school.

D3040 Distribution Systems

1. Classrooms
    a. Each typical classroom will be 900 SF and will be served by two 4'x4' ceiling induction units (active chilled beam) to maintain 76°F/50% RH cooling and 70°F heating set points, with individual space zone controls. Primary air will be provided by roof mounted ERU's.
    b. Each kindergarten classroom will be 1,100 SF and Art & Music classrooms will be 1,200 SF; will be served by two 4'x4' ceiling induction units (active chilled beam) to maintain 76°F/50% RH cooling and 70°F heating set points, with individual space zone controls. Primary air will be provided by roof mounted ERUs.
    c. The first stage of ERU heating is by the energy recovery wheel, and further heating is achieved through a hot water coil. The first stage of cooling is by the energy recovery wheel, and further cooling is achieved through a chilled water coil. The energy wheel stops to achieve economizer operations, which uses up to 100% outdoor air for free cooling when the outdoor air enthalpy is within an acceptable range. Supply air filtration is provided by MERV 8 prefilters and MERV 16 final filters; exhaust side has MERV 8 filters to protect the energy recovery wheel. The ERU's operate continuously with 100% outside air during occupied hours to provide ventilation.

d. The ERU's will be shut off during summer unoccupied hours. The ERU's will operate at 100% recirculation mode and at 67% fan speed during winter unoccupied periods to maintain 55°F setback set point.

e. Each classroom will be provided with a CO2 sensor as well as temperature and humidity sensor to continuously monitor the dew point of the space and shut off chilled water flow to prevent condensation in case a window is left open during summer.

f. The corridors will be conditioned by four pipe fan coil units.

2. Remaining Areas

a. Cafeteria

1) Will be served by a rooftop air handling unit which provides heating, cooling, and ventilation. Heating is provided by hot water and cooling is provided by a chilled water coil. Air filtration is provided by MERV 8 prefilters and MERV 16 final filters.

2) Fans are controlled by VFD's and operate at reduced speed and ramps up when required to meet the increased demand for heating or cooling.

3) Demand controlled ventilation modulates the outdoor airflow to reflect the actual occupancy based on readings at the return air carbon dioxide (CO2) sensor. The unit is also equipped with economizer which uses up to 100% outdoor air for free cooling when the outdoor air enthalpy is within an acceptable range.

4) FTR or radiant panels will be provided along the perimeter with large windows.

5) Fans and heating coil controls will be on stand-by electric power so that this space can be used as a temporary public shelter if required.

b. Kitchen

1) Kitchen requires approximately 4,000 CFM of exhaust and is connected to a dedicated exhaust fan. There is no dishwasher. The fan will run continuously during occupied hours.

2) Makeup air is provided by a 3,200 CFM indoor makeup air unit. Heating is provided by a hot water coil and cooling is provided by a chilled water coil. Air filtration is provided by MERV 8 prefilters and MERV 16 final filters. The make-up air unit will be interlocked to the kitchen exhaust hood.

3) Melink or equal variable volume system will be considered to modulate the kitchen exhaust and make up air system between 30%-100% to reflect the actual cooking demand as seen by the sensors, to achieve energy savings.

Offices

1) Will be served by a packaged variable air volume (VAV) rooftop HVAC unit. Heating is provided by a hot water coil, cooling is accomplished through a self contained DX system, air side economizer, and fans are equipped with VFD's. Demand controlled ventilation modulates the outdoor airflow to reflect the actual occupancy based on readings at the return air CO2 sensor. Air filtration is provided by MERV 8 prefilters and MERV 16 final filters.

2) Heating and cooling modulates to maintain supply air temperature set point, which will be reset based on outdoor condition. Supply fan modulates to maintain duct static pressure set point, which will be reset based on demand. Return fan tracks the supply fan. The unit is also equipped with economizer which uses up to 100% outdoor air for free cooling when the outdoor air enthalpy is within an acceptable range.

3) Each zone, comprising of individual space or group of spaces, will be served by a variable air volume (VAV) terminal box which consists of a motorized damper and a silencer. Each VAV box's supply air distribution ductwork will contain a 4-row duct mounted hot water reheat coil sized for maximum 500 FPM (due to low geothermal heating water temperature). Each zone will have its own heating/cooling controls.

d. The Library

1) Will be served by a single zone VAV roof mounted air handling unit which provides heating, cooling, and ventilation. Heating is provided by a hot water coil and cooling is provided by a chilled water coil. Air filtration is provided by MERV 8 prefilters and MERV 16 final filters.

2) Demand controlled ventilation modulates the outdoor airflow to reflect the actual occupancy based on readings at the return air CO2 sensor. The unit is also equipped with economizer which uses up to 100% outdoor air for free cooling when the outdoor air enthalpy is within an acceptable range.

3) Supply fan modulates from 100% to 50% to maintain space set point, on further reduction or increase in demand outside this fan parameter heating/cooling will be modulated to maintain set point. Return fan tracks the supply fan. The unit is also equipped with economizer which uses up to 100% outdoor air for free cooling when the outdoor air enthalpy is within an acceptable range.

The gymnasium

1) Will be served by a single zone VAV roof mounted air handling unit which provides heating, cooling, and ventilation. Heating is provided by a hot water coil and cooling is provided by a chilled water coil. Air filtration is provided by MERV 8 prefilters and MERV 16 final filters.

2) Demand controlled ventilation modulates the outdoor airflow to reflect the actual occupancy based on readings at the return air CO2 sensor. The unit is also equipped with economizer which uses up to 100% outdoor air for free cooling when the outdoor air enthalpy is within an acceptable range.

3) Supply fan modulates from 100% to 50% to maintain space set point, on further reduction or increase in demand outside this fan parameter heating/cooling will be modulated to mainbtain set point. Return fan tracks the supply fan. The unit is also equipped with economizer which uses up to 100% outdoor air for free cooling when the outdoor air enthalpy is within an acceptable range.

f. IT rooms will be cooled by a split DX system. Smaller electric and data rooms will be ventilated by fans.

g. Miscellaneous spaces throughout the building will contain convectors, cabinet unit heaters, and finned tube radiation for heating.

h. All entrance vestibules and stairways will be conditioned by four pipe fan coil units.

i. Utility spaces will be ventilated by intake louvers and exhaust fan, and heated by unit heaters.

D3060 Controls & Instrumentation

1. The building shall be controlled by a direct digital control (DDC).
2. Each space with a temperature sensor will have integral dual-circuit occupancy sensor to reduce energy.
3. The DDC system shall be based on open protocol BACnet interface technology, to allow for competitive future flexibility.
4. User interface will be based on high-end graphics and web based offsite accessibility.
5. The DDC System shall be capable of monitoring and controlling all points in the building HVAC system, energy recovery units (ERUs), boilers, pumps, heat pumps, air handling units, packaged HVAC units, and DX cooling units. In addition, the DDC system shall monitor certain points of plumbing system as well as other selected systems to provide means of energy conservation.
6. The DDC system will be on stand-by electric power to assure that heating system can continue to operate.
7. Integration as per the town of Lexington's standards.

D40 Fire Protection

D4010 Sprinklers

Building will be served from the new 6" fire service line from the street. Cross connection control shall be provided by use a supervised double check valve assembly backflow preventer on the fire service as it enters the building in a dedicated sprinkler room. A sprinkler riser with alarm check valve will be provided to meet the pressure and flow requirements of the sprinkler system.

The entire building shall be protected throughout with a wet automatic fire suppression system. The interior and exterior loading dock will have a dry sprinkler system. A fire department siamese connection will be provided within 100 feet of a fire hydrant. This system shall be designed in accordance with NFPA Standard 13, 2013, the Massachusetts State Building Code, 8th Edition and the town of Lexington Fire Department requirements.

Sprinklers shall be supplied from the standpipes. Floor control valve stations, consisting of a monitored shut-off valve, flow switch and an Inspector's test valve and sight glass, shall be provided at each floor take-off from the standpipe system. This shall report sprinkler flow to the fire alarm system on a floor-by-floor basis.

Sprinkler heads in electrical and mechanical rooms shall be standard response, 212 degree temperature listing. Sprinklers in all other areas shall be quick response heads.

D4020 Standpipes

Standpipes shall be supplied in all required egress stairs. Standpipes would be designed in accordance with NFPA Standard 14, 2014, and Lexington Fire Department requirements. Standpipes shall be located in each required egress stairway, and adjacent to the Stage. Additionally, standpipes shall be located so that no part of the building is more than 200 feet from a standpipe valve. Each standpipe shall be equipped with a 2 1/2" fire department hose valve with 1 1/2" reducer at the stair floor landing. Because the building is not a high rise, there is no minimum pressure requirement for the standpipes.

D4090 Fire Protection Systems

Standpipes & sprinklers shall be supplied from a dedicated water service, entering the building in the sprinkler room. The building service shall be equipped with a wet main alarm riser check valve, located at the service entrance. From there, this line would run to each stairways, and then up through the stairways as standpipes. Fire protection piping shall be schedule 40 piping with threaded fittings for any piping sized 2" and less. For sizes over 2", schedule 10 piping with roll grooved fittings and couplings shall be used. All valves controlling the flow of water shall be equipped with supervisory devices that report to the Fire Alarm system. Kitchen hood will be protected with a dry agent "Ansul R-102" packaged hood suppression system

D50 Electrical

D5010 Electrical Service & Distribution

Provide new secondary metered service to the building. Extend 2, underground, empty 5"C, from a pad mounted transformer near the building to location out at the street for connection to the utility. Primary cabling & transformer will be provided by Utility. Provide a 6'x6' transformer pad. Provide a 2000amp, 480V, 3 phase, 4W underground feeder from the utility transformer to a 2000amp, 480V, 3 phase, 4W main switchboard.

Provide a 500kW natural gas generator for optional standby and emergency loads. Emergency and options distribution will be electrically separated include two separate automatic transfer switches. The emergency distribution equipment will be installed in a dedicated 2hr rated closet separate from optional and normal distribution equipment.

Provide 480V and 208V distribution through the building connecting lighting and motor loads to the 480V distribution and convenience and other power to the 208V distribution.

Provide pathways including back boxes and conduit for communications, security and future classroom technology.

D5020 Lighting & Branch Wiring

Lighting will be primarily dimmable, linear LED type using either 1'x4' recessed or linear pendant indirect/direct approaches.

All lighting will be automatically controlled using a combination of Ceiling occupancy sensors in classrooms, offices and smaller spaces and programmable relays or controllable circuit breakers for larger spaces such as corridors and gymnasium. Perimeter spaces will have closed loop light level sensors 12' from window for 2 zone dimming control of primary and secondary daylight zones.

Selected fixtures in egress paths will be connected to emergency panels.

D5025 Submetering

To meet LEED, Advanced Energy Metering requirements, building loads will be metered by system. To accomplish this, all panels will have branch circuit monitors/metering systems to allow aggregating energy use by system type as follows:

1. Lighting panels
2. Receptacle loads
3. Kitchen Loads
4. HVAC ventilation
5. HVAC cooling
6. HVAC chiller

D5026 Distributed Antennae System (cell phone repeater)

The building will have a distributed antennae system for cell phone repeaters. The system shall be coordinated with the cell phone provider(s) identified by the Town of Lexington.

D5030 Communication & Security

Fire Alarm System

New addressable, voice evacuation, Class A supervised fire detection and alarm system meeting the requirements of the NFPA-72.

A new Master box connected to the Town's municipal loop will be provided at the main entrance and a separate 1" conduit with ISMA cabling will be provided out to the street for connection to the municipal loop.

Fire alarm control panel will be located in the main electric room with a LCD remote annunciator located at the Main entrance where the fire department responds to an alarm condition.

Since the building will be covered by a sprinkler system, full automatic detection is not required. System type smoke detectors shall be provided as a minimum in the main electrical room, electrical closets, elevator lobbies & machine room, data/telephone rooms, along exit paths and at the top of the stairways.

Fire suppression systems shall be tied to the fire alarm control panel.

Interface & control modules will be provided air handling unit shut down, smoke damper operation, door hold release, door hardware bypass elevator recall, and any other systems requiring control under an alarm condition.

Structured Cabling System

Telecommunication service will consist of Telephone and CATV services from service providers extended to a demarcation point in the first floor MDF Room.

Backbone cabling from the MDF will be extended to intermediate telephone/data rooms (IDFs) on each level.

Voice/data outlets shall be installed in all offices, library, classrooms, gym, Cafeteria, and conference rooms. Voice/data outlets shall be installed at every desk location in all offices.

Furnish and install conduits sleeves between technology equipment rooms (Network and Data rooms) and the above finished ceiling of nearest corridor. Provide vertical chases between floors to accommodate fiber optic cabling and multi-pair cabling between the main Network room and Data rooms. Provide OM4 12 strand 50 micron multimode fiber and 6 strand single mode fiber optic cable along with multi-pair voice riser cable between the main Network room and each of the Data rooms. Provide fiber patch panels and voice cross-connect blocks for multi-pair riser cable.

Furnish and install eight data drops in each classroom, one at the teacher's desk location, two on the opposite wall from the teacher's desk, 2 at the projector above the marker board, two for the wireless access point in the ceiling and one at the door for telephone.

Furnish and install two gang outlet box, plaster ring, with 1¼" conduit to nearest accessible ceiling, insulating bushings and pull line for all voice/data outlet locations. If nearby accessible ceiling is not feasible extend conduits to nearest Data Closet.

Furnish and install a structured cabling system consisting of Category 6A voice/data cable, modular jacks, patch panels, wiring blocks, racks, fiber optic cable, fiber patch panels, 2 and 4-post open equipment racks, devices plates, outlet boxes, conduit, etc. for a complete and fully functional voice/data/video system.

Each classroom, resource room, ELL and SLP rooms, Library/Media Center, and other designated instructional spaces shall have conduit pathways installed to support future wall mounted interactive LCD short throw projector and marker board. These pathways will include two double gang empty outlet boxes, with two 1¼" conduits from each box to the nearest accessible ceiling, insulating bushings and pull line for all future audio-video cabling shall be installed. Future cabling shall be provided with projectors under a separate contract during the furniture, fixtures and equipment phase of the project. If nearby accessible ceiling is not feasible extend conduits to nearest Data Closet.

Provide 100% wireless coverage in the building. Provide wireless access point ceiling cabling and wall enclosures at designated locations throughout the building. Provide two Category 6A data cables and outlets for connection of a future Wireless Access Pont to the building Local Area Network.

General Application of Telephone/Data Outlets

Location	Notes
Administrative & Private Offices	1 outlet at each work station consisting of 2 data and 1 telephone drop.
Shared Faculty Offices	1 outlet at each work station consisting of 2 data and 1 telephone drop.
Faculty Workrooms	1 outlet at each work station consisting of 2 data and 1 telephone drop.
General Classrooms	2 data drops for student stations. 2 data drops for teacher outlet consisting of 1 data and 1 telephone drop. 2 data drops for short throw projector at teaching wall, and 2 data drops for wireless access point in the ceiling.

Location	Notes
Elevator Machine Room	2 telephone drops.
Wireless Access Points (though out)	2 data drop per WAP point. Assume 15 points minimum.
Electric Vehicle Charging Station	1 data drop at each for network connection and demand response.

Distributed Communication System and Master Clock

Provide a Distributed Communication System (public address system) with speakers in all classrooms, offices, admin, conference rooms, library, gym, Cafeteria, corridors, and selected areas outside the school. The Distributed Communication system equipment shall be located in the main Network room. System shall be accessed directly thru a dynamic paging microphone located in the main office area, and also through telephone system handsets via dialing a special access code to make pages from any telephone handset. The Distributed Sound system shall be interfaced to the Master Clock system for scheduled bell tones.

Provide a new master clock system in the building. Secondary clocks shall be installed in all classrooms, offices, administration areas, and in all common spaces such as conference rooms, library, gym and Cafeteria. The master clock shall be located in the main Network room.

Digital Signage System

55” and/or 65” digital video signage displays shall be installed at three locations (Main Entrance, outside both the Gym and Cafeteria, which will support the distribution and display of customized school information and content.

Furnish and install all Category 6A cable, devices plates, outlet boxes, conduit, etc. for a complete and fully functional digital signage system.

Furnish and install two gang outlet box, plaster ring, 1¼” conduit to nearest accessible ceiling, insulating bushings and pull line for all digital Signage System outlet locations. If nearby accessible ceiling is not feasible extend conduits to nearest Data or Network room.

Gymnasium Local Sound System

The sound system shall be furnished with an amplifier, compact disk player, iPad or Smartphone Bluetooth interface, wireless microphone receiver, microphone outlets and an assistive listening system transmitter mounted in a sound system rack with a lockable door.

The sound system including permanently mounted speakers in the Gymnasium and shall provide for the pickup, amplification and simultaneous reproduction of any program audio source that is selected from any of the sound system inputs.

Program sources shall include rack mounted compact disc player; interface for presentation computer, tablet or Smartphone audio via Bluetooth and both wired and wireless microphone systems.

Music Rooms Local Sound System

The sound system shall be furnished with an amplifier, recorder compact disk player, Bluetooth amplifier interface, wireless microphone receiver, microphone outlets and an interface to the speech reinforcement system for broadcasting from the speech reinforcement system to the local sound system. System shall be mounted in a sound system rack with a lockable door. Provide speakers, mic jacks and wiring in the room.

Cafeteria Local Sound System and Projector

The sound system shall be furnished with an amplifier, compact disk player, iPad or Smartphone Bluetooth interface, wireless microphone receiver, microphone outlets and an assistive listening system transmitter mounted in a sound system rack with a lockable door.

The sound system including permanently mounted speakers in the Cafeteria shall provide for the pickup, amplification and simultaneous reproduction of any program audio source that is selected from any of the sound system inputs. Program sources shall include rack mounted compact disc player; interface for presentation computer, tablet or Smartphone audio via Bluetooth and both wired and wireless microphone systems.

A high lumen data projector shall be permanently mounted in the ceiling of the cafeteria that can be used with the electric screen recessed and mounted in the ceiling above the stage. Audio and video connections at the stage will be provided for interfacing presentation equipment (laptop) to the projector and the local sound system.

Audio-Video Door Intercom System

Furnish and install a video/audio door intercom system at the main entry doors and cafeteria exterior door for extended day pick up. These devices provide visual verification of visitors, two way communication and remote door release from inside the Main office (and Cafeteria for Extended Day pick up). The system shall include door stations, master stations, and all low voltage cabling and power supplies. Electronic door latch hardware shall be provided by the door vendor.

Classroom Speech Reinforcement System

Provide a speech reinforcement system in all classrooms, resource rooms, ELL and SLP rooms, Library/Media Center, and other designated instructional spaces. System shall consist of a ceiling flush mounted amplified speaker with integrated wireless capability for connecting to both teacher and student microphones, as well as other audio source equipment via a wireless media source connector.

Security System.

Furnish and install a complete security system including but limited to magnetic door contacts, motion detectors, sirens, keypad control panels, conduit and wire.

Furnish and install magnetic contacts on all exterior doors. Furnish and install motion detectors in gym, corridors, lobbies and all exterior window rooms.

Furnish and install a security camera system including server, color IP cameras, 360 degree cameras, camera housings, conduit and Category 6A cabling. Furnish and install interior IP cameras at all egress doors and corridors. Furnish and install exterior cameras around the exterior of the building. Furnish and install Ethernet switches with Power over Ethernet (PoE) ports for all IP security cameras. Furnish and install a Network Video Recorder (NVR), Video Management software system, and Client software. The NVR shall be sized for the recording and archiving of full motion video from all cameras for thirty (30) days of image storage.

Surveillance system head end equipment shall be located in the main Network room. Provide a dedicated rack for all video surveillance head end equipment including the NVR, rack-mounted monitor, and a UPS system.

Furnish and install a Card/Proximity Access Control system at the designated door locations. The system shall include Card/Proximity Readers, all low voltage cabling and power supplies, a system server with Management Software system.

Electronic door latch hardware and Request to Exit devices shall be provided by the door hardware vendor.

Furnish and install a complete conduit system for the security system. Furnish and install all required conduits, outlet boxes, pull lines, plaster rings, junction boxes required for a complete security system.

Lightning Protection System

A new lighting protection system, designed and installed in accordance with NFPA780 shall be provided. Air terminals will be bonded to a network of copper conductors on the roof. Copper downconductors will be bonded to the roof network and shall run down the side of the building, terminating in a connection to concrete encased ground rods.

The lightning protection system shall be bonded to the main building ground bar, building steel and all metallic service piping excluding any gas piping. Surge arrestors will be provided on the main electrical and telecommunication services to prevent lightning surges in the line damaging equipment or posing a hazard to occupants.

Technology Systems procured and installed during the FFE phase of the project:

Telephone and Voicemail System

Provide a telephone system in the building including telephone in all classrooms and at all teacher/staff workstations. The telephone system shall be capable of Voice over IP. Provide all head end equipment including a voice mail system sized appropriately for the number of users. Provide telephone handsets in all classrooms, at every desk in offices and in common spaces, such as conference room, library, Cafeteria, and gym. Mitel is the preferred vendor and a standard in the Lexington Public Schools.

Instructional Video Presentation Equipment

Video presentation equipment at all teaching stations including classrooms, resource rooms, ELL and SLP rooms, Library/Media Center, etc. Equipment shall include interactive ultrashort projectors and document cameras. Projectors shall be mounted to the wall with specialized cabling extending between the projector and a projector interface outlet on the teaching wall.

Computer Network Equipment

Computer network equipment shall include but not be limited to local area network switches, wireless access points, servers, teacher and staff computers, teacher tablets, student computers, Chromebooks and Chromebook carts, iPads and iPad carts, and printers in work rooms and specialized printer locations.

Portable Video Presentation System

High lumen projector with computer and video connections on a mobile cart for use in the Gym and/or other areas of the school

Visitor Management Security System

System for automating and conducting the verification and sign in of visitors to the school building. System will automatically scan visitor license information, verify the identity of the visitor, and print visitor badges for use while in the building.

Point of Sale System

Electronic cash register comprised of a custom computer and monitor, specialized software, bar code scanner, and designed specifically for automating the food service checkout functions of the cafeteria.

E 10 EQUIPMENT

E1010 Foodservice Equipment

The facility shall include all the necessary components of a functional kitchen to include a receiving area to be used as a staging point for the breakdown and distribution of delivered goods. Refrigerated rooms for the bulk storage of refrigerated and frozen products are to be offered and sized to accommodate the needs of the facility. Dry goods storage shall also be made available for the keeping of canned, boxed, and other non-refrigerated food items. Food grade storage shelving and dunnage platforms shall be provided for dry goods storage. In addition to dry food storage, a separate bulk paper goods storage room will be made available for storage of disposable items like plastic utensils, foam serving trays, and other paper related items.

Food preparation shall take place on stainless steel tables of various sizes and configurations. Tables may be fashioned with sinks, drawers, shelves, and overhead pot storage hooks. Motorized food preparation equipment such as a food slicer, food cutter, and mixer shall be provided. Sizing of this equipment will be based on the scope of food preparation as many purveyors now sell pre-prepared ingredients that are pre-washed and sliced.

Cooking shall take place in a central location adjacent to both food storage and preparation. Equipment shall consist of standard pieces such as convection ovens, boiling kettles, braising pans, steamers, and open burner range tops. Adjustments shall be made to cooking equipment to suite the specific menu.

A recycling room will be provided adjacent to the serving lines with a rinse sink for students to rinse and recycle disposable trays, containers and flat ware. The recycling room will be designed for future use as a tray wash room.The facility will include the necessary ware washing equipment to process ware, pots, trays, and pans.

Other support facilities located in the kitchen will include a staff toilet and a dedicated kitchen slop sink with enough space for the storage of mops, buckets, and detergents. A clothes washer and dryer will be provided for the washing of mop heads, aprons, and kitchen hand towels. Typically grouped with this equipment are employee locker accommodations for the storage of personal items like coats, handbags, or shoes.

Equipment that is required includes:

- Automatic food slicer, food processor.
- The kitchen must be provided with a mechanical means to wash ware and to sanitize area with a 180-degree rinse process.
- Walk in cooler and freezer, storage shelves, and mechanical refrigeration system.
- Dry storage shelving, can storage racks, and transport work carts.
- Prep tables with sinks, over shelves, and utility connection points.

- Mobile worktables, speed rack for sheet pans, and dunnage platforms for storage.
- Cooking equipment will consist of combination oven/steamer, convection oven, range top, steamer, braising pan, and kettle.
- Serving equipment will consist of counters, sneeze guard, cold pans, hot pans, display shelves, and air screed refrigerated display units.
- Miscellaneous kitchen equipment will consist of reach in refrigerators, hot food holding cabinets, and electrical drop cords.

Refer to the budget estimate for additional items.

E1030 Serving Area

Serving will take place on counters organized into a linear configuration allowing for orderly and secure serving of food products. Counter are grouped into multiple hot food serving lines that will serve the typical school lunch. These lines shall include the necessary equipment needed to provide the cold side offerings such as fruit, salads, and beverages.

Each of the lines will funnel into a common area large enough to accommodate the flow of traffic where the transaction is to take place. Counters with tray slides will be provided to accept "Point of Sale" terminals where students can pay with cash or type in a code that is linked to a declining balance pre-paid system.

E1090 Other Equipment

Theater and Stage Equipment

Cafeteria Platform Drapery – Stage drapery and traveler tracks including all rigging and accessories, as follows:

Main Stage Curtain: Bi-parting velour curtain (KM Majestic velour) with heavy duty and cord operated track (H&H 400 Series) and fixed velour front valence.

Rear Curtain: Bi-parting velour curtain (KM Majestic velour) with heavy duty cord operated track (H&H 400 Series).

Side Curtains: Two velour side curtains (KM Majestic velour) with walk-draw track (H&H 300 Series).

Projection Screen: Electrically operated screen at cafeteria stage, 12’-8” wide x 8’-0” high x 36” blackdrop (Da Lite, Stewart Film Screen, Draper).

Athletic Equipment: By Jaypro Sports, Porta, Draper, Spiceland, Hussey, or equal, as follows:

Main and Side Court Backstops: Ceiling (structure) mounted forward fold electrically operated backstop with glass backboard with padding and manual height adjustment feature.

Gym Divider Curtain: 50 feet wide by approximately 22' high, electrically operated. When fully raised, the lowest point of the curtain shall be approximately 20 feet above the main basketball court. Curtain fabric shall be flame resistant with the lower 8-foot section of curtain solid vinyl and the upper part 80% open polyester raschel knit.

Wall Mats: plywood backed, fire retardant treated 14 oz vinyl with 2" prime polyurethane core. Pads to be installed from 18" AFF to 7'0" AFF around full perimeter of gym.

Folding (Telescoping) Bleachers: 2 seating areas at 16'-0" long (in sections of 8'-0" lengths), 3 rows high, wall attached and manually operated. Clear southern pine seats and risers.

Dock Lift:

Scissors type electric hydraulic lift for loading via hand carts and four wheeled carts for pit mounting at the interior of the building, Blue Giant Lo Master Series (Advance Lifts, Inc., St. Charles, IL, Equipment Company of America, Hieleah, FL)

Appliances: Energy Star rated appliances as follows:

- Main Office - Refrigerator/freezer (undercounter) and microwave
- Staff Lunch / Work Rooms (2) - 18 CF Refrigerator / freezer, undercounter dishwasher, and 2 microwave ovens (each of 2 rooms)
- Extended Day - 18 CF Refrigerator / freezer
- Exam (Nurse) - Undercounter ice maker, 18 CF Refrigerator
- Kitchen: Heavy duty stacked washer/dryer

E20 FURNISHINGS

E2010 Fixed Furnishings

Window Shades: Manual roller shades at all occupied spaces in shad pocket (3% openness PVC-free); motorized double shades at cafeteria (3% openness and black-out).

Casework: Red oak, quarter sawn, book matched with concealed hinges, heavy duty drawer glides. Red oak veneer: rift cut, book matched.

G BUILDING SITEWORK

G10 Site Preparation

G1010 Site Clearing

Strip and remove from the site all topsoil within the project area below building and pavement footprint and within the work area.

G1020 Site Demolition and Relocations

Demolish existing pavements, remove trees, fencing and other existing site features as required for the new work.

G1030 Site Earthwork

Strip and remove from the site all existing topsoil to project subgrade or deeper as necessary within the structure footprint and below pavement areas.

G1040 Hazardous Waste Remediation – *Not Applicable*

G1050 Ledge / Rock Removal

Remove existing bedrock / ledge to project subgrade as required for the new work

G20 Site Improvements

G2010 Roadways

Bituminous Concrete Pavement Vehicular: (1.5) inch wearing course, (2) inch base course, (12) inch compacted gravel base.

Concrete Pavement Vehicular: 4000 psi, (9) inch reinforced concrete with #4 rebar @ (12) inch each way, (12) inch compacted gravel base, light broom finish, expansion joints, spaced at (20) feet maximum, shall have steel slip dowel connectors.

Cape Cod Berm: 12" wide x 4" high sloped bituminous concrete. Materials and installation per MDOT and Town of Lexington Department of Public Works Standards.

Concrete Pavement Vehicular - Colored: 4000 psi, (8) inch reinforced concrete with #4 rebar @ (12) inch each way, (12) inch compacted gravel base. Integral Color by Scofield or approved equal, color selected from standard colors. Expansion joints spaced at (20) feet maximum, shall have steel slip dowel connectors.

Granite Vertical Curb: (6) inch reveal, eased edges, saw top spit face granite both straight and curved piece, ease top edges, (18) inch depth. Lengths and radius of pieces vary. Depth and setting to match the Massachusetts Highway Department's Standards. Materials and installation per Massachusetts Highway Department's Standards (MHD).

G2020 Parking Lots

Bituminous Concrete Pavement Vehicular: (1.5) inch wearing course, (2) inch base course, (12) inch compacted gravel base.

Porous Bituminous Concrete Pavement Vehicular: The porous asphalt system for certain parking area is designed in accordance with the latest specifications and standards as developed by the University of New Hampshire Stormwater Center for cold climates. The system section includes 4 inches of permeable asphalt pavement, over a (23) inch base that includes four layers of graded gravels and open graded stone. These include a (4) inch thick graded crushed stone "Choker Course", an (8) inch thick sand "Filter Course", a (3) inch thick peastone "Filter

Course", and an (8) inch thick open graded crushed stone "Reservoir Course". Porous Asphalt is a "Limited Impact Development" stormwater Best Management Practice. Stormwater Management functions in include: water quality treatment; peak flow reduction; storm volume reduction; and groundwater recharge.

Granite Vertical Curb: (6) inch reveal, saw top spit face granite both straight and curved piece, ease top edges, (18) inch depth. Lengths and radius of pieces vary. Depth and setting to match the Massachusetts Highway Department's Standards. Materials and installation per Massachusetts Highway Department's Standards (MHD).

Cape Cod Berm: 12" wide x 4" high sloped bituminous concrete. Materials and installation per MDOT and Town of Lexington Department of Public Works Standards.

Vehicular Pavement Line Striping: Striping and Handicap Parking Symbols shall meet all applicable requirements of the Massachusetts Highway Department (MHD) and the manual of uniform traffic control devices (MUTCD).

Handicap Parking Signage: Metal signs on metal posts, (1) per handicap parking space. Signs shall meet all applicable requirements of the Massachusetts Highway Department (MHD) and the manual of uniform traffic control devices (MUTCD).

Parking for Electric Vehicle: will be clearly marked reserved for electric vehicles. Electric vehicle charging stations will be provided.

G2030 Pedestrian Paving

Flush Granite Curb: saw thermal top spit face granite both straight and curved piece, ease top edges, (18) inch depth. Lengths and radius of pieces vary. Depth and setting to match the Massachusetts Highway Department's Standards. Materials and installation per Massachusetts Highway Department's Standards (MHD).

Bituminous Concrete Pavement Pedestrian: (1) inch wearing course, (2) inch base course, (12) inch compacted gravel base.

Concrete Pavement Pedestrian: 4000 psi, (5) inch reinforced concrete with WWF 6x6 W2.9 X W2.9, (6) inch compacted gravel base, light broom finish. Expansion joints, spaced at (20) feet maximum, and tooled control joints spaced (4) feet max.

Concrete Pavement Pedestrian – Colored: 4000 psi, (5) inch reinforced concrete with WWF 6x6 W2.9 X W2.9, (6) inch compacted gravel base, light broom finish. Integral Color by Scofield or approved equal selected from standard colors. Expansion joints, spaced at (20) feet maximum, and tooled control joints spaced (4) feet max.

Handicap Curb Cut Ramps: Concrete Pavement Pedestrian and tactile surface.

Tactile Warning Surface: Conforming to the current ADA and MAAB regulations for Detectable Warning Surfaces. Vitrified polymer composite or homogeneous glass and carbon reinforced composite cast-in-place tiles, compressive strength: 28,000 psi minimum by: ADA Solutions, Inc., 800-372-0519; Armor Tile, 1-800-682-2525 or stainless steel cast-in-place tiles by Advantage Tactile Systems, Inc., 800-679-4022. Color selected by the Architect from standard color choices and as approved as a Federal Color.

Stone Dust Paving: (4) inch thick compacted stone dust resulting from the quarrying of bluestone. Set on (6) inches of compacted gravel base.

Bluestone Paving: Natural cleft finish irregular weathered 'flagstone like' bluestone, 2" minimum thickness. Sizes as shown on the drawings. Set in (4) inches of stone dust over (6) inches of crushed gravel base.

Log Paving: (1 – 1.5) foot diameter x (1) foot long logs cut from existing hardwood trees that are to be removed from the site. Log paving is to be set on end, flush with adjacent paving on compacted subgrade. Fill voids with compacted stone dust.

Bark Mulch Path: (6) foot wide path. Remove leaf litter and topsoil from pathway location, compact subgrade and install a (6) inch layer of shredded aged pine bark flush with adjacent elevation. Compact pathway.

G2040 Site Development

Cast In Place Concrete Retaining Wall: For height see drawings, 4500 psi, (18) inch thick, #5 vertical reinforcement @ (9) inch OC, #4 horizontal reinforcement @ (12) inch OC. Expansion joints @ (30) feet OC max. 4500 PSI concrete footing. #5 rebar @ (9) inch OC for footing. Metal handrails (42) inch high on top of the wall made with (1.5) inch O.D. rails. Footing width (5) feet deep and (18) inch thick.

Segmental Retaining Wall A: Modular units shall be the 50 series Gravity retaining wall, weathered edge as manufactured by Recon Retaining Walls available from Shea Concrete (800-696-7432). Units shall include corner pieces, full capstones, corner caps, middle caps and end caps etc. to complete the work. Color of concrete modular units shall be selected by the Landscape Architect from the manufacturer's standard colors and textures. System shall include accessories including but not limited to connecting pins, adhesive, unit fill, crushed stone drainage behind the wall and 6" pvc drain at bottom/back of wall. Contractor to supply shop drawings stamped by a MA registered structural engineer.

Segmental Retaining Wall B: Modular units shall be the 50 series Gravity retaining wall, weathered edge as manufactured by Recon Retaining Walls available from Shea Concrete (800-696-7432). **Note that in additions to the blocks required for the height of the wall that the blocks will need to be extended 3 feet below the bottom of wall due to the steep slope that the wall is being constructed on.** Units shall include (24) inch top face/(60) inch guardrail mounting block, corner pieces, full capstones, corner caps, middle caps and end caps etc. to complete the work. Color of concrete modular units shall be selected by the Landscape Architect from the manufacturer's standard colors and textures. System shall include accessories including but not limited to connecting pins, adhesive, unit fill, crushed stone drainage behind the wall and 6" pvc drain at bottom/back of wall. Contractor to supply shop drawings stamped by a MA registered structural engineer.

Precast Stone Walls: Retaining and Free Standing. Stone to be selected from (8) standard stone selections, varying height, structural interlocking system with reinforced concrete backing, reinforced concrete footing, geo-grid reinforcement and footing drain system structurally designed and provided by Natural Stone Wall Solutions, naturalstonewallsolutions.com. System to include geogrid, drainage aggregate and (6) inch footing drain pipe. Stamped shop drawings are required and completed by structural engineer. Contractor to supply shop drawings stamped by a MA registered structural engineer.

Stone Bands: Flush New England fieldstone to mimic the (2) foot width and design of the Stone Walls. Stone to be (1) foot deep minimum over (6) inches of gravel base.

Handicap Ramp: The same than Concrete Pavement Pedestrian with Galvanized Metal Handrails.

Precast Flagpole Base: Reinforced concrete footing, stainless steel dowels. Architectural Precast, 8' diameter, 2'-2" exposed, ½" radius at all edges with (3) flush uplights cast flush into the base. Color to be selected. Light sandblast finish.

Precast Seatwall: Reinforced concrete footing, stainless steel dowels at 2' on center. Architectural Precast seat walls 1'-6" wide x 2'-0" height (1'-6" exposed), ½" radius at all edges. Color to be selected. Light sandblast finish.

Asphalt Color Play Surfacing: Plexipave System as manufactured by California Products Corporation and distributed by Cape and Islands Tennis and Track, 800-540-3346. Court Patch Binder shall be used to correct any minor surface deficiencies in the Bituminous Concrete Surface. Tack Coat, Plexitac Binder, Rubber Granules (Color to be selected), Plexitrac Coating (Color to be selected), Plexicolor Line Paint, Plexicolor Pigment to be installed as recommended by the supplier.

Stone Boulders: Local natural New England fieldstone boulders where shown on the drawings. (2) feet x (2) feet to (6) feet x (6) feet random sizes.

Playground Safety Surface: Poured in place surface by Surface America, Inc., Contact: PO Box 157, Williamsville, NY 14231; Telephone: (800) 999-0555, (716) 632-8413; Fax: (716) 632-8324; B. Proprietary Products/Systems; or approved equal. Poured-in-place playground surfacing system, including the following: Polyurethane PlayBound Poured-In-Place Primer, (5) inch thick PlayBound Poured-in-Place Basemat, (.5) inch PlayBound Poured-In-Place Top Surface (6 colors) over (12) inch of crushed stone and Mirifi 140N filter fabric. Flat pipe spaced at (10) feet on center connected to the storm drainage system with solid (6) inch pvc pipes. Refer to G2060 and G2070 for system components.

G2050 Site Improvements

Trash and Recycling Receptacles: (6) - Chase Park trash receptacle by landscape forms, side opening, surface mounted. Liner: (36) gallon polyethylene, black. Polyester powder coat, standard silver/gray color.

Flagpole: (45) feet high concealed halyard cone-tapered aluminum flagpole of extruded tubing. Ground set and embedded in reinforced concrete foundation. Inside mounted winch. Flagpole to accommodate an 8' x 12' flag at a constant wind speed of (115) MPH. Manufactured by Concord Industries, 214-380-8186.

Benches: (8) Multiplicity benches, Ipe with back and backless, .25" carbon steel plate frame with powder coat finish, color by landscape forms.

Sculptural Benches: (9) G-01 TWIG benches. GFRC concrete, color to be selected. Tournesolsiteworks.com or landscapeforms.com.

Curved Wood Benches: (4), (2 x 2) inch square tube powdercoated metal frame and legs, (20) inches wide, (15) inches tall with Ipe wood wedge slats minimum (4) inches wide running perpendicular to the frame. All fasteners are to be stainless steel.

Log Seats: (1 – 2) foot diameter x (3) foot long logs cut from existing hardwood trees that are to be removed from the site. Log paving is to be set on end with (1.25 – 2) feet exposed.

Picnic Benches: (4) Charlie Tables, ADA 67" oval without umbrella hole, surface mounting hardware, color to be selected from 22 powdercoated color, metallic colors or 2013 color series options. Steel seat with perforated pattern and steel table top with perforated pattern. Manufactured by Landscape Forms, 800-381-3455.

Stainless Steel Bollards: (20) - Stainless Steel, (8) inch diameter x (3) feet exposed and a total length of (6) feet with flat top. Embed in reinforced concrete footing. Footing constructed to frost depth.

Removable Stainless Steel Bollards: (2) - Stainless Steel, (8) inch diameter x (3) feet exposed and a total length of (6) feet with flat top. Removable and lockable. Footing constructed to frost depth.

Metal Bollards: (20) painted metal bollard (6) inch diameter x (42) inch exposed with dome top. Embed in reinforced concrete footing. Footing constructed to frost depth.

Bicycle Racks: (16) - bola, stainless steel tubing with #4 satin finish, embedded by Landscape Forms, 800-381-3455.

Chain Link Fencing (4) feet high: Steel Pipe, brown PVC coated finish 2.375" OD end, corner, intermediate and pedestrian gate posts, 1.66" OD top and mid rails. Brown PVC coated, helically wound Aluminized 9 gauge (2) inch diamond mesh. All post caps, braces, sleeves, ties, clips, stretcher bars, truss rods and other accessories to be brown vinyl coated.

Chain Link Fencing (6) feet high: Steel Pipe, brown PVC coated finish 2.375" OD end, corner, intermediate and pedestrian gate posts, 1.66" OD top and mid rails. Vehicular gate post: (6) inch OD schedule 40 pipes, brown PVC coated. Aluminized 9 gauge (1) inch diamond mesh. All post caps, braces, sleeves, ties, clips, stretcher bars, truss rods and other accessories to be brown vinyl coated.

Baseball Backstop: Steel pipe, PVC coated finish, 4" OD end, corner and line posts and 2" OD horizontal rail and roof members. PVC coated helically wound and woven 2" diamond mesh roof fabric and side fabric, diamond mesh of 9 gauge core wire for roof and 6 gauge for side fabric. All post caps, braces, sleeves, ties, clips, stretcher bars, truss rods and other accessories to be vinyl coated.

Home Plate and Pitching Rubber: HP-100 Bury All Home Plate and PR-424 movable pitching rubber by Jaypro, 800-243-0533.

Dugout Benches: Provide products which meet or exceed this equipment by Gametime (800) 235-2440 or Equal. Bench: 8 foot bench with back # P1842, bolt-down, with expansion bolts. Frame Color: Dark green powder coat. Seat and Back Color: Dark green PVC.

Infield Surface: Manufactured by Partac Peat Corporation, Kelsey Park, Great Meadow, New Jersey, (908) 637-4191 or Approved Equal. Beam Clay Baseball Diamond Infield Mix, Beam Clay Pitcher's Mound Mix and Beam Clay Home Plate Mix, depth as recommended by the manufacturer.

Home Plate and Pitching Rubber: Provide products which meets or exceeds the requirements of this equipment by Jaypro (800) 243-0533 or Equal. Home Plate: HP-100 Bury-All Home Plate. Pitching Rubber: PR-424, Movable

Wood Cedar Fence: (6) foot high cedar fence. (5-1/2) in posts with beveled top, (3) (3- ½) inch horizontal rails, (3- 5/8) inch ship lap V grooved vertical boards with (2) inch cap piece. Mortise and tenon construction by Walpole Woodworkers, walpolewoodworkers.com.

Ornamental Double Leaf Gate: (4) foot high cedar fence. (5-1/2) in posts with beveled top, (3) (3- ½) inch horizontal rails, (3- 5/8) inch ship lap V grooved vertical boards with (2) inch cap piece, gate hardware, latches and hinges. Mortise and tenon construction by Walpole Woodworkers, walpolewoodworkers.com.

Ornamental Fence at Bus Area: 4' high anodized aluminum picket fencing. The posts and rails shall be extruded HS-35 aluminum alloy having a minimum yield strength of 35,000 psi. All pickets shall have a minimum yield strength of 25,000 psi. Minimum (3/4) inches x (.050) inches thick. Spacing between pickets shall be a maximum of (4) inches on center. Style #202 by Jerith Manufacturing.

Basketball Goal: (1) hoop by Porter (603) 929-4384 or Equal. Heavy duty Gooseneck Pole – #176, 5-9/16" diameter pole with (6) foot extension. Backboard and Goal - #00176540, rectangular backboard and heavy-duty orange rim with tamper proof hardware and cloth net.

Decorative Gravel: Smooth water washed riverstone, multi-color consisting of grays, beige, burgundy and brown stone. (3) inch to (6) inch size.

G2060 Landscape Drainage:

Drainage to be installed in the Drainage Blanket under the Amended Sport Field Topsoil and under the Playground Safety Surface:

Ridged and Perforated PVC Pipe and Fittings: SDR-35.

Solid and Perforated Flexible Pipe and Fittings: ADS/Advanced Drainage Systems, 800-821-6710.

Filter Fabric: Mirifi #140.

Rigid Pipe: (6) inch solid And Perforated PVC Drain Pipe And Fittings.

Flexible Pipe: (6) inch Solid And Perforated Pipe And Fittings

Flat Pipe: (12) inch Advanedge Flat Pipe and Accessories as Manufactured by Advanced Drainage Systems, Inc., 1-800-733-9554.

Drainage Blanket: Granular fill as required for fill beneath sports field areas shall be uniformly graded sand or sand and gravel consisting of clean, inert, rounded grains of quartz or other durable rock and free from loam or clay, surface coatings, mica, other deleterious materials with the following gradation.

Percent Passing		
U.S. Sieve No.	Minimum	Maximum
4 inches		100
1 inch	70	100
Number 4	40	100
40	15	50
200	0	15
0.002mm	0	0.5

Tests shall be by combined hydrometer and wet sieving in compliance with ASTM D422.

The ratio of the particle size for 70% passing (D70) to the particle size for 20% passing (D10) shall be 8.0 or less. (D70/D20 < 8.0)

The saturated hydraulic conductivity of the fill shall not less than 2 inches per hour according to ASTM D5856-95 (2000) when compacted to a minimum of 92% Standard Proctor, ASTM 698.

G2070 Soil Preparation:

Topsoil: Existing and stockpiled on site.

Coarse Sand: Uniformly graded coarse sand for soil mixing and the Drainage Blanket.

U.S. Sieve No.	Minimum	Maximum
4	100	
10	70	100
20	40	75
40	15	40
100	0	12
200	0	5
0.002mm clay	0	0.30

Drainage Blanket: Coarse sand (12) inches in depth installed under the Amended Topsoil for Sportsfields.

Compost: Stable humus-like material produced from aerobic decomposition of biosolids amended with yard trimmings, agricultural residuals and/or source separated municipal waste.

Chemical Fertilizers: As required and recommended by testing laboratory.

Subgrade Scarification: Discing, ripping or rototilling (18) inch deep.

Amended Topsoil for Sportsfields: 1 part topsoil, 1.5 part coarse sand, 1.5 part compost. 12" deep for sportsfields.

Amended Topsoil for General Lawns and Plant Backfill Mix: 1 parts topsoil, 1 part course sand and 1 part compost. 6" deep for general lawn areas.

G2080 Landscaping

All plants shall be specimen quality per the American Standard of Nurserymen

Provide amended topsoil for backfill mix in all planting pits and beds. Provide a continuous (18) inch minimum layer for all plant beds. Provide imported topsoil for backfill mix (12) inch minimum around the sides of all root balls.

Provide a minimum of (6) inch of amended topsoil for all lawn areas.

Mulching: All planting beds and tree pits shall be mulched with a (2) inch layer of mulch which shall be shredded aged pine bark.

Trees: As shown on the drawings. All trees shall be staked and guyed.

Shrubs: As shown on the drawings.

Groundcovers: As shown on the drawings.

Lawns: Seed mix shall be 30% Kentucky Bluegrass, 30% Fescue, 30% Perennial Rye Grass.

Sports Field Lawns: Seed mix shall be 10% Perennial Rye Grass and 90% Kentucky Bluegrass. Seed with cultipac seeder.% Annual rye grass. Hydroseed with hydromulch.

Conservation Seed Mix: New England Roadside Conservation Seed Mix.

Sod for Sports Field Lawns: 100% Kentucky Bluegrass.

Lawn Maintenance: Warranty and replacement 90-day maintenance by the Contractor, 90-day replacement and warranty by the Contractor. The Owner's Maintenance begins at the acceptance of the 90-day Maintenance.

Plant Warranty: Warrant and replacement for One Year after the end of the 90-Day Maintenance Period.

G2090 Irrigation:

Provide and underground, automatic irrigation system for the softball field using city water. Provide all necessary water and electrical connections for the irrigation system.

G30 Site Mechanical Utilities

G3010 Water Supply

Water supply for domestic water service and fire protection will be from the existing Town of Lexington 12 inch water main in Massachusetts Avenue and will loop through the site to connect to the 6 inch water main in Crosby Road and the water main in Roosevelt Street.

Under the proposed plan, new water services from the Town water main will be provided for domestic use and fire protection purposes. This will consist of an 8 inch CLDI water main loop connecting at three locations to the existing mains. A 4 inch domestic water service and a separate 8 inch fire service will supply water to the building from the new water main loop.

Three new exterior fire hydrants will be provided around the building off the new water main loop.

The existing water services to the existing building will be cut and capped at the existing mains when no longer needed to serve the existing building.

G3020 Sanitary Sewer

Sanitary sewer for the building will connect to an on-site existing manhole near Massachusetts Avenue that joins into the existing 14 inch Main that runs along the western side of the site.

The proposed site system will consist of a 4 inch gravity sewer to convey kitchen waste and a 6 inch sewer for domestic waste. A 2,000 gallon external grease trap will be provided for the Kitchen waste. A 6 inch sanitary sewer is provided for the domestic waste. The proposed site sewer will be an 8 inch PVC pipe. Sewer manholes will be provided at all changes in direction and at intervals not more than 250 feet.

The new sewers beyond 10' of the foundation wall shall be constructed of SDR 35 PVC pipe. The sewer system will be gravity flow.

See D2030 Sanitary Waste *for more information.*

G3030 Storm Sewer

The Stormwater Management System for the proposed project will be designed to bring the site into full compliance with the current Lexington Stormwater Regulations, Wetlands Protection Bylaw and the Massachusetts Department of Environmental Protection (MassDEP) Stormwater Management Regulations. Meeting these regulations will assure the Town will be in compliance with their NPDES Phase II Permit from the U.S. Environmental Protection Agency for this project. This will also protect the existing Town and State Stormwater System and on-site and downstream wetlands and surface and groundwater resources.

Stormwater runoff from the site dischargers generally to a wetland and intermittent stream system located in the western portion of the site. The site and the wetland are tributary to Hobbs Brook that flows to the Cambridge water supply reservoir. This is classified as an "Outstanding Water Resource" under the Mass. Surface Water Quality Standards, and as a "Critical Area" under the Mass. Stormwater Management Regulations. These require higher than standard treatment for stormwater discharges that must be complied with. The Town of Lexington Bylaws and Regulations regarding Stormwater Management also have higher levels of treatment and groundwater recharge than state standards.

To meet the above requirements, the site stormwater will be managed utilizing several stormwater Best Management Practices (BMPs) selected to fit into the project. These include the following:

Bio-retention Basin

A "Bio-Retention Basin" (aka Rain Gardens) is planned to provide for water quality treatment and recharge for the east driveway. This is an open vegetated shallow basin which filters water through a special soil mix in the basin bottom. The Rain Gardens will overflow to the storm drain system through an outlet control structure. Pre-treatment will include deep sump catch basins and sediment forebays at the ends of the main basin.

Underground Recharge Systems:

Several underground recharge systems are proposed to provide recharge and flow attenuation from the impervious areas of the site including the building, paved plazas / play areas, and driveways. Due to shallow groundwater conditions, the systems will be low profile and will consist of concrete leaching chambers surrounded with open grade washed stone and filter fabric. Chambers under vehicular pavement areas will be pre-cast concrete. Systems not subject to vehicle loads will be plastic (HDPE) arch type chamber systems. Overflows will be to the drain piped drain system or to the woodland to the west of the site.

Porous Rubber Play Surfaces

These are rapidly permeable play surfaces that will receive some runoff from the adjacent paved play areas. To accept the added runoff from the adjacent play areas, an 8 inch thick stone bed will be added below the play surface to serve as a reservoir course for storage and to facilitate exfiltration (recharge) to the underlying soil. The porous rubber play surfaces are further described in the landscape sections.

Porous Asphalt Pavement at the Main Parking Lot:

This system is part of the overall stormwater management system and is described above under the pavement section of this Narrative. Porous Asphalt is a "Limited Impact Development" stormwater Best Management Practice. Stormwater Management functions include: water quality treatment; peak flow reduction; storm volume reduction; and groundwater recharge.

Stormwater Treatment Units (Particle Separators)

These are structural water quality treatment systems designed to meet the water quality discharge standards of the Massachusetts Stormwater Management Regulations. In this case they will be used where added pre-treatment is necessary where other space is not sufficient for normal pretreatment systems. They designed to remove a minimum of 50 percent of the annual total suspended solids load and will also trap floating debris and hydrocarbons such as gasoline and oils. There are several types of these units available that are suitable for this purpose including “Stormceptor”, “CDS Technologys Units” “Downstream Defender” and “Baysaver” to name a few.

Pipe Drain Systems

All piped collection systems including site drains and roof drains will be designed for a minimum 25 year storm flow capacity. Piping systems will be PVC SDR 35 pipe or HDPE (High Density Polyethylene) except in areas of minimal cover or special load requirements.

Catch Basins

Catch Basins for driveways and parking areas will be precast concrete structures with a 4 foot deep sump below the outlet pipe invert. Each catch basin will include an oil and gas trap hood meeting the Town of Lexington DPW standards.

G3060 Fuel Distribution (Gas)

Gas supply to the building will be from the existing 4-inch gas main - closest point from the Street. The service to the building is to be sized by the gas utility company. The gas service to the existing school will be relocated to continue service to the existing building during construction.

G40 Site Electrical Utilities

G4010 Electrical Distribution

Two empty 5” conduits will be extended underground from a pad mounted transformer location near the building to a utility pole on Crosby St for the utility’s primary service. A concrete transformer pad will be provided for the utility’s pad mounted transformer. The primary electric service voltage for the pad mounted transformer will be 13.8 KV and the secondary electric service voltage will be 277/480-volts, 3-phase, 4-wire.

Secondary service conductors will be extended in multiple parallel sets of concrete encased schedule 40 conduits from the pad-mounted transformer to the secondary switchboard located in the new electric room in the school.

G4020 Site Lighting

New site lighting will be provided for walkways, roadways and parking lots. Light poles will have reinforced concrete bases and shall be dark sky compliant. All site lighting will be connected to the networked lighting control system and will be controlled by time schedule.

Roadway and Parking Lot Light Fixtures – IES Full cut-off LED fixtures on 20'-0" pole.

Walkway Light Fixtures - IES Full cut-off LED fixture on 14'-0" pole.

Building mounted lighting fixtures – Building mounted full cut off, LED lighting fixtures shall be provided as required at all doors and for building security.

G4030 Site Communications & Security

Furnish and install four 4" underground communication service conduits in concrete encased duct banks and manholes from the existing utility company pole. Typical for telephone, cable TV, fire alarm and spare.

LIFE CYCLE COST ANALYSIS

Introduction

In accordance with MGL c. 149 §44M and in consultation with our engineering consultants, we have prepared preliminary life cycle cost analyses (LCCA) to determine which design decisions related to all energy and water consuming devices and overall building operation and maintenance are the most cost effective.

Indoor Potable Water Use Reduction

The projected indoor potable water use reduction has been calculated according to the methodology prescribed by the LEED BD+C: Schools v4 for Indoor Water Systems. The water use savings projections are based upon the comparisons of the following:

- Design Indoor Water Use Consumption vs. Baseline Indoor Water Use Consumption (LEEDv4 and Massachusetts Code 9th Edition)
- Resulting design Sewage Conveyance Water Use Consumption vs. Baseline Sewage Conveyance Water Use Consumption (248 CMR Base Case Plumbing Code 2009)

HVAC Systems

The HVAC systems LCCA is based upon the chosen geothermal system for plant heating/cooling as well as an induction system for major airside distribution within the building.

Electrical Systems

The Electrical systems LCCA is provided for the following systems:

- Lighting Fixtures

Indoor Potable Water Use Reduction

Preliminary LCCA has been performed for potable water consumption for indoor water systems. The projected indoor potable water use reduction has been calculated according to the methodology prescribed by the LEED BD+C: Schools Credit 2- Indoor Water Use Reduction.

Calculation for potable water use is performed through low flow water plumbing fixture and compared with base case required by code.

Water Efficiency

LEED- Water Efficiency

BASE CASE (248 CMR Plumbing Code)

PROJECT : HASTINGS ELEMENTARY SCHOOL

Credit 2 - Water use Reduction

Baseline Indoor Water Consumption Calculation

Fixture Type	Flow-rate	Rate	Duration		Occupants	Daily Uses	Water Use
Conventional Toilet (Male)	1.6	gpf	1	flush	380	1	608
Conventional Urinals (Male)	1.0	gpf	1	flush	380	2	760
Conventional Toilet (Female)	1.6	gpf	1	flush	380	3	1824
Lavatory (per LEED v4)	0.5	gal/min	0.5	min.	760	3	570
Class Room Sinks	2.2	gal/min	0.25	min.	675	1	371
Hand sink-kitchen	2.2	gal/min	0.25	min.	115	1	63

Total Daily Volume	4197
Number of School Days	180
Design Total Annual Volume (gal)	755,370.00

DESIGNED

PROJECT : HASTINGS ELEMENTARY SCHOOL

Credit 2 - Water use Reduction

Design Indoor Water Consumption Calculation

Fixture Type	Flow-rate	Rate	Duration		Occupants	Daily Uses	Water Use
Low flow Flush Toilet (Male)	1.1	gpf	1	flush	380	1	418
Urinals (ultra low flow)	0.000	gpf	1	flush	380	2	0
Low Flow Flush Toilet (Female)	1.1	gpf	1	flush	380	3	1254
Lavatory (low flow hand free)	0.35	gal/min	0.5	min.	760	3	399
Class Room Sinks	1.5	gal/min	0.25	min.	675	1	253
Hand Sink - Kitchen	1.5	gal/min	0.25	min.	115	1	43

Total Daily Volume	2367
Number of School Days	180
Design Total Annual Volume (gal)	426,105.00

Credit Water Efficiency-Credit 3 water use reduction.

Design	Annual Water Consumption (gal)	Annual Water Savings (gal)	% of Water Reduction
Designed	**426,105.00**	**329,265.00**	**43.59%**
Baseline	**755,370.00**		

Total annual potable savings are 329,265 gallons or 44,019 cubic feet water and sewer saving (1 cu = 7.48 gal). Cost savings can be calculated based on the Town of Lexington Water Department.

Water Conservation & LCCA

Conservation Method	Number of Installations	Incremental Initial Cost ($/unit)	Incremental Initial Cost ($)	Annual Savings ($)		Maintenance Costs	Payback Period* (yrs) *Includes Direct Energy Only*
				Direct Water	Direct Energy		
Installation of ULF toilets	39	$20.00	$780.00	$1,804.00	$0.00	$0.00	0.43
Installation of waterless urinals	10	-$252.00	-$2,520.00	$1,804.00	$0.00	$555.00	-2.02
Installation of faucet aerators (Class room sinks & kitchen sinks)	35	$15.00	$525.00	$197.00	$423.00	$0.00	0.85
Total (excluding Landscape)			-$1,215.00	$3,805.00	$423.00	$555.00	-0.74

HVAC Systems

The LCCA analysis of the geothermal & induction unit HVAC distribution system has been prepared and the results are shown below.

The analysis is based on the following assumptions:

Initial Costs: The costs for an induction unit system are based upon the schematic design cost estimate of $4,862,536 from A.M. Fogarty dated June 20, 2017.

Maintenance Costs: The system will be maintained by the same in-house maintenance crew that the school department already pays salaries for. Therefore, maintenance costs have not been added.

Yearly Energy Expenses: $111,029 with 3% yearly escalation (refer to the attached Energy Report by the Green Engineer).

Induction Unit System LCCA:

CALCULATION SHEET		VAV International, Inc.
Project:	Lexington Hastings Elementary School	400 West Cummings Park S. 4700
Subject:	Induction System	Woburn, MA 01801
Calculated By:	JH	Date: June 23, 2017

LIFE CYCLE COST ANALYSIS (present worth of net cash flow)

	Description:	Induction Unit System		
Interest Rate:	7.00%	Investment Required	$6,093,307	
Income Tax Rate:	0.00%			
Years of Study:	20			
	Initial Costs:	$4,862,536		

Year	Income	Expenses	Net Income	Deductions	Taxable Income	Income Taxes	Net Cash Flow	Present Worth of Cash Flow	Accumulated Present Worth
0							($4,862,536)	($4,862,536)	
1	$0	$0	$0	$0	$0	$0	$0	$0	($4,862,536)
2	$0	$102,276	($102,276)	$0	($102,276)	$0	($102,276)	($89,328)	($4,951,864)
3	$0	$105,344	($105,344)	$0	($105,344)	$0	($105,344)	($85,987)	($5,037,851)
4	$0	$108,505	($108,505)	$0	($108,505)	$0	($108,505)	($82,771)	($5,120,622)
5	$0	$111,760	($111,760)	$0	($111,760)	$0	($111,760)	($79,675)	($5,200,297)
6	$0	$115,113	($115,113)	$0	($115,113)	$0	($115,113)	($76,696)	($5,276,993)
7	$0	$118,566	($118,566)	$0	($118,566)	$0	($118,566)	($73,827)	($5,350,820)
8	$0	$122,123	($122,123)	$0	($122,123)	$0	($122,123)	($71,066)	($5,421,886)
9	$0	$125,787	($125,787)	$0	($125,787)	$0	($125,787)	($68,408)	($5,490,294)
10	$0	$129,560	($129,560)	$0	($129,560)	$0	($129,560)	($65,850)	($5,556,144)
11	$0	$133,447	($133,447)	$0	($133,447)	$0	($133,447)	($63,387)	($5,619,531)
12	$0	$137,450	($137,450)	$0	($137,450)	$0	($137,450)	($61,016)	($5,680,547)
13	$0	$141,574	($141,574)	$0	($141,574)	$0	($141,574)	($58,734)	($5,739,281)
14	$0	$145,821	($145,821)	$0	($145,821)	$0	($145,821)	($56,538)	($5,795,819)
15	$0	$150,196	($150,196)	$0	($150,196)	$0	($150,196)	($54,423)	($5,850,242)
16	$0	$154,702	($154,702)	$0	($154,702)	$0	($154,702)	($52,388)	($5,902,630)
17	$0	$159,343	($159,343)	$0	($159,343)	$0	($159,343)	($50,428)	($5,953,058)
18	$0	$164,123	($164,123)	$0	($164,123)	$0	($164,123)	($48,542)	($6,001,600)
19	$0	$169,047	($169,047)	$0	($169,047)	$0	($169,047)	($46,727)	($6,048,327)
20	$0	$174,118	($174,118)	$0	($174,118)	$0	($174,118)	($44,979)	($6,093,307)
	$0	$2,568,853	($2,568,853)	$0	($2,568,853)	$0	($7,431,389)	($6,093,307)	

HVAC LCCA Summary

A summary of the Induction Unit HVAC Systems based on a 20 year LCCA is shown below.

Summary of Findings:

Induction Unit System

Initial Cost:	**$4,862,536**
Annual Energy Cost:	**$102,276**
Investment Required:	**$6,093,307**

Electrical Systems

High Efficiency Lighting & Lighting Control Systems

High efficiency lighting fixtures and lighting controls which automatically turn off fixtures based on space occupancy or time schedule are strategies incorporated in the electric lighting design and specification for the Hastings Elementary School.

Lighting Power Density Analysis

The specification of highly efficient LED light fixtures and an efficient layout of those fixtures results in a lighting power density of 0.60 watts per square foot for the proposed Hastings Elementary School. The Massachusetts Commercial Energy Code allows 0.87 watts per square foot maximum for School/University Building Types. This is a **savings of 31%** based on fixture specification and layout alone.

The LCCA analysis of the Proposed Lighting Design vs. the MA Code compliant Base Design is shown below and indicates a cost savings of $33,286 over 10 years in favor of the proposed design.

Lighting Life Cycle Cost Analysis for High Performance Lighting Fixtures & Layout

Interest/discount rate	5%	
Energy Rate	$0.17	per kWhr
Energy inflation rate	3%	
LCC range	10	years

	Year									
Base System (0.87 W/sf)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Annual Energy Costs (future valuew/inflation)	$37,419	$38,541	$39,697	$40,888	$42,115	$43,379	$44,680	$46,020	$47,401	$48,823
Annual Energy Costs (net present value)	$35,637	$34,958	$34,292	$33,639	$32,998	$32,370	$31,753	$31,148	$30,555	$29,973

Capital Cost	$614,671
Cummulative Energy costs	$327,324
Total Life Cycle Cost	**$941,995**

	Year									
High Performance System (0.6 W/sf)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Annual Energy Costs (future valuew/inflation)	$25,806	$26,580	$27,378	$28,199	$29,045	$29,916	$30,814	$31,738	$32,690	$33,671
Annual Energy Costs (net present value)	$24,577	$24,109	$23,650	$23,199	$22,757	$22,324	$21,899	$21,482	$21,072	$20,671

Capital Cost	$682,968
Cummulative Energy costs	$225,740
Total Life Cycle Cost	**$908,708**

Net LCC Savings of Proposed System	$33,286

The Green Engineer, Inc.

Sustainable Design Consulting

Hastings Elementary School Energy Analysis

To: Donna DiNisco, Principal
From: Anthony Hardman, PE
Date: June 28, 2017
Project: HASTINGS SCHOOL, Lexington, MA

I. Executive Summary

A Schematic Development level energy analysis has been conducted for the Hastings Elementary School project using an 8 May 2017 pricing set and supplemental guidance provided by the design team via emails and conference calls. Project scope includes about 110,000 SF of classrooms, offices, a gymnasium, a kitchen, a cafeteria and support spaces. A geothermal heating and cooling design alternative is also included in this analysis. The analysis assumes the ASHRAE 90.1-2013 / IECC 2015 energy code as the baseline, which is consistent with state permitting requirements. An interpolation table is used to adjust performance to LEED v4 requirements, which reference an older baseline energy code. Performance against both the "code" baseline and "LEED" baseline is provided to satisfy state permitting requirements and MSBA incentive requirements respectively. Figure 1 presents the energy use index (EUI) of the code baseline, proposed and proposed geothermal buildings. Additionally, each pie slice in the graphic represents a distinct energy enduse that is represented in the total building EUI. In summary, both the conventional and geothermal designs exceed stretch code and MSBA requirements with 17.3% and 49.7% site energy savings respectively. This corresponds to a LEED energy cost savings of 21.1% and 16.2% respectively, which qualifies for an additional 2% in MSBA funding. It is important to note the distinction that stretch code references *energy* performance while LEED references *energy cost* performance. Data for the geothermal design alternative is included in Table 1.

Figure 1: Building EUI Comparison by Case

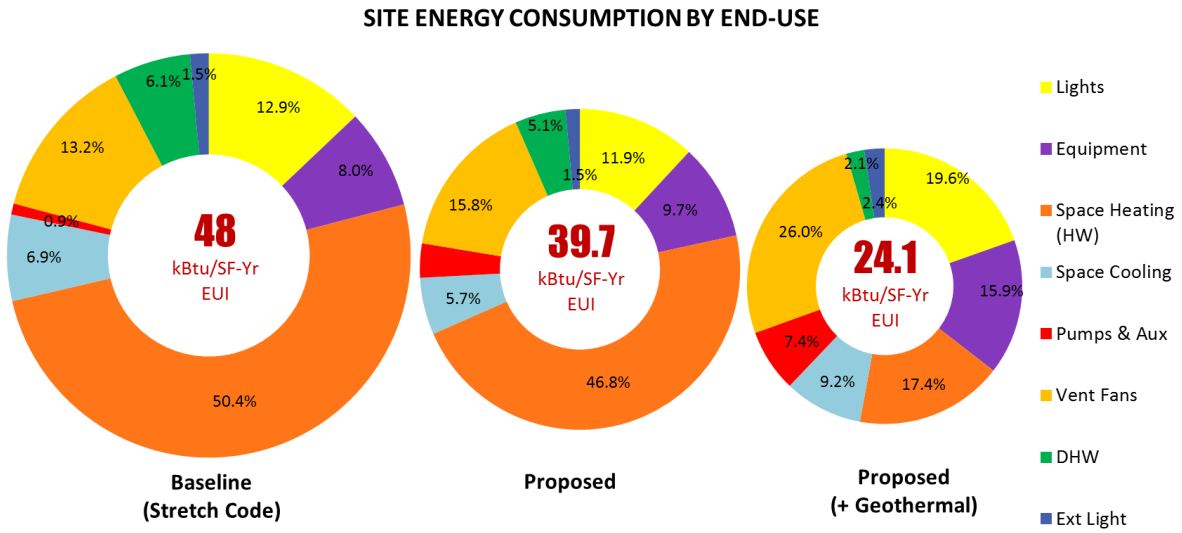


Figure 2 compares simulated energy use to actual energy use of similar, local, recently constructed elementary schools and is provided for reference purposes only. The blue columns represent simulated energy use data of the building as designed. The grey columns represent actual benchmarked energy use data while the blue columns represent simulated energy use data of the

two Hastings design alternatives. Simulated energy use is determined following energy code modeling protocol. The energy code modeling protocol governs most (but not all) energy use components in a representative building. Due to these ungoverned loads, in addition to other variables discussed in Section II, simulated energy use is typically less than actual operating energy use. Despite these limitations, the results correlate well to historical energy use for a newly constructed elementary school.

Figure 2: Historical Benchmark EUI (Grey) vs Simulated EUI (Blue)

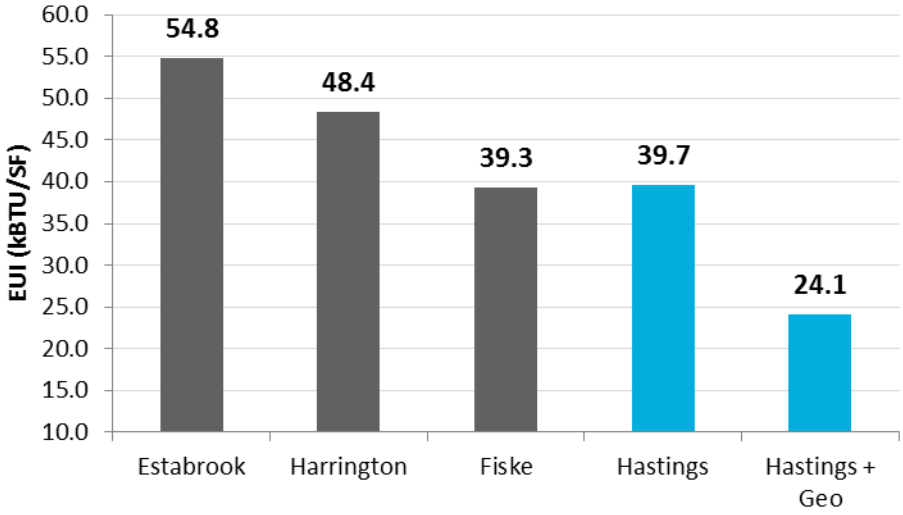


Table 1 summarizes key performance metrics for the project. Annual energy use and cost are reported for each case. Energy use savings are required to show compliance against the state energy code while energy cost savings can be used to determine the number of eligible LEED points.

Table 1: Energy Use by Case

CASE	ENERGY USE (MBTU)	ENERGY SAVINGS OVER CODE (%)	ENERGY SAVINGS OVER LEED (%)	COST SAVINGS OVER CODE (%)	COST SAVINGS OVER LEED (%)
Code Baseline	5,243	N/A	N/A	N/A	N/A
LEED Baseline	5,705	N/A	N/A	N/A	N/A
Proposed	4,334	17.3%	24.0%	11.2%	21.1%
Proposed + Geo	2,636	49.7%	53.8%	5.7%	16.2%

All "LEED Baseline" energy use and energy cost data contained in the tables of this report are interpolated values based on studies published by the Department of Energy[1]. The department of energy study indicates that the ASHRAE 90.1-2013 energy code outperforms the ASHRAE 90.1-2010 energy code by 8% on an energy basis and 11% on an energy cost basis for the primary school building type. Therefore, LEED baseline energy use and cost data was calculated using the following equations:

$$LEED\ Baseline\ Energy\ Cost = \frac{Code\ Baseline\ Energy\ Cost}{(1 - 11\%)}$$

[1] PNNL-ASHRAE Standard 90.1-2013 Determination Quantitative Analysis

$$LEED\ Baseline\ Energy\ Use = \frac{Code\ Baseline\ Energy\ Use}{(1 - 8\%)}$$

Notable energy conservation measures include a high performance envelope, daylighting controls, energy recovery and an active radiant heating & cooling system. Performance may still improve through the remainder of the design phases as the lighting, HVAC systems and building controls are further refined.

A lifecycle cost analysis is also included in Section IV for the proposed geothermal heating and cooling plant.

II. Modeling Methodology

The energy analysis was conducted using eQUEST v3.65, which is the most widely used tool in the industry. eQUEST uses the DOE2 simulation engine to estimate annual energy consumption by simulating a year of building operations based on a typical weather year and user inputs.

It is important to keep in mind the limitations of energy models when reviewing this information. Energy consumption is highly dependent on weather conditions, equipment operations & maintenance and the actual operating schedule of the building. The numbers generated will not necessarily be an accurate projection of actual energy costs, but can serve as an accurate comparison between alternatives.

The prescribed methodology requires a baseline building model that conforms to the minimum code requirements as defined by ASHRAE 90.1-2013 Appendix G. Once the baseline model has been created according to code requirements, a proposed case model is built reflecting the latest design documents. A comprehensive list of energy modeling inputs has been provided at the end of this report.

The software used for this analysis exceeds ASHRAE 90.1-2013 Section G.2.2.1 requirements of the referenced energy code states which mandates the following capabilities at a minimum:

1. 8760 hours per year
2. Hourly variations in occupancy and equipment schedules
3. Thermal mass effects
4. Ten or more thermal zones
5. Part-load performance curves for mechanical equipment
6. Capacity and efficiency correction curves for mechanical heating and cooling equipment
7. Airside economizers with integrated control
8. Baseline building design characteristics specified in Section G3

FY'18 budgeted utility rates provided by the town have been used in accordance with ASHRAE 90.1 Appendix G guidelines and are provided below.

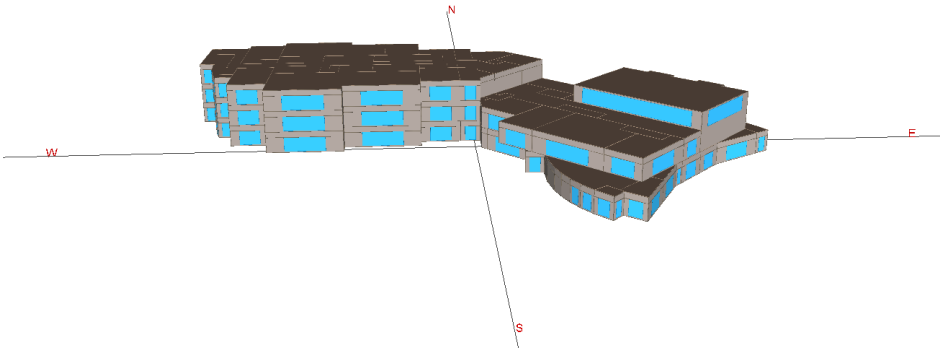
Electricity - $0.22 / kWh
Natural Gas - $1.13 / Therm

All mentions of Appendix G or other sections of the baseline "code" are in specific reference to ASHRAE 90.1-2013.

III. Project Description

Proposed

Figure 3: 3D Model Rendering



Hastings Elementary school comprises 110,000 SF of newly constructed space. Envelope components will use a combination of rigid and spray foam insulation products to form a continuous thermal barrier that greatly exceeds code requirements. High performance windows have also been specified to maximize thermal performance and daylight availability.

The mechanical system consists of two primary air delivery configurations. An active chilled beam system provides heating and cooling at the zone level for (predominantly) classrooms using chilled and hot water from the central plant. An upstream constant volume energy recovery unit provides tempered primary ventilation air for these units. Non classroom spaces are served by more traditional overhead variable air volume (VAV) systems. A single air cooled chiller provides chilled water for most of the building. Two condensing hot water boilers provide primary heating energy for the facility.

At the direction of the lighting design team, a 0.70 w/sf lighting power density has been assumed for this analysis which is 20% better than the baseline code allowance of 0.87 w/sf. In addition, daylighting controls in perimeter spaces will actively measure ambient light levels and reduce electrical lighting loads accordingly.

The building operating schedule was provided by the town and has been summarized in the following table. Schedules are rounded to the nearest hour to accommodate energy model input limitations.

Table 2: Building Operating Schedule

COMPONENT	OCCUPIED MODE (M-F)	UNOCCUPIED MODE (Nights & Wknd)
Gym	5am	9pm
Library	6am	3pm
Café	5am	7pm
Kitchen	6am	2pm
Administration	5am	6pm
Classrooms	5am	3pm
Summer HVAC (All)	8am	3pm
Lights	6am	9pm

Baseline (ASHRAE 90.1-2013)

The Baseline building thermal zoning matches the design while ASHRAE 90.1-2013 compliant building envelope, lighting and HVAC systems following Appendix G modeling methodology. A detailed table of inputs is provided at the end of this report which highlights the significant differences between the baseline and proposed buildings.

IV. Geothermal Heating and Cooling LCCA

A geothermal heating and cooling system is currently favored over a conventional air cooled chiller and condensing boiler plant. In this configuration, a series of water-to-water heat pumps (WWHPs) would provide all the chilled and hot water necessary for space conditioning needs. A vertical bore ground heat exchanger serves as the primary energy "source." The interior installed cost of the WWHP system is approximately equal to the conventional system. Therefore, the cost premium is assumed to be attributable to the ground heat exchanger. The design team estimates the additional cost of the geothermal system to be $2,200,000.

Cited WWHP heating and cooling efficiency provided by the engineers is 3.2 COP and 14 EER respectively.

As reported in Table 1 of the executive summary, this configuration increases site energy savings to 49.7% over the base code (from 17.3%). Conversely, LEED energy cost savings decrease to 16.2% (from 21.1%). Overall, annual energy costs are about $10,000/yr greater than the conventional system. This is due to the historically large disparity between electricity and natural gas prices. Although the geothermal system is about 350% more efficient than the condensing boiler cited in this analysis, a BTU of electricity is about 570% more expensive than a BTU of natural gas. As a result, the geothermal system is more expensive to operate and does not pay back when compared to the conventional boiler/chiller alternative. These results are summarized in the following table.

Table 3: LCCA Summary

CASE	ANNUAL ENERGY COST ($)	ENERGY COST SAVINGS ($)	CAPITAL COST PREMIUM ($)	SIMPLE PAYBACK (YRS)
Proposed	159,772	N/A	N/A	N/A
Proposed + Geo	169,671	(9,899)	2,200,000	(222)

In order to incentivize geothermal systems, the Massachusetts Clean Energy Center has funded a grant program to capitalize energy efficiency projects. According to the MassCEC website, the school may be eligible for $200,000 in grant funding. It's unclear how long MassCEC funding will last and the funding amount still does not yield a positive payback period relative to the conventional basis of design.

V. Detailed Output Data

The output data for each run is provided in the following tables, which parses out individual end use consumption.

Table 4: Energy by End Use

Energy Use Comparison (MMBtu/yr)													
Option	Description	Lights	Equipment	Space Heating (HW)	Space Cooling	Pumps & Aux	Vent Fans	DHW	Ext Light	TOTAL	COST	CODE COST SAVINGS ($)	CODE COST SAVINGS (%)
N/A	Stretch Code Baseline	678	419	2,644	361	46	693	322	78	**5,243**	179,984	N/A	N/A
N/A	LEED v4 Baseline	Interpolated data only published at the building level								**5,705**	202,457	N/A	N/A
N/A	**Proposed**	517	419	2,029	249	149	686	222	63	4,334	159,772	20,213	11.2%
#1	Proposed w/Geothermal	516	419	458	244	194	686	56	63	2,636	169,671	10,313	5.7%

Table 5: Energy by Fuel Type

Energy Use Comparison (By Fuel Type)											
Fuel	Description	Lights	Equipment	Space Heating (HW)	Space Cooling	Pumps & Aux	Vent Fans	DHW	Ext Light	TOTAL	COST
Electricity	Stretch Code Baseline (kWh)	198,669	118,623	-	105,849	13,564	203,035	-	22,978	**662,718**	146,196
Gas	Stretch Code Baseline (Therms)	-	146	26,436	-	-	-	3,222	-	**29,804**	33,789
Electricity	LEED v4 Baseline (kWh)	Interpolated data only published at the building level. See Table 3 for building level values.									
Gas	LEED v4 Baseline (Therms)										
Electricity	**Proposed (kWh)**	151,363	118,623	2,057	72,933	43,756	200,963	-	18,497	**608,192**	134,167
Gas	**Proposed (Therms)**	-	146	20,224	-	-	-	2,215	-	**22,585**	25,605
Electricity	Proposed w/ Geothermal (kWh)	151,363	118,623	134,357	71,424	56,883	200,963	16,274	18,497	**768,383**	169,505
Gas	Proposed w/ Geothermal (Therms)	-	146	-	-	-	-	-	-	**146**	166

VI. Design Case and Baseline Model Input Summary:

Building Envelope (Construction Assemblies)						
Model Input	**Baseline Case**			**Proposed Case**		
	Description	Insulation R-value	Assembly U-factor/ C-factor / F-factor	Description	Insulation R-value	Assembly U-factor/ C-factor / F-factor
Roofs	Insulation over steel deck	R30 ci	U-0.032	7" Polyiso over roof deck	R34.2 ci	U-0.021
Walls	Light weight steel frame assembly	NC: R13 + R10 ci	U-0.055	Masonry exterior, 3" continuous Polyiso, 1" Spray foam cavity insulation (R4.2 effective)	R21 ci + R4.2	Assembly: U-0.036
Slab-On-Grade Floors	Unheated 6" slab on grade	R15 for 24in	F-0.51	2" Horizontal XPS, fully insulated 6" slab on grade	R10	F-0.64

Fenestration and Shading		
Model Input Parameter / Energy Efficiency Measure	**Baseline Case**	**Proposed Case**
Vertical fenestration Area (% of Wall area)	22.00%	24.30%
Vertical Glazing Description	Curtainwall	Aluminum framed fixed low-e
Vertical Glazing U-factor	Curtain Wall Assembly U-0.42	Curtain Wall Assembly U-0.37
Vertical Glazing SHGC	Assembly SHGC-0.4	North & East Assembly SHGC-0.41 South & West Assembly SHGC-0.34
Shading Devices	N/A	3' Canopy South Side Vertical fins on E/W
Fenestration Visual Light Transmittance	0.44	North & East Assembly VT-0.54 South & West Assembly VT-0.37

HVAC (Air-Side)		
Model Input Parameter / Energy Efficiency Measure	**Baseline Case**	**Proposed Case**
Primary HVAC Type	Packaged VAV per Table G3.1.1A	DOAS + Active chilled beams in classrooms.
Other HVAC Type	PSZ-AC in Gym, cafeteria & kitchen (G3.1.1B applies due to loads that differ substantially from the rest of the building) Unit Ventilator in basement & attic mechanical rooms.	Parallel PVAV in administration. Hydronic RTU in Gym & Library. Melink MAU in Kitchen.
Total Cooling Capacity	Oversized by 15% according to G3.1.2.2	See Waterside Section
Unitary Cooling Efficiency	EER: 9.5 to 9.8 depending on capacity	N/A
Fan System Operation	Matches design.	Operates continuously while occupied - cycled to meet load during unoccupied hours
Outdoor Air Design Min Ventilation	Matches design.	ERUs: 21,500 cfm AHUs: 9,050 cfm RTUs: 2,400 cfm MAU: 4,000 cfm
HVAC Air-side Economizer Cycle	Yes	Included on all ventilation systems.
Economizer High-Limit Shutoff	70F db	Dual enthalpy
Design Airflow Rates (Conditioned Space)	Autosized based on 20F delta-T	ERUs: 21,500 cfm AHUs: 19,000 cfm RTUs: 9,000 cfm MAU: 4,000 cfm
Total System Fan Power	Calculated according to G3.1.2.9. 121.4 kW	131.9 kW per engineer guidance
Exhaust Air Energy Recovery	50% Total effectiveness in Gym and Cafeteria	70% Total effectiveness on ACHB system
Demand Control Ventilation	Not required per 6.4.3.9.	Included in all regularly occupied spaces.
Supply Air Temperature Reset Parameters	Temperature reset by 5F depending on loads	Not included due to humidity control.

HVAC (Water-side)		
Model Input Parameter / Energy Efficiency Measure	**Baseline Case**	**Proposed Case**
Number of Chillers	N/A	Basis of Design: One Chiller Geothermal: 13 WWHPs
Chiller Part-Load Controls	N/A	Multiple compressors, staged to meet load.
Chiller Capacity (Per Chiller)	N/A	300 Tons
Chiller Efficiency	N/A	Basis of Design: 10.3 EER (14.6 IEER) Geothermal: 14 EER
Chilled Water Loop Supply Temperature	N/A	42F
Chilled Water (CHW) Loop Delta-T	N/A	12F
CHW Loop Temp Reset Parameters	N/A	40F @ 79F OA WB 49F @ 75F OA WB
CHW Loop Configuration	N/A	Variable primary, variable secondary.
Number of CHW Pumps	N/A	3 Total
Primary CHW Pump Power	N/A	21.5 kW
Number of Boilers	2	2
Boiler Part-Load Controls	Staged to meet load	Staged to meet load
Boiler Capacity (Per Boiler)	Autosized	1350 mbh
Boiler Efficiency	80%	93.0%
Boiler Water Loop Supply Temperature	180F	140F
Hot Water or Steam (HHW) Loop Delta-T	50F	40F
HHW Loop Temp Reset Parameters	180F @ 20F OA 150F @ 50F OA	140F @ 20F OA 100F @ 60F OA
HHW Loop Configuration	Constant speed (HW system serves less than 120kSF per G3.1.3.5)	Constant primary, variable secondary.
Number of HHW Pumps	1	3 Total
Primary HHW Pump Power	19 w/gpm (7.7 kW)	6.1 kW
Primary HHW Pump Speed Control	Constant speed (HW system serves less than 120kSF per G3.1.3.5)	Variable speed

Service Water Heating		
Model Input Parameter / Energy Efficiency Measure	**Baseline Case**	**Proposed Case**
SHW Equipment Type	Matches design	(2) 300mbh gas storage tanks 20% low flow fixture reduction
SHW Storage Tank Capacity (Gal)	Autosized	2 x 130 gal
Equipment Efficiency	80%	95% Condensing
Temperature Controls	Matches design	140F supply w/mixing valves

Lighting		
Model Input Parameter / Energy Efficiency Measure	**Baseline Case**	**Proposed Case**
Interior Lighting Power Density (Average)	Building Area Method 0.87 w/sf	Building Area Method 0.70 w/sf
Daylight Dimming Controls	Primary sidelighting included as stipulated in 9.4.1.4 w/ **two step controls at 35% and 70% intervals.**	Classrooms: Dual scene controls, desk level lighting setpoint 35 FC with **continuous dimming to 30%.** Admin: Single scene control, desk level lighting setpoint 35 FC with **continuous dimming to 30%.**
Total Exterior Lighting Power	7.2 kW	5.8 kW

Miscellaneous		
Model Input Parameter / Energy Efficiency Measure	**Baseline Case**	**Proposed Case**
Receptacle equipment	Offices 1.0 w/sf Classrooms 0.5 w/sf Kitchen 10 w/sf	Matches baseline
Other	N/A	N/A

LEED DOCUMENTATION

DINISCO DESIGN
architects + planners

29 June 2017

Massachusetts School Building Authority
40 Broad Street, Suite 500
Boston, MA 02109

To Whom It May Concern:

This is an acknowledgement that the Lexington School District has identified a goal of 2% additional reimbursement from the MSBA High Efficiency Green School Program. As their Designer, I have submitted a completed LEED-S v4 scorecard showing all prerequisites and 53 attempted points, which will meet that goal.

The scope of work for this project will include the construction elements and performance tasks to achieve that goal, and all subsequent documents, including but not limited to, specifications, drawings, and cost estimates will match the scope of work indicated in the submitted scorecard.

The timeline for LEED-S is as follows:

- USGBC registration will occur at the beginning of the Design Development phase in July 2017.
- Provisional / design submission will occur at the end of the Construction Document phase in December 2018.
- Final / construction submission will occur at the completion of construction currently anticipated to be August 2020 (Building construction completion anticipated February 2020, site work completion thereafter).

Sincerely,

Richard N. Rice, Principal
DiNISCO DESIGN

LEED for Schools v4
Project Scorecard

Project Name: Maria Hastings Elementary School
Project Address: 7 Crosby Rd, Lexington, MA 02421
Date Updated: June 26, 2017
(Includes Geothermal)

Phase	Yes	?	No				
	1	0	0		**Integrative Process**		1
D	1			Credit 1	**Integrative Process**		1

	Yes	?	No				
	3	2	10		**Location & Transportation**		15
D			x	Credit 1	**LEED for Neighborhood Development Location**		15
D	1			Credit 2	**Sensitive Land Protection**		1
D			2	Credit 3	**High Priority Site**		2
D	1		4	Credit 4	**Surrounding Density and Diverse Uses**		5
D		1	3	Credit 5	**Access to Quality Transit**		4
D			1	Credit 6	**Bicycle Facilities**		1
D		1		Credit 7	**Reduced Parking Footprint**		1
D	1			Credit 8	**Green Vehicles**		1

	Yes	?	No				
	6	5	1		**Sustainable Sites**		12
C	Y			Prereq 1	**Construction Activity Pollution Prevention**		Required
D	Y			Prereq 2	**Environmental Site Assessment**		Required
D	1			Credit 1	**Site Assessment**		1
D		2		Credit 2	**Site Development - Protect or Restore Habitat**		2
D	1			Credit 3	**Open Space**		1
D		3		Credit 4	**Rainwater Management**		3
D	2			Credit 5	**Heat Island Reduction**		2
D	1			Credit 6	**Light Pollution Reduction**		1
D			1	Credit 7	**Site Master Plan**		1
D	1			Credit 8	**Joint Use of Facilities**		1

	Yes	?	No				
	5	1	6		**Water Efficiency**		12
D	Y			Prereq 1	**Outdoor Water Use Reduction**		Required
D	Y			Prereq 2	**Indoor Water Use Reduction**		Required
D	Y			Prereq 3	**Building-level Water Metering**		Required
D	1	1		Credit 1	**Outdoor Water Use Reduction**		2
D	3		4	Credit 2	**Indoor Water Use Reduction**		7
D			2	Credit 3	**Cooling Tower Water Use**		2
D	1			Credit 4	**Water Metering**		1

	Yes	?	No				
	15	6	10		**Energy & Atmosphere**		31
C	Y			Prereq 1	**Fundamental Commissioning and Verification**		Required
D	Y			Prereq 2	**Minimum Energy Performance**		Required
D	Y			Prereq 3	**Building-level Energy Metering**		Required
D	Y			Prereq 4	**Fundamental Refrigerant Management**		Required
C	5	1		Credit 1	**Enhanced Commissioning**		6
D	6	2	8	Credit 2	**Optimize Energy Performance**		16
D	1			Credit 3	**Advanced Energy Metering**		1
C			2	Credit 4	**Demand Response**		2
D	3			Credit 5	**Renewable Energy Production**		3
D		1		Credit 6	**Enhanced Refrigerant Management**		1
C		2		Credit 7	**Green Power and Carbon Offsets**		2

	Yes	?	No		Materials & Resources	13
	6	1	6			
D	Y			Prereq 1	**Storage & Collection of Recyclables**	Required
C	Y			Prereq 2	**Construction and Demolition Waste Management Planning**	Required
C	3		2	Credit 1	**Building Life-cycle Impact Reduction**	5
C	1		1	Credit 2	**Building Product Disclosure and Optimization**-Environmental Product Declarations	2
C			2	Credit 3	**Building Product Disclosure and Optimization**-Sourcing of Raw Matls.	2
C		1	1	Credit 4	**Building Product Disclosure and Optimization**-Material Ingredients	2
C	2			Credit 5	**Construction and Demolition Waste Management**	2

	Yes	?	No		Indoor Environmental Quality	16
	10	1	5			
D	Y			Prereq 1	**Minimum IAQ Performance**	Required
D	Y			Prereq 2	**Environmental Tobacco Smoke (ETS) Control**	Required
D	Y			Prereq 3	**Minimum Acoustical Performance**	Required
D	2			Credit 1	**Enhanced IAQ Strategies**	2
C	2		1	Credit 2	**Low-Emitting Materials**	3
C	1			Credit 3	**Construction IAQ Management Plan**	1
C	2			Credit 4	**IAQ Assessment**	2
D	1			Credit 5	**Thermal Comfort**	1
D	1	1		Credit 6	**Interior Lighting**	2
D			3	Credit 7	**Daylight**	3
D	1			Credit 8	**Quality Views**	1
D			1	Credit 9	**Acoustic Performance**	1

	Yes	?	No		Innovation	6
	6	0	0			
D	1			Credit 1	**Innovation in Design: To be determined**	1
D	1			Credit 2	**Innovation in Design: To be determined**	1
D	1			Credit 3	**Innovation in Design: To be determined**	1
C	1			Credit 4	**Innovation in Design: To be determined**	1
C	1			Credit 5	**Innovation in Design: To be determined**	1
C	1			Credit 6	**LEED Accredited Professional**	1

	Yes	?	No		Regional Priority Credits - earn up to 4 points	4
	1	3	0			
					Lexington, MA	
		1		Credit 1	**Renewable Energy Production (2pt / 3%)**	1
		1		Credit 2	**Access to Quality Transit (1 pt)**	1
	1			Credit 3	**Building Life-Cycle Impact Reduction (2pts)**	1
		1		Credit 4	**Optimize Energy Performance (8pts)**	1
				Credit 5	*Site Development - protect or restore habitat (2pts)*	
				Credit 6	*Surrounding Density and Diverse Uses (4 pts)*	

Yes	?	No	Project Totals (Certification Estimates)	110
53	19	38		

Certified: 40-49 points, **Silver:** 50-59 points, **Gold:** 60-79 points, **Platinum:** 80+ points

3-DIMENSIONAL CLASSROOM MODEL

HASTINGS
ELEMENTARY SCHOOL

LEXINGTON, MA

SCHEMATIC DESIGN

Interior Perspective
Typical Classroom
"Cluster" & Project Area

29 JUNE 2017

DINISCO DESIGN
architects + planners

HASTINGS ELEMENTARY SCHOOL

LEXINGTON, MA

SCHEMATIC DESIGN

Interior Perspective
Typical Classroom

29 JUNE 2017

DINISCO DESIGN
architects + planners

HASTINGS ELEMENTARY SCHOOL

LEXINGTON, MA

SCHEMATIC DESIGN

Interior Perspective
Typical Classroom

29 JUNE 2017

DINISCO DESIGN
architects + planners

3-DIMENSIONAL BUILDING & CONTEXTUAL MODELS

HASTINGS ELEMENTARY SCHOOL

LEXINGTON, MA

SCHEMATIC DESIGN

Exterior Perspective
Aerial View from South

29 JUNE 2017

DINISCO DESIGN
architects + planners

HASTINGS ELEMENTARY SCHOOL

LEXINGTON, MA

SCHEMATIC DESIGN

Exterior Perspective
Aerial View from East

29 JUNE 2017

DINISCO DESIGN
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HASTINGS ELEMENTARY SCHOOL

LEXINGTON, MA

SCHEMATIC DESIGN

Exterior Perspective
Pedestrian Approach from Crosby Road

29 JUNE 2017

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HASTINGS
ELEMENTARY SCHOOL

LEXINGTON, MA

SCHEMATIC DESIGN

Exterior Perspective
Drop Off & Main Entrance

29 JUNE 2017

DINISCO DESIGN
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HASTINGS
ELEMENTARY SCHOOL

LEXINGTON, MA

SCHEMATIC DESIGN

Exterior Perspective
View from Entry Drive

29 JUNE 2017

DINISCO DESIGN
architects + planners

HASTINGS ELEMENTARY SCHOOL

LEXINGTON, MA

SCHEMATIC DESIGN

Exterior Perspective
View from Playground

29 JUNE 2017

DINISCO DESIGN
architects + planners

SCHEMATIC FLOOR PLANS

HASTINGS ELEMENTARY SCHOOL

LEXINGTON, MA

SCHEMATIC DESIGN

First Floor Plan

LEGEND

- CLASSROOM
- SPECIAL EDUCATION
- LIBRARY
- ART/MUSIC
- STAGE
- GYMNASIUM
- KITCHEN/CAFETERIA
- ADMIN/EXTNDED DAY
- BUILDING SERVICES

GROSS AREA CALCULATIONS

FIRST FLOOR	**45,380 SF**
SECOND FLOOR	40,748 SF
THIRD FLOOR	23,592 SF
ROOF	280 SF
TOTAL	110,000 SF

0 15 30

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29 JUNE 2017

DINISCO DESIGN
architects + planners

HASTINGS ELEMENTARY SCHOOL

LEXINGTON, MA

SCHEMATIC DESIGN

Second Floor Plan

LEGEND

- CLASSROOM
- SPECIAL EDUCATION
- LIBRARY
- ART/MUSIC
- STAGE
- GYMNASIUM
- KITCHEN/CAFETERIA
- ADMIN/EXTNDED DAY
- BUILDING SERVICES

GROSS AREA CALCULATIONS

FIRST FLOOR	45,380 SF
SECOND FLOOR	**40,748 SF**
THIRD FLOOR	23,592 SF
ROOF	280 SF
TOTAL	110,000 SF

0 15 30

N

29 JUNE 2017

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HASTINGS ELEMENTARY SCHOOL

LEXINGTON, MA

SCHEMATIC DESIGN

Third Floor Plan

LEGEND

- CLASSROOM
- SPECIAL EDUCATION
- LIBRARY
- ART/MUSIC
- STAGE
- GYMNASIUM
- KITCHEN/CAFETERIA
- ADMIN/EXTNDED DAY
- BUILDING SERVICES

GROSS AREA CALCULATIONS

FIRST FLOOR	45,380 SF
SECOND FLOOR	40,748 SF
THIRD FLOOR	**23,592 SF**
ROOF	280 SF
TOTAL	110,000 SF

0 15 30

N

29 JUNE 2017

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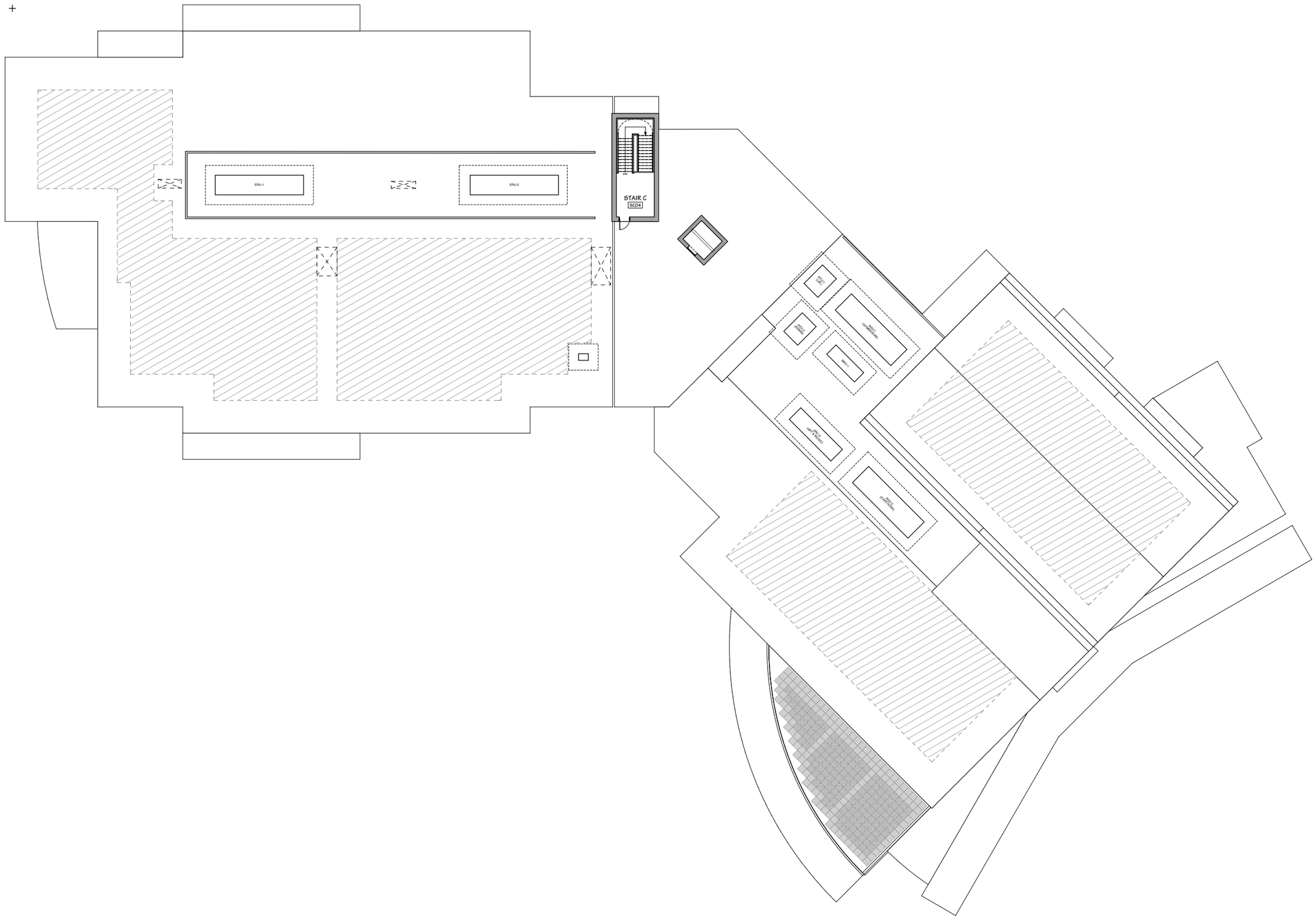

HASTINGS ELEMENTARY SCHOOL

LEXINGTON, MA

SCHEMATIC DESIGN

Roof Plan

LEGEND

- CLASSROOM
- SPECIAL EDUCATION
- LIBRARY
- ART/MUSIC
- STAGE
- GYMNASIUM
- KITCHEN/CAFETERIA
- ADMIN/EXTNDED DAY
- BUILDING SERVICES

GROSS AREA CALCULATIONS

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