3.3.3 - FINAL EVALUATION OF ALTERNATIVES

B. CONSTRUCTION IMPACT - OPTION 2.1

Option 2.1 would require major renovations within the existing occupied school and would be undertaken in 2 or 3 phases. Modular classrooms may be required on site to provide necessary swing space during renovations. Scheduling work over summer or holiday breaks may alleviate some of the disruption but would need to be carefully managed. The anticipated construction schedule is 48 months.

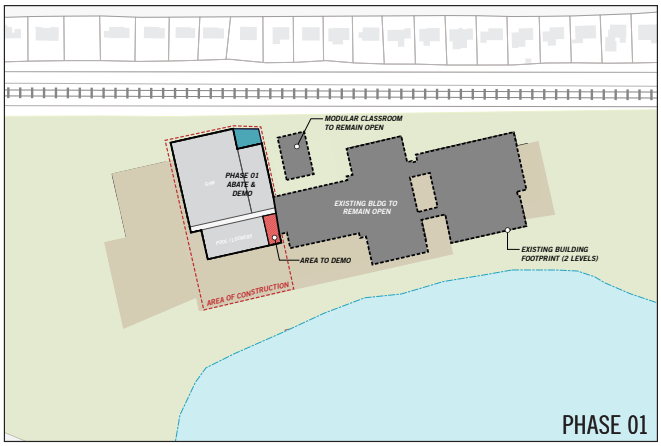
Work under this would be very disruptive to students and staff. Students would be forced to move two to three times to accommodate the multiple construction phases. Disruption from noise, dust, odors and construction traffic could be anticipated.

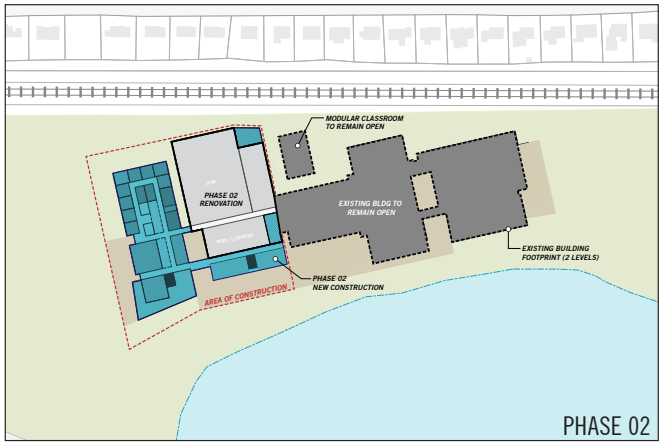
The detailed plan for phasing and swing space would be determined during schematic design to best coordinate with the educational programs to minimize the impact on students and staff.

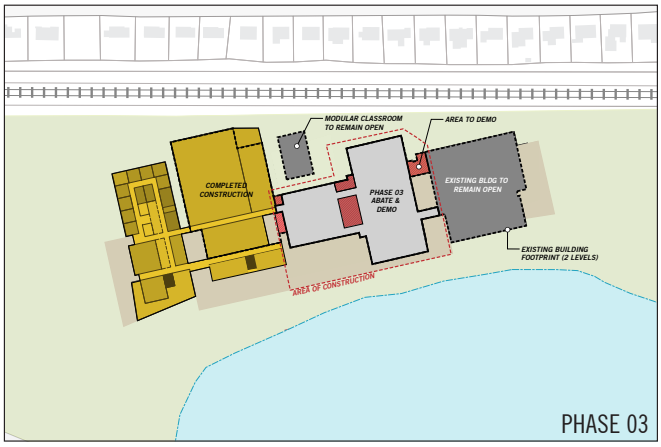
I. DESIGN AND CONSTRUCTION SCHEDULE - OPTION 2.1

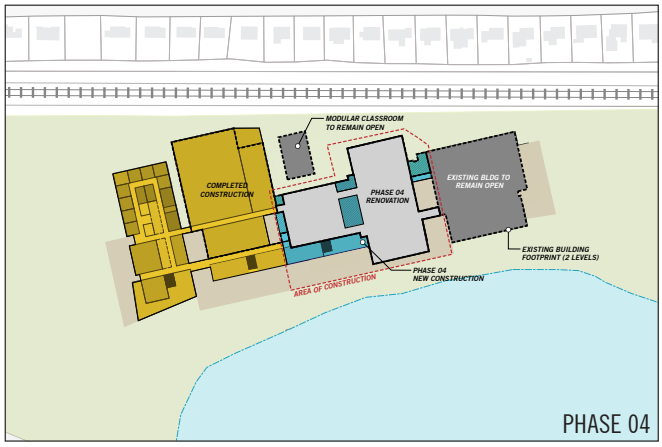
Anticipated MSBA Approval of PSR	April 10th, 2018 (MSBA Board Meeting)
Anticipated MSBA Approval of SD	August 29th, 2018 (MSBA Board Meeting)
Special Town Meeting/Ballot Vote	November 2018
Design Development Complete	November 2018 - April 2019
Construction Documents Complete	May 2019 – January 2020
Bid and Award	February 2020 - March 2020
Construction (multiple phases)	April 2020 – March 2024 (48 months)

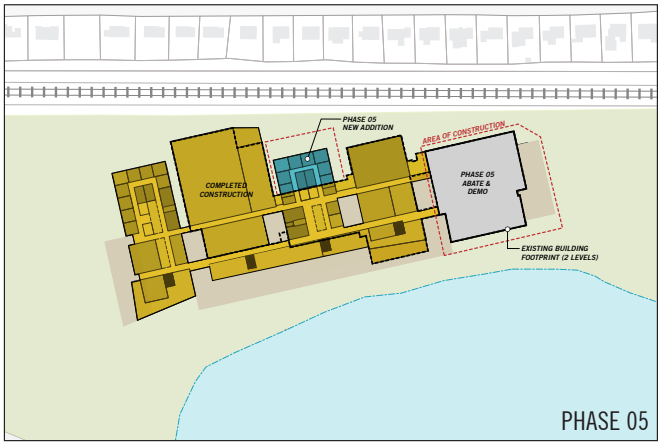
B. CONSTRUCTION IMPACT - OPTION 2.1 / Phasing Diagrams

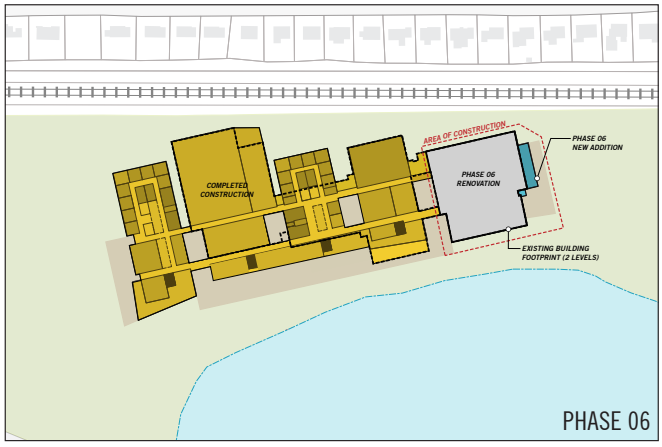


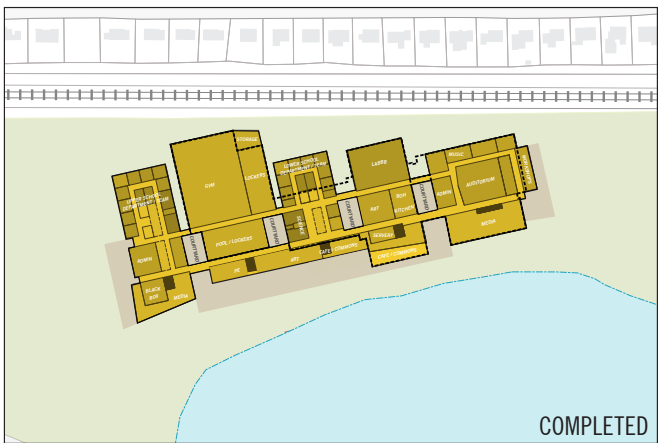










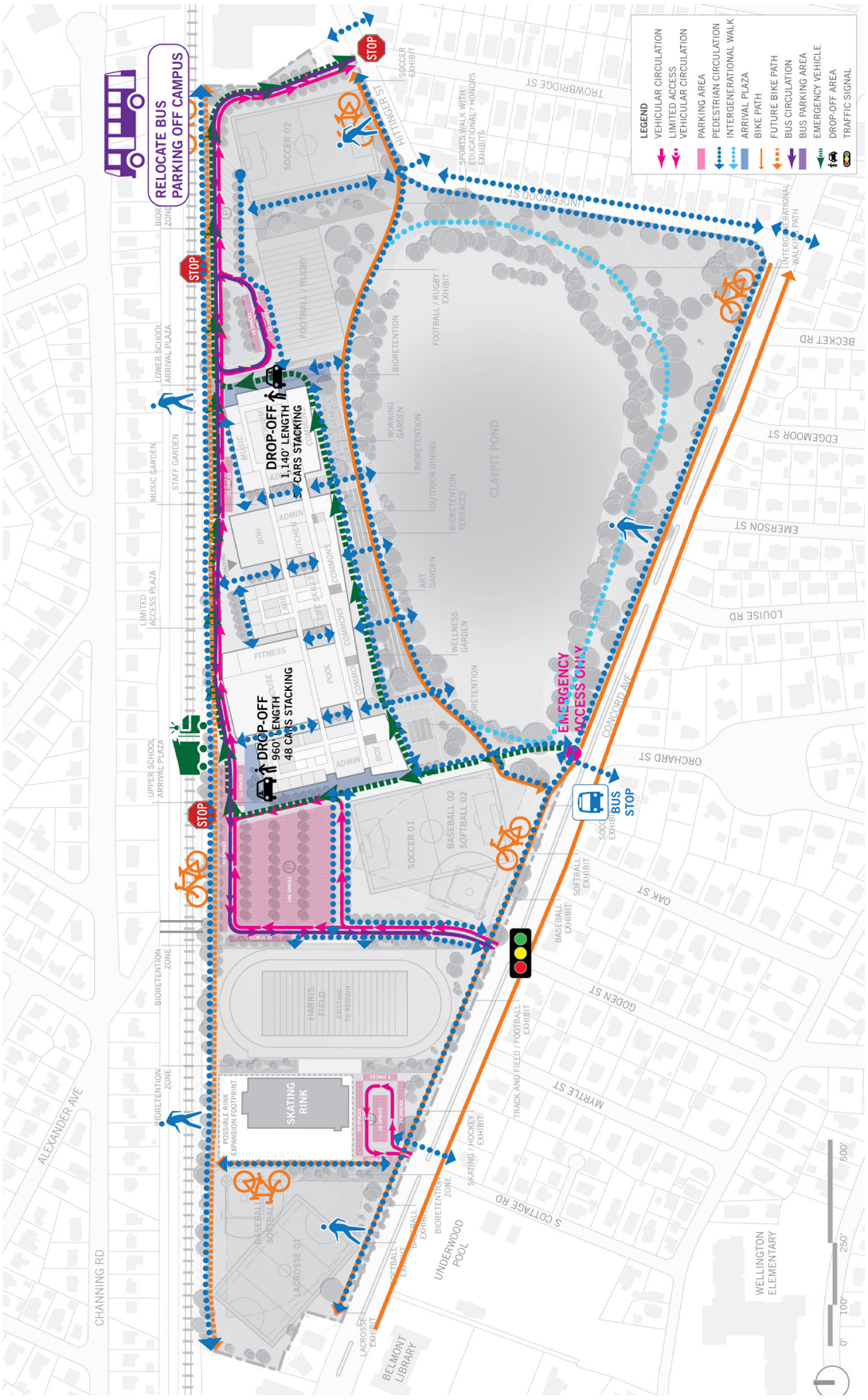


Demolition
Renovation
Addition
Complete

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

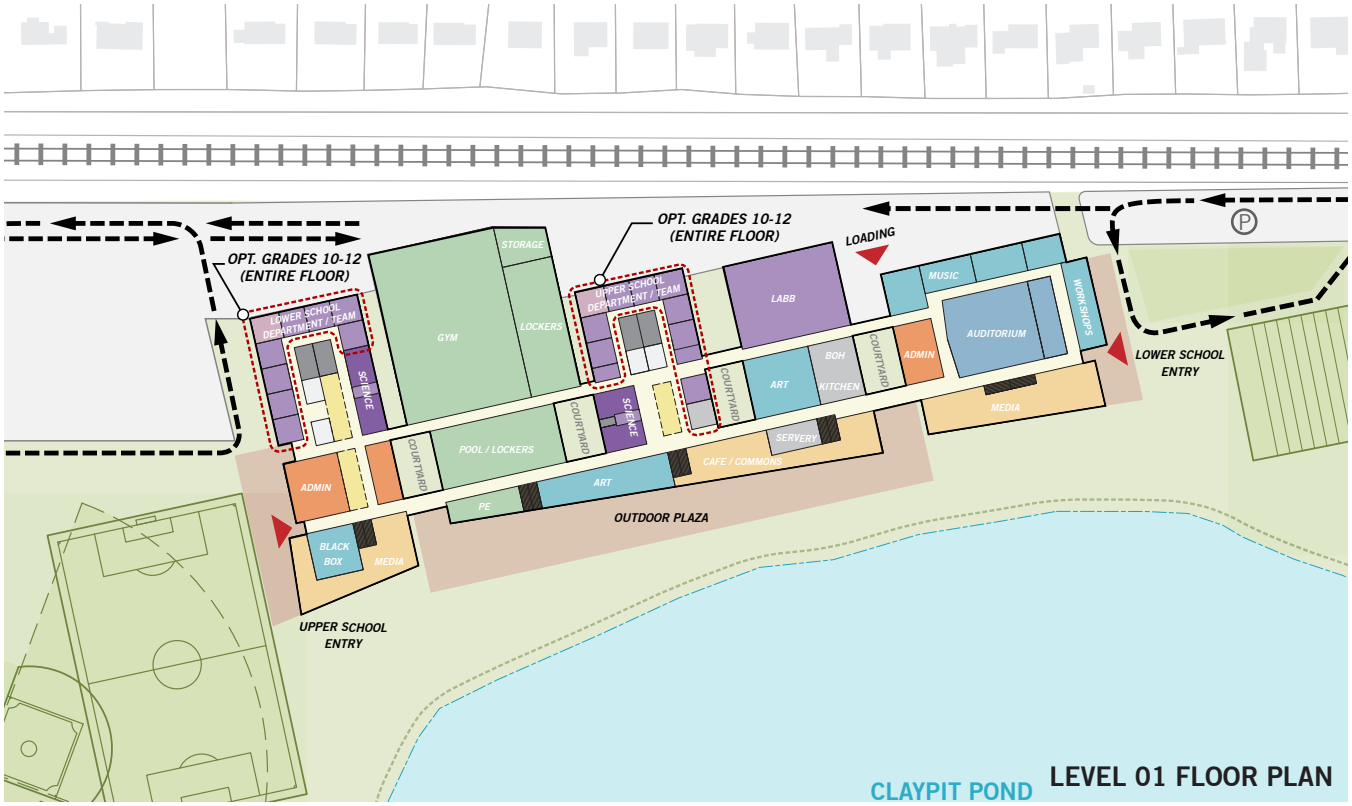
C. CONCEPT DRAWING - OPTION 2.1 / Site

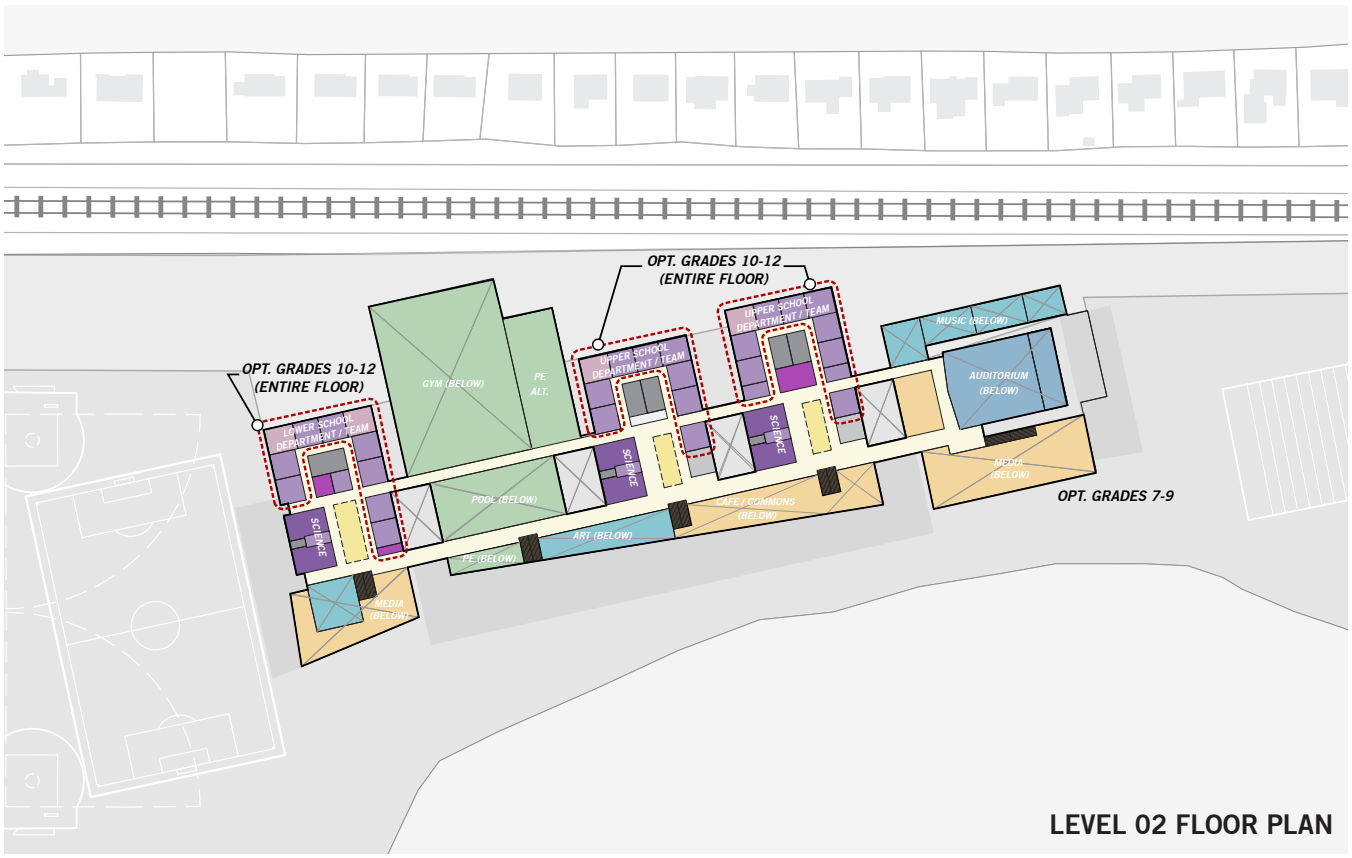
C. CONCEPT DRAWING - OPTION 2.1 / Traffic Site Plan



3.3.3 - FINAL EVALUATION OF ALTERNATIVES

C. CONCEPT DRAWING - OPTION 2.1 / Architectural

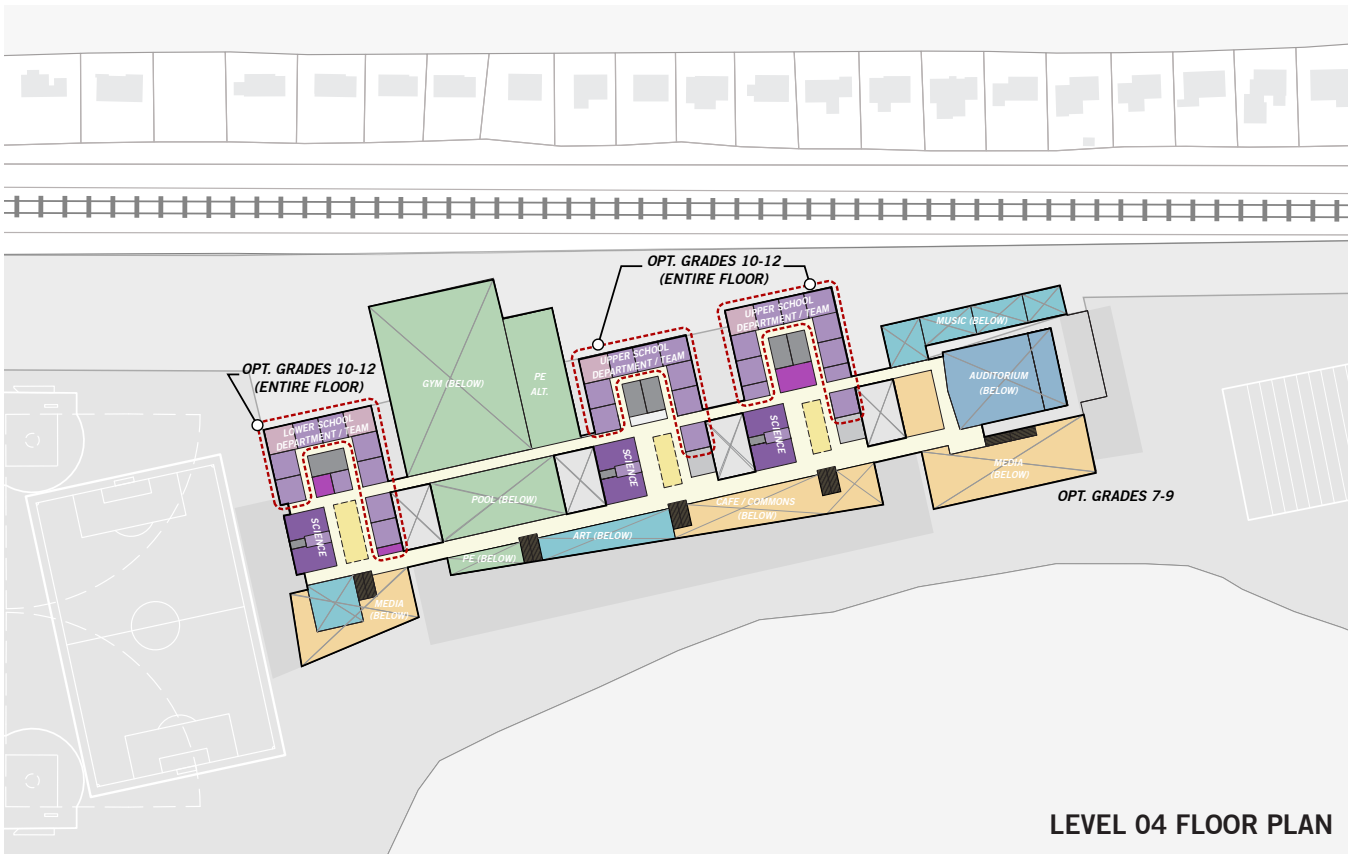




C. CONCEPT DRAWING - OPTION 2.1 / Architectural

Core Academic
Art & Music
Admin./ Guidance
Health & PE
Media Center
Auditorium & Drama
Dining/ Food Service
Medical
Circulation
Custodial/ Maint.
District Offices
Special Education

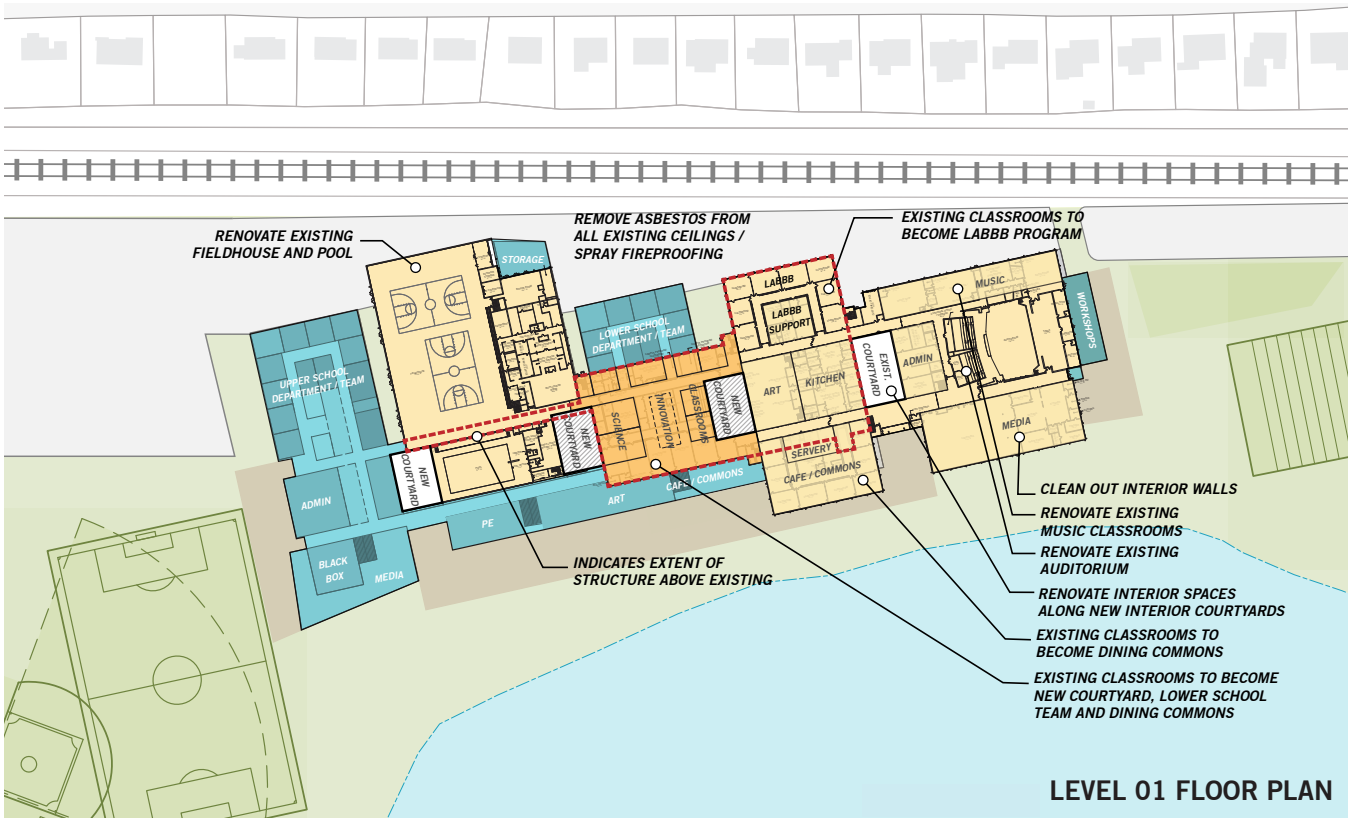
LEVEL 03 FLOOR PLAN

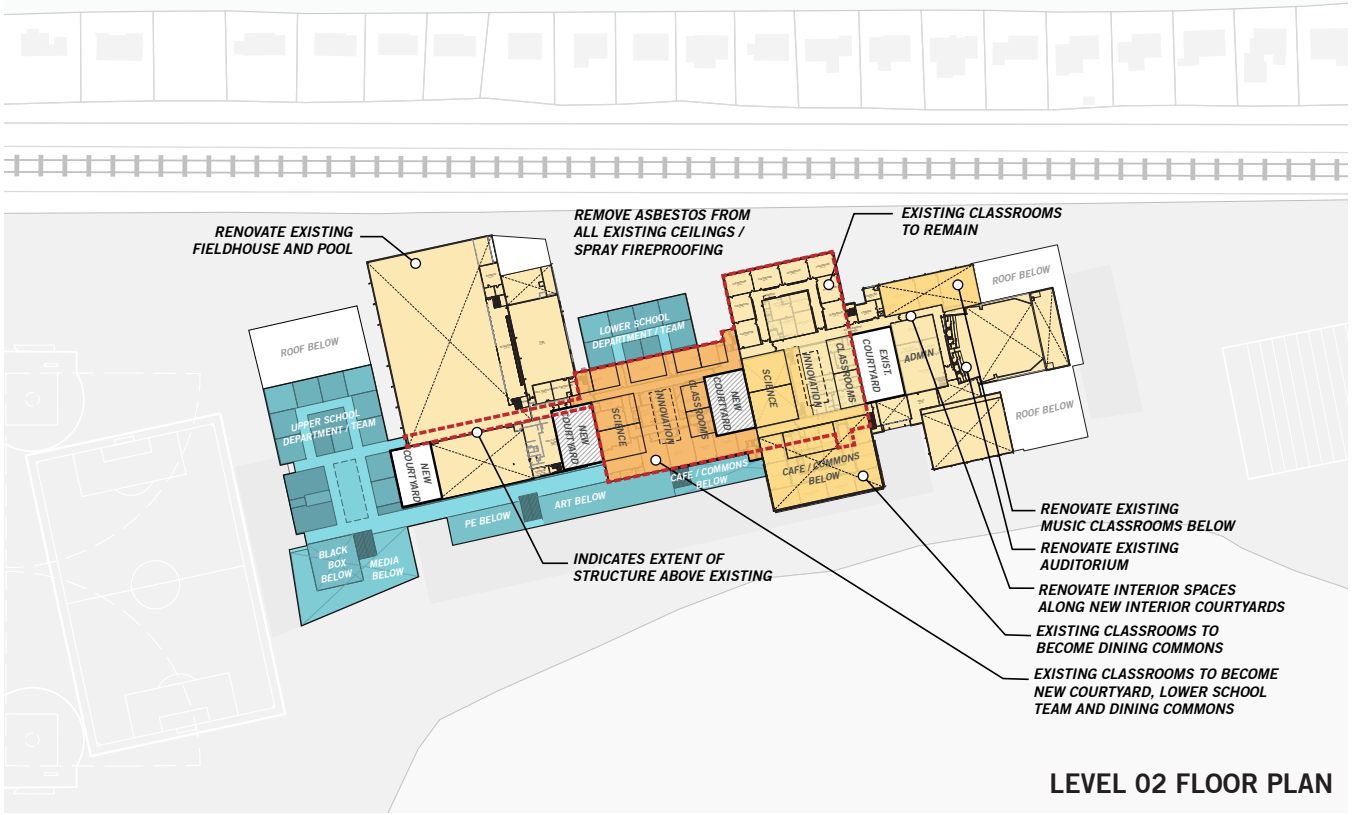


LEVEL 04 FLOOR PLAN

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

C. CONCEPT DRAWING - OPTION 2.1 / New, Renovated, and Existing to Remain Areas





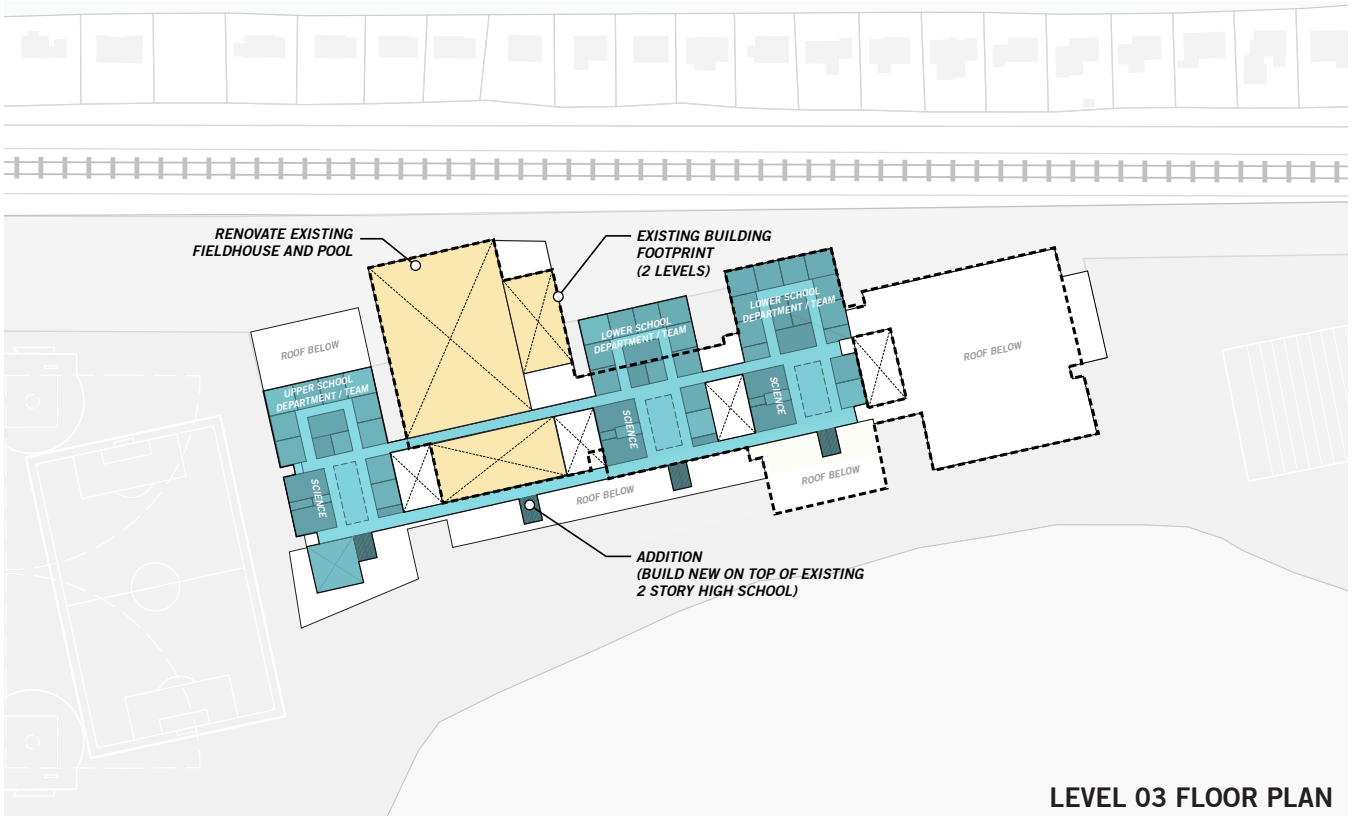
Demolition

Minor Renovation (Maintain Existing Facade and Floor Slabs)

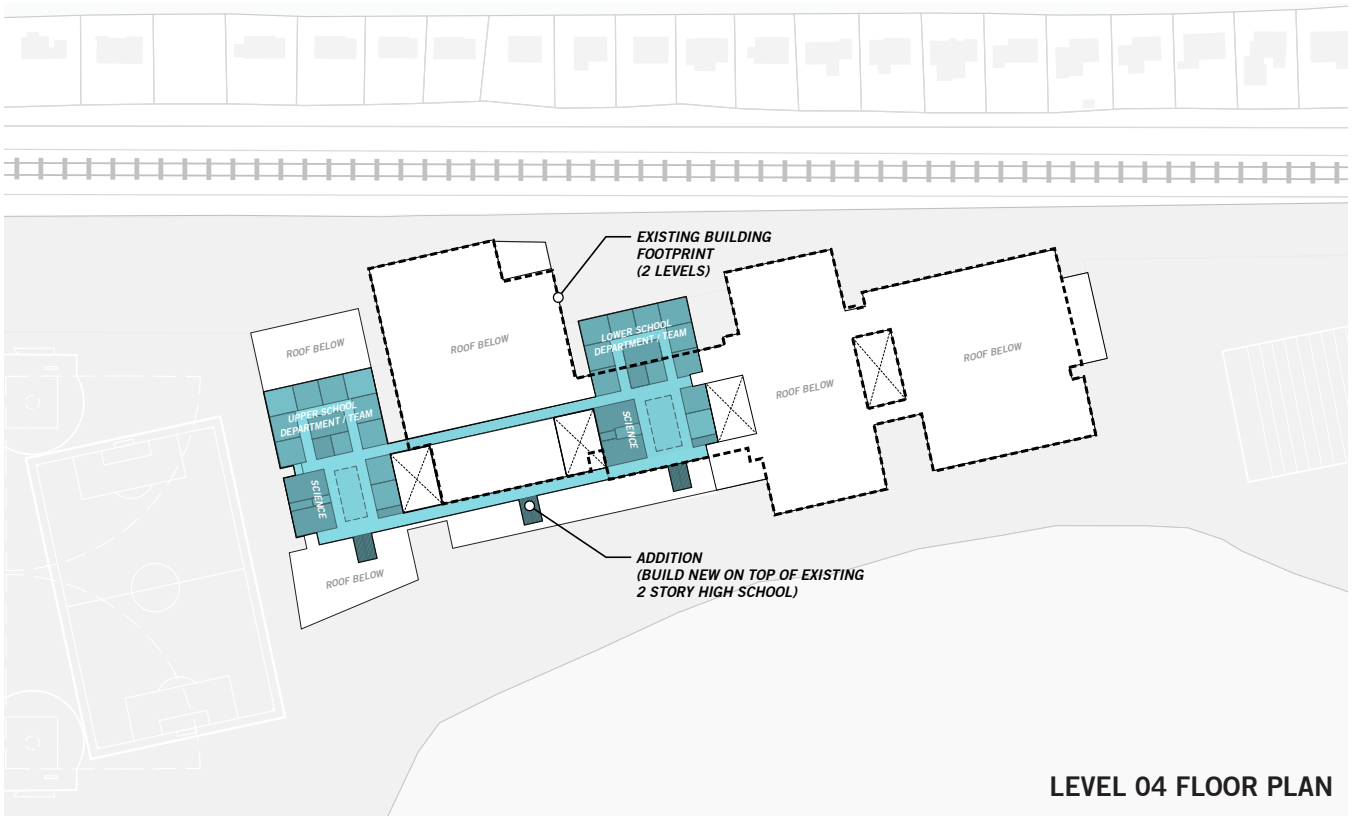
Moderate Renovation (Maintain Existing Facade, Alterations to Existing Floor Slabs)

Major Renovation (Alterations to Existing Facade and Floor Slabs)

Addition



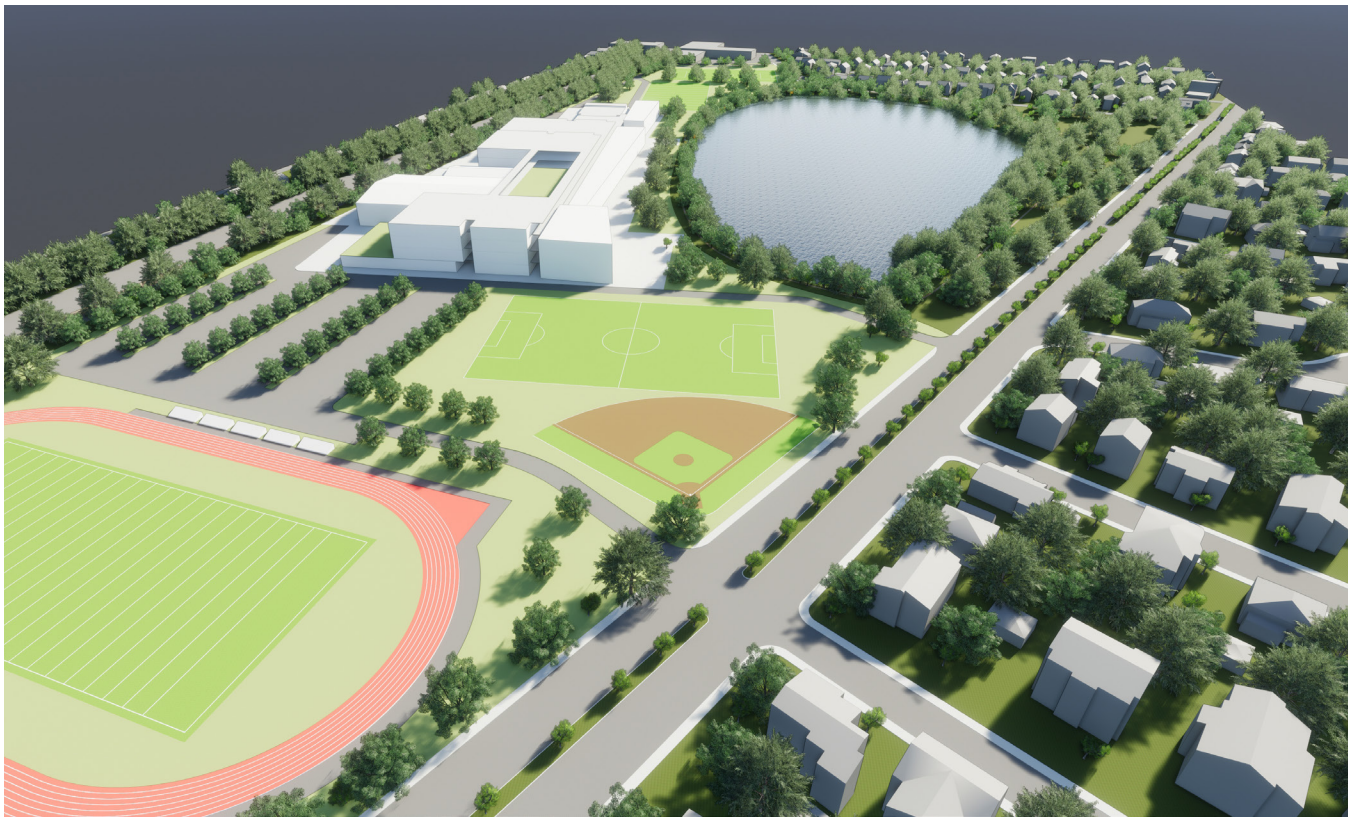
LEVEL 03 FLOOR PLAN

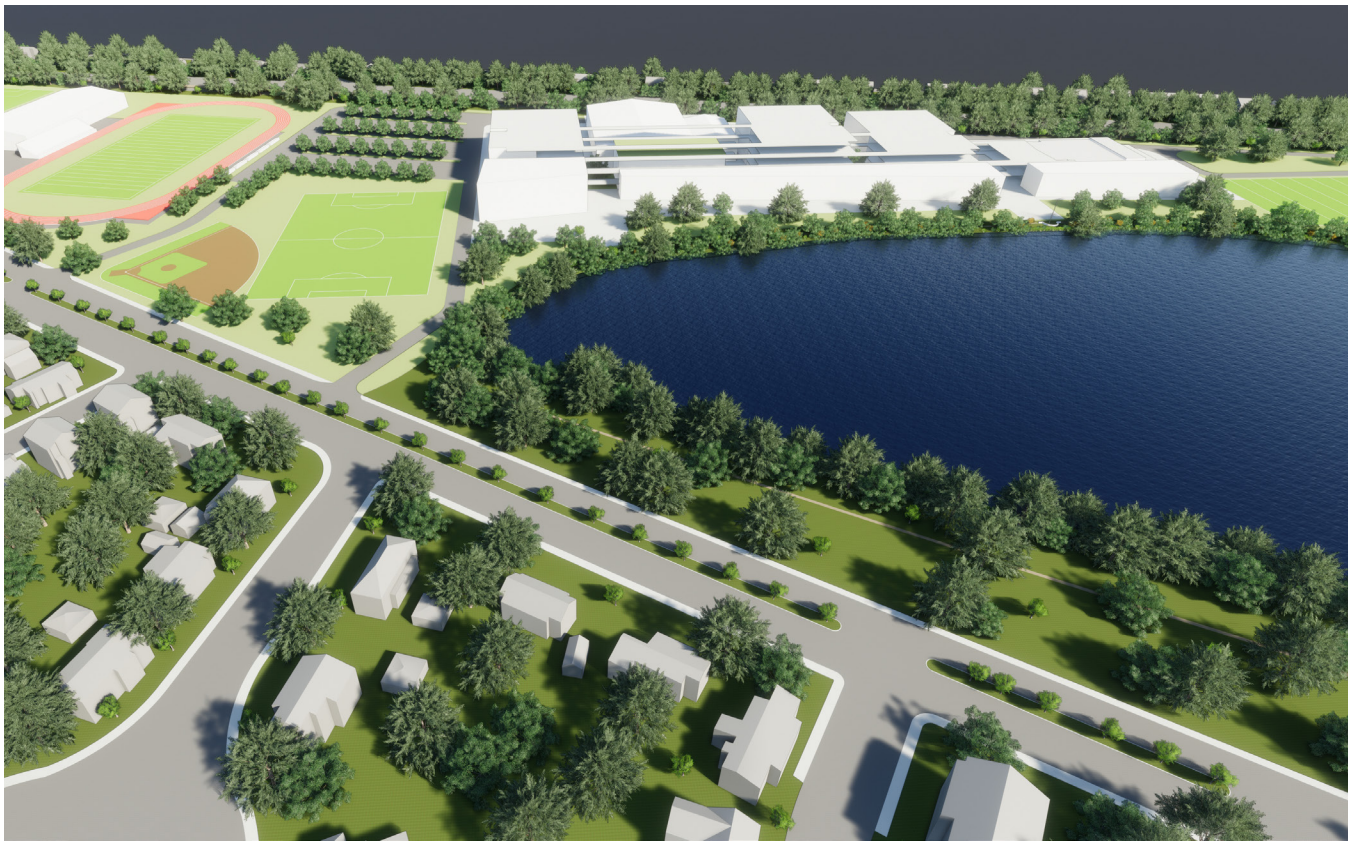


LEVEL 04 FLOOR PLAN

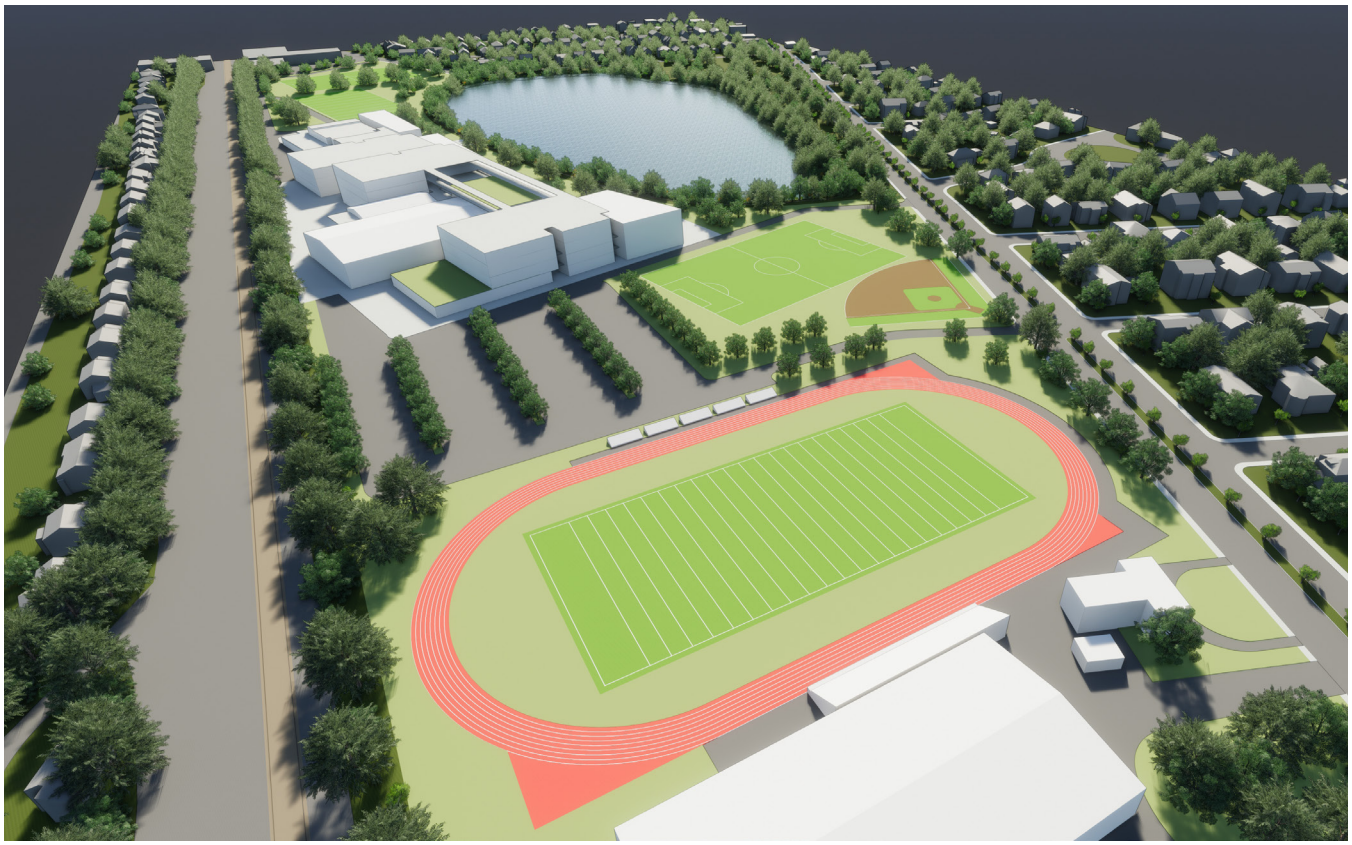
3.3.3 - FINAL EVALUATION OF ALTERNATIVES

C. CONCEPT DRAWING - OPTION 2.1





C. CONCEPT DRAWING - OPTION 2.1



BELMONT HIGH SCHOOL
Structural Narrative – Option 2.1
Major Renovations and Minor Addition to the Existing School

January 22, 2018

PROPOSED SCHEME

The proposed scheme calls for phased renovations and additions to the existing school. In the first phase, an addition will be constructed at the northwest corner of the existing building. The addition will house the upper school administration, science laboratories and general classrooms, as well as a black box theatre, an alternative PE space, upper school cafeteria, and kitchen and mechanical spaces. The next phase would require a total gut renovation of the existing building. In this case, the existing building will have to essentially meet the requirements of the Code for New Construction. This will require the addition of a new lateral load resisting system in the form of braced frames and/or masonry shear walls. Modifications will be required to the existing column foundation receiving braced frames; and, new tie beams will be required to connect the existing column foundations at the locations of existing slabs-on-grade.

PRIMARY STRUCTURAL CODE ISSUES RELATED TO THE EXISTING STRUCTURE

If any repairs, renovations, additions or change of occupancy or use are made to the existing structure, a check for compliance with 780 CMR, Chapter 34 “Existing Structures” (Massachusetts Amendments to The International Existing Building Code 2015) of the Massachusetts Amendments to the International Building Code 2015 (IBC 2015) and reference code “International Existing Building Code 2015” (IEBC 2015) is required. The intent of the IEBC and the related Massachusetts Amendments to IEBC is to provide alternative approaches to alterations, repairs, additions and/or a change of occupancy or use without requiring full compliance with the code requirements for new construction.

The IEBC provides three compliance methods for the repair, alteration, change of use or additions to an existing structure. Compliance is required with only one of the three compliance alternatives. Once the compliance alternative is selected, the project will have to comply with all requirements of that particular method. The requirements from the three compliance alternatives cannot be applied in combination with each other.

The three compliance methods are as follows:

1. Prescription Compliance Method.
2. Work Area Compliance Method.
3. Performance Compliance Method.

Comment
The approach is to evaluate the compliance requirements for each of the three methods and select the method that would yield the most cost effective solution for the structural scope of the project. The selection of the compliance method may have to be re-evaluated after the impact of the selected method is understood and after analyzing the compliance requirements of the other disciplines, Architectural, Mechanical, Fire Protection, Electrical and Plumbing.
Since portions of the existing building are considered un-reinforced masonry bearing wall structures, the analysis and reinforcement of the existing structure would be governed by the requirements of Appendix A1 “Seismic Strengthening Provisions for Un-reinforced Masonry Bearing Wall Buildings” in the IEBC.

D. STRUCTURAL SYSTEMS - OPTION 2.1

1. PRESCRIPTIVE COMPLIANCE METHOD

In this method, compliance with Chapter 4 of the IEBC is required. As part of the scope of this report, the extent of the compliance requirements identified are limited to the structural requirements of this chapter.

Additions
Based on the project scope, the following structural issues have to be addressed:

- All additions should comply with the code requirements for new construction in the IBC.
- For additions that are not structurally independent of the existing structure, the existing structure and its addition, acting as a single structure, shall meet the requirements of the code for new construction for resisting lateral loads, except for the existing lateral load carrying structural elements whose demand-capacity ratio is not increased by more than 10 percent, these elements can remain unaltered.
- Any existing gravity, load-carrying structural element for which an addition or its related alterations causes an increase in the design gravity load of more than 5 percent shall be strengthened, supplemented or replaced.

Alterations

- Any existing gravity, load-carrying structural element for which an addition or its related alterations causes an increase in the design gravity load of more than 5 percent shall be strengthened, supplemented or replaced.
- For alterations that would increase the design lateral loads or cause a structural irregularity or decrease the capacity of any lateral load carrying structural element, the structure of the altered building shall meet the requirements of the code for new construction, except for the existing lateral load carrying structural elements whose demand-capacity ratio is not increased by more than 10 percent, these elements can remain unaltered.

2. WORK AREA COMPLIANCE METHOD

In this method, compliance with Chapter 5 through 13 of the IEBC is required. As part of the scope of this report, the extent of the compliance requirements identified are limited to the structural requirements of these chapters.
In this method, the extent of alterations has to be classified into LEVELS OF WORK based on the scope and extent of the alterations to the existing structure. The LEVEL OF WORK can be classified into LEVEL 1, LEVEL 2 or LEVEL 3 Alterations. In addition, there are requirements that have to be satisfied for additions to the existing structure.
The extent of the renovations (includes Architectural, FP and MEP renovations) for this project will exceed 50 percent of the aggregate area of the building, thus the LEVEL OF WORK for this project would be classified as LEVEL 3 Alterations. This would require compliance with provision of Chapter 7, 8 and 9 of the IEBC. The scope of the project includes new additions to the existing structure; this would trigger compliance with provisions in Chapter 111 of the IEBC.

Level 3 Alterations

- Any existing gravity, load-carrying structural element for which an alteration causes an increase in the design gravity load of more than 5 percent shall be strengthened, supplemented or replaced.
- For alterations where more than 30 percent of the total floor area and roof areas of the building or structure have been or proposed to be involved in structural alterations within a 12 month period, the evaluation and analysis shall demonstrate that the altered building complies with the full design wind loads as per the code requirements for new construction and with reduced IBC level seismic forces.
- For alterations where not more than 30 percent of the total floor and roof areas of the building are involved in structural alterations within a 12 month period, the evaluation and analysis shall demonstrate that the altered building or structure complies with the loads at the time of the original construction or the most recent

substantial alteration (more than 30 percent of total floor and roof area). If these alterations increase the seismic demand-capacity ratio on any structural element by more than 10 percent, that particular structural element shall comply with reduced IBC level seismic forces.

- For alterations that involve structural alterations to more than 30 percent of the total floor and roof area of the building within a 12 month period, the evaluation and analysis shall demonstrate that the altered building structure complies with IBC for wind loading and with reduced IBC level seismic forces.
- For alterations where more than 25 percent of the roof is replaced for buildings assigned to seismic design category B, C, D, E or F, all un-reinforced masonry walls shall be anchored to the roof structure and un-reinforced masonry parapets shall be braced to the roof structure.

Additions

- All additions shall comply with the requirements for the code for new construction in the IBC.
- Any existing gravity, load-carrying structural element for which an addition or its related alterations cause an increase in design gravity load of more than 5 percent shall be strengthened, supplemented or replaced.
- For additions that are not structurally independent of the existing structure, the existing structure and its addition, acting as a single structure, shall meet the requirements of the code for new construction in the IBC for resisting wind loads and IBC Level Seismic Forces (may be lower than loads from the Code for New Construction in the IBC), except for small additions that would not increase the lateral force story shear in any story by more than 10 percent cumulative. In this case, the existing lateral load resisting system can remain unaltered.

3. PERFORMANCE COMPLIANCE METHOD

Following the requirements of this method for the alterations and additions may be onerous on the project because this method requires that the altered existing structure and the additions meet the requirements for the code for new construction in the IBC.

PARTICULAR REQUIREMENTS OF COMPLIANCE METHODS

For our project, in order to meet compliance with one of the two compliance methods “Prescriptive Compliance Method” or the “Work Area Compliance Method”, we have to address the following:

1. PRESCRIPTIVE COMPLIANCE METHOD

Additions

The proposed additions will be designed structurally independent of the existing structure, thus, would not impart any additional lateral loads on the existing structure.

If the proposed alterations are such that the alterations increase the design lateral loads on the existing building or cause any structural irregularity of decrease the lateral load carrying capacity of the building, the structure of the altered building shall meet the requirements of the Code for New Construction in the IBC.

If the proposed additions increase the design gravity load on portions of the existing roof members, these members would have to be reinforced and this incidental structural alteration of the existing structure would have to be accounted for in the scope of the alterations to the existing school and would trigger requirements for alterations.

Alterations

Alterations that would increase the design gravity loads by more than 5 percent on any structural members would have to be reinforced.

If the proposed alterations of the structure increase the effective seismic weight on the existing structure due to the greater snow loads from the drifted snow against any proposed addition, or, by addition of equipment on the roof, the increase of the effective seismic weight from the drifted snow and the equipment would require that the existing lateral load resisting system comply with the requirements of the Code for New Construction in the IBC and it would increase the demand-capacity ratio on certain structural elements of the existing lateral load resisting system.

2. WORK AREA COMPLIANCE METHOD

Level 3 Alterations
If the proposed structural alterations of the existing structure are less than 30 percent of the total floor and roof areas of the existing structure, we have to demonstrate that the altered structure complies with the loads applicable at the time of the original construction and that the seismic demand-capacity ratio is not increased by more than 10 percent on any existing structural element. Those structural elements whose seismic demand-capacity ratio is increased by more than 10 percent shall comply with reduced IBC level seismic forces. The percentage increase in seismic demand-capacity ratio on any particular structural element from the added snowdrift load against the proposed addition would be fairly low, thus, this would not have any major impact on the existing lateral load resisting system, though we would have to verify that the increase in seismic demand-capacity ratio on any of those particular structural elements is not greater than 10 percent.

If the proposed structural alterations of the existing structure exceed 30 percent of the total floor and roof areas of the existing structure, we have to demonstrate that the altered structure complies with the IBC for wind loading and with reduced IBC level seismic forces.

Existing anchorage of all unreinforced masonry walls have to be evaluated. If the existing anchorage of the walls is deficient, the tops of the masonry walls will require new connections to the structure.

Additions
The proposed additions will be designed structurally independent of the existing structure; thus, it would not impart any additional lateral loads on the existing structure.

Comment
The compliance requirements of the two methods, in most respects, are very similar. The Work Area Compliance Method would trigger anchorage of un-reinforced masonry walls, if re-roofing of the existing structure is included as part of the scope for this project. The Prescriptive Compliance Method would require that the existing lateral load resisting system meet the requirements of the code for new construction of the IBC, even for small increases of design lateral loads. We are required to comply with requirements of Appendix A1 of IEBC for either method, which requires anchorage of all existing masonry walls. Based on this, we would recommend the Work Area Compliance Method for the project.

Summary of Renovations to the Existing Structure
Based on the scope of the proposed scheme for renovations of the existing school, we have determined that the existing structure would essentially have to comply with the Code for New Construction which would require the addition of new lateral load resisting elements such as structural steel braced beams on masonry shear walls throughout the floor plates at every level. All of the un-reinforced masonry walls are required to be anchored to the floor and roof structure and all of the roof diaphragms have to be reinforced, to resist uplift loads per the Code for New Construction. The addition of braces will require modifications to the existing column foundations at the brace locations and will require the addition of new piles. At the locations of existing slabs-on-grade, new tie beams will be required to connect the existing column foundations.

Belmont High School
Belmont, Massachusetts

Structural Narrative
Option 2.1 - Renovations and Additions

Proposed Scheme for the Proposed Addition

SUBSTRUCTURE

FOUNDATIONS

Based on the construction of the existing school and the recommendations of the Geotechnical Engineer, the entire addition will be supported on pile foundations. The columns of the proposed structure would bear on 4 ft. – 0 in. deep reinforced concrete pile caps on structural steel piles. The exterior walls will be supported on 5 ft. – 0 in. deep grade beams spanning between pile caps with intermediate piles at 10 ft. – 0 in. on center. Based on an assumed pile capacity of 50 tons, a typical interior column in the four story classroom wings would be supported on 8 ft. – 0 in. x 8 ft. – 0 in. x 4 ft. 0 in. deep pile caps on a four pile group and a typical exterior column would be supported on 8 ft. – 0 in. x 8 ft. – 0 in. x 4 ft. 0 in. deep pile caps on a three pile group. The columns supporting the long span structure of the single story gymnasium, cafeteria, music spaces and other ancillary spaces would be supported on 8 ft. – 0 in. x 8 ft. – 0 in. x 4 ft. – 0 in. deep pile caps on three pile groups. In addition, the ground floor slab would be supported on single piles with a 2 ft. – 0 in. x 2 ft. – 0 in. x 2 ft. – 0 in. deep pile caps spaced out approximately 15 ft. – 0 in. (including interior and exterior pile caps supporting the columns.) All of the interior and exterior pile caps will be tied to the supported concrete slab.

SLAB ON GRADE

Based on the construction of the existing school and the recommendations of the Geotechnical Engineer, the lowest level of the proposed addition would be a 12 in. thick reinforced concrete slab reinforced with 6 psf reinforcing over a vapor barrier on 2 in. thick rigid insulation on compacted granular structural fill supported on piles.

SUPERSTRUCTURE

FLOOR CONSTRUCTION

Typical Floor Construction
A 5 ¼ in. light weight concrete composite metal deck slab reinforced with welded wire fabric on wide flange steel beams spanning between steel girders and columns. The weight of the structural steel is estimated to be 15 psf for the typical framing.

ROOF CONSTRUCTION

Typical Roof Construction
The roof construction would be galvanized, corrugated 1 ½ in. deep, Type 'B' metal roof deck spanning between wide flanged steel beams and girders. At locations of roof supported mechanical equipment, a concrete slab will be provided similar to the typical supported floor slab. The weight of the structural steel is estimated to be 13 psf.

Low Roof Structure above the Kitchen, Mechanical Room and the Utility Areas
The roof would be a continuation of the adjacent second floor and would be similar to the typical floor construction of 5 ¼ in. light weight concrete composite metal deck slab reinforced with welded wire fabric on wide flange steel beams spanning between steel girders and columns. This roof will be supporting the mechanical units. The units would be screened by a screen comprised of structural steel posts and beams. The weight of the structural steel is estimated to be 15 psf.

Alt. PE and Media Center Roof Framing
The roof construction would be acoustic, galvanized corrugated 3 in. deep, Type 'NA' metal roof deck spanning between long span metal joists and hollow structural steel columns. The weight of the structural steel is estimated to be 13 psf.

D. STRUCTURAL SYSTEMS - OPTION 2.1

VERTICAL FRAMING ELEMENTS

Columns
Columns would be hollow structural steel columns. Typical columns would be HSS 8 x 8 columns and the columns at the double story spaces at the Gymnasium and Lobby would be HSS 12 x 12.

Lateral Load-Resisting System
The proposed addition would be separated from the existing building by way of an expansion joint. The typical lateral load resisting system for the other parts of the school would be concentric steel braced frames comprised of hollow structural steel sections.

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

E. SITE UTILITIES - OPTION 2.1

SITE UTILITIES

Storm Drainage

Stormwater from the site will continue to be directed to Clay Pit Pond. Outside of the existing stormwater outfalls into Clay Pit Pond it is expected that the entire stormwater system will have to be reconstructed so that the new stormwater system can effectively mitigate stormwater quality, rate and volumes from the project site. Runoff generated by the new parking and driveway areas would be collected in a catch-basin to manhole closed drainage system. Water quality from these areas would be addressed by directing those flows through Stormceptor water quality units (or similar). Volume and rates of stormwater from the site would then be addressed by directing these flows to subsurface infiltration systems located beneath the parking areas. The infiltration systems would consist of galleys of 36-inch perforated pipe in crushed stone bedding. Overflows from these infiltration systems would then be directed through the new closed drainage system to the existing outfalls to Clay Pit Pond.

Roof drainage from the building is not required to be treated for water quality, therefore it can be tied directly into the new closed drainage system prior to discharge from the existing outfalls. A portion of the roof drainage could be daylighted to a raingarden or stormwater demonstration area that is incorporated into the landscape design. This landscaped area would consist of an area with variable topography to direct the stormwater through it, plantings to provide treatment and nutrient uptake, walkways or boardwalks that allow students to observe the processes and possibly even hardscape stormwater features such as runnels or small falls to provide aeration.

The new and reconstructed athletic fields would have sub-drainage located below the topsoil layer, as is typical of turf field construction. The sub-drains can be connected directly into the new closed drainage system.

Sewer

This scheme does not appear to conflict with the existing sewer main which bisects the site, running west to east approximately under the sidewalk, adjacent to the existing access drive in front of the school. That existing sewer main would be maintained during construction, and new service connections from the new school would be connected to it. Lab waste flows would be directed through a pH neutralization system prior to connection to the sanitary sewer system. Flows from the cafeteria would be directed through a new, 10,000-gallon, external grease trap.

Water

It appears that portions of the new construction would conflict with the existing water main that is routed around the rear of the existing building. Approximately 2,000 linear feet of new 8-inch water main would be installed in the first phase of the construction, along the rear property line, out of the way of any future phases. New 4-inch domestic water and 6-inch fire services would be provided to the building from the new 8-inch main. Six new fire hydrants, located along the main, would also be provided as directed by the Belmont Fire Department

Natural Gas

The existing gas service conflicts with the proposed construction. A new gas service, located to the west of the proposed building would be provided from the existing gas main in Concord Avenue to the mechanical area located at the rear of the proposed building.

Electrical

Portions of the new construction conflict with the existing primary electric service. A new ductbanck consisting of four 4-inch, concrete encased conduits would be installed from the existing substation located just east of the site on Hittinger Street to the new electric room located to the rear of the proposed building.

PRELIMINARY PERMITTING CONSIDERATIONS

Wetlands Protection Act (310 CMR 10.00)

A Notice of Intent would need to be filed with the Town of Belmont Conservation Commission for any work within 100-feet of Clay Pit Pond. In addition, a Stormwater Pollution Prevention Plan (SWPPP) would need to be prepared and an application filed with the Environmental Protection Agency under the National Pollutions Discharge Elimination System (NPDES) program for the construction related activities. Erosion control measures will need to be installed and maintained in good working order around the perimeter of the site. Due to the phase nature of the construction, the perimeter controls will have to be re-installed several times over the duration of the project.

Flood Plain

Based on the Flood Insurance Rate Map (FIRM), Community

E. SITE UTILITIES - OPTION 2.1

Panel Number 25017C0418E dated June 4, 2010, the portions of the existing High School site are located within Zone X (Areas determined to be outside the 0.2% annual chance floodplain). There is no regulatory requirement for working within a Zone X. The Zone AE, which is associated with the 100-year flood area, is located in close proximity to the banks of Clay Pit Pond. None of the proposed building or any critical infrastructure is being proposed within the Zone AE.

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

F. BUILDING SYSTEMS / PFP - OPTION 2.1

FIRE PROTECTION

A. General

1) A major renovation to the existing building, and a minor addition, will require a new sprinkler system to be installed.

B. To comply with current codes, this existing building and addition will require a complete sprinkler system installation per the Massachusetts State Building Code, Chapter 34. The Fire Protection system would be designed to meet the requirements of NFPA 13 "Installation of Sprinkler Systems" and Chapter 9 of the Massachusetts State Building Code, 780 CMR, "Fire Protection Systems".

C. A new dedicated 8" sprinkler service, connected to the town water system in the street, should be brought into the building. The exact entrance location will need to be coordinated with the Architect. As the sprinkler service enters the building a Massachusetts approved double check valve backflow preventer assembly, complete with OS&Y valves on the inlet and outlet, will be required.

D. The building will be protected by three types of sprinkler systems and each will protect the following areas:

- Wet sprinkler system – base building system
- Dry sprinkler system – to protect areas subject to freezing; i.e. loading docks and outdoor walkways covered by building overhangs, etc.
- Pre-action sprinkler system – to protect the MDF room

E. The alarm check valves for the wet and dry sprinkler systems will be installed on separate risers after the double check valve assembly in the water service entrance room. The alarm check valves will be complete with standard trim packages including pressure gauges, retard chamber, 2" main drain, water flow indicator and supervisory switches. The dry alarm valve will be supplied with an air compressor and associated appurtenances.

F. Fire protection piping main feeds to the fire protection systems from the alarm check valves will extend out to the building through the first-floor ceiling space. The piping will then extend to all areas of the building to provide complete sprinkler cover age throughout. Potential sprinkler zoning will be coordinated with any new fire wall layouts.

G. The fire protection design will include a combination standpipe system located in all egress stairways. These standpipes will feed the sprinkler system as well as provide a fire department hose connection at each level of the building.

H. The sprinkler system risers will feed the sprinkler system at each floor level. Each floor will be a separate zone. The floor control valve assembly at the riser that feeds each floor will contain a flow switch and tamper switch. An inspector's test connection will be installed on the floor control valve station. If the auditorium stage is greater than 1,000 square feet, fire department valves will be required on each side of the stage.

I. Sprinkler heads installed in gypsum or suspended ceilings will be glass bulb, quick response, chrome plated semi-recessed type. In areas without ceilings, brass upright sprinklers will be installed. Where upright sprinklers are subject to potential damage, such as in storage rooms, protective cages will be installed. In areas where it is not possible to run piping above the ceiling the use of sidewall sprinkler heads would be recommended.

J. The MDF room will be protected by a pre-action sprinkler system. A pre-action alarm valve with all required appurtenances will need to be located next to or near the MDF. Piping from this valve will extend into the room and connect to sprinkler heads. The piping system will be filled with compressed air. Once a sprinkler head activates, the air will discharge and open the pre-action alarm valve to allow water into the system and through the open sprinkler head.

K. Sprinkler piping for the system will be as follows:

- Piping 2" and smaller shall be schedule 40 black steel with cast iron fittings with threaded joints.
- Piping 2 ½" and larger shall be Schedule 10 black steel with malleable iron fittings with rolled grooved joints.
- Dry sprinkler systems will be supplied with Schedule 10 galvanized piping throughout.

F. BUILDING SYSTEMS / PFP - OPTION 2.1

L. All tamper and flow switches installed on the sprinkler system will be connected to the buildings fire alarm system. Each tamper and flow switch will be a dedicated point on the fire alarm system.

M. The exterior fire department connection for the sprinkler system will be a flush type mounted on the exterior of the building within 100' of a fire hydrant. The exact type of connection (storz or siamese) will be coordinated with the Belmont Fire Department. Final location and number of fire department connections will also be coordinated with the Belmont Fire Department.

N. The hydraulic requirements for the building will be as follows:

- Light Hazard - All offices, corridors and the auditorium hydraulically calculated to deliver 0.1 gpm per square foot over the most remote 1,500 square feet.
- Ordinary Hazard - All storage rooms and mechanical rooms hydraulically calculated to deliver 0.15 gpm per square foot over the most remote 1,500 square feet.
- Ordinary Hazard Group II - The stage area hydraulically calculated to deliver 0.2 gpm per square foot over the most remote 1,500 square feet.

PLUMBING

A. General

1) A major renovation to the existing building and a new addition would require that all existing plumbing systems be modified to comply with current codes.

2) All existing plumbing systems, or portions thereof, that were capable of remaining and being maintained should also be removed or modified to meet the requirements of any planned renovations.

3) All existing plumbing systems to be removed as part of the select building demolition should be removed back to the nearest point of connection of their respective system.

4) New above ground sanitary waste piping should be installed throughout remaining portions of the existing building to replace the existing older system that is currently in place.

5) New above ground domestic hot and cold water piping should be installed throughout remaining portions of the existing building to replace the existing older systems that are currently in place.

6) Install new waste outlets as required to accept HVAC condensate and sprinkler waste discharge.

B. Plumbing Fixtures

1) All water closets, urinals and lavatories in the existing building are old and not current water conserving type. Removal of all fixtures is required as the existing fixtures have reached the end of their serviceable life. Water closets should be replaced with new dual flush valve fixtures. A full flush will discharge at a rate of 1.6 gallons per flush (gpf). When only flushing liquid waste and paper, the reduced flush rate will be 1.1 gpf. Urinals should be replaced with 0.25 gpf fixtures. Lavatories should be replaced and new low-flow type faucets (0.5 gpm or less) added with temperature limit stops which will deliver water with a maximum temperature of 110°F. ADA requirements for fixture spacing, mounting heights and protection of any exposed piping will also need to be met during a renovation to the bathrooms.

2) The state plumbing code dictates the number of plumbing fixtures required in a building. Minimum plumbing fixture requirements will be determined once the total occupancy numbers for the building have been established based on the final plan layout.

C. Domestic Cold-Water System

1) The existing 6" domestic water line that enters the building is the original service to the building. Although the existing 6" domestic water service appears to be adequate to meet the current building water requirements, consideration should be given to replacing it with a new 6" dedicated domestic water service since a new 8" water service would also be brought in at this time to feed the new sprinkler system. The installation of a water meter on the new service will be provided to allow the town to be able to monitor water usage as may be required.

D. Domestic Hot Water System

1) The existing steam water heaters serving the larger portions of the building are original to the building and have passed their useful life expectancy. Also with the use

of these steam water heaters, the boilers are required to operate during the summer months to allow hot water to be created for the building. It is recommended to install new gas-fired storage type water heaters in the same locations as the existing. It is also recommended that redundant water heaters be included in the new system design. This would allow the system to continue to deliver hot water if one of the water heaters were to need service. The water heaters would be sized to provide hot water to all fixtures within the building.

2) The existing electric water heaters serving the various wings of the building are older and have passed their useful life expectancy. These should be removed. The new gas-fired water heaters should provide hot water to all fixtures that these units currently serve.

E. Sanitary Waste and Vent System

1) The sanitary system in the existing building appears to be in good condition but replacement may be required because of a possible fixture count change and probable relocation of fixtures in the renovation plan. Any new piping would connect to the existing waste and vent piping at a convenient point to be determined by further investigation.

F. Storm Drainage

1) The existing building roof drainage appears to be in good condition and no replacement is required. The roof itself appears to be in good condition and leaks around the roof drains themselves have not been reported.

2) New roof drains and storm water piping system will need to be added to the new addition. Discharge of the storm water will be coordinated with the civil engineer.

3) Backwater valves should be installed on all interior storm system piping originating from roof drains on lower roof sections as per the state plumbing code.

G. Natural Gas System

1) Currently the existing gas service is more than adequate to meet the school's demand requirements. Gas piping should be reconfigured to serve all mechanical equipment that will require gas. Any new gas-fired kitchen equipment can be connected to the new capped gas service located just outside of the building near the kitchen.

H. Insulation

1) The pipe insulation that currently exists should be tested to determine the extent of any hazardous materials. The insulation should be removed and replaced with new fiberglass insulation with an all service jacket. Domestic water and horizontal storm drainage piping that is not currently insulated should have new insulation installed.

2) Insulation will also need to be provided on waste piping and water piping below handicapped lavatories and sinks.

I. Hose Bibbs and Wall Hydrants

1) During any renovation done to the building the existing hose bibbs in the toilet rooms should be removed and new wall mounted hose bibbs with an integral vacuum breaker and removable tee handle installed. In the new addition, hose bibbs will be provided in all bathrooms and mechanical spaces. New wall hydrants will be provided on the exterior of the building and their locations coordinated with the architect.

J. Cross Connection Control

1) The existing hose bibbs and wall hydrants do not have backflow prevention devices. Backflow devices should be integral to all new hose bibbs and wall hydrants installed during the renovation.

2) All service sink faucets installed during a renovation and in the new addition will also be supplied with integral vacuum breakers.

3) A new reduced pressure backflow preventer assembly should also be installed on the existing 6" domestic water service (or on a new service if this is the preferred option) to further protect the town's domestic water system.

K. Boys, Girls and Pool Locker Room/Shower Areas

1) All locker room/shower areas should be completely renovated. Floor drains within any new shower stalls should be arranged so that the water from one shower does not enter the adjacent shower area. New shower valves should be installed with code compliant shower heads. Master mixing valves should be installed at each shower location. Valves shall be provided with limiting

stops set to a maximum water temperature delivery of 112°F.

2) All plumbing fixtures will be replaced as discussed in the "Plumbing Fixture" section of this report.

L. Kitchen

1) If kitchen renovations include the addition of new or replaced gas-fired equipment this equipment can be connected to the new gas service located outside the building as noted above.

2) Any new gas equipment would be fed by gas piping connecting to a master shut-off valve that would be interconnected with the kitchen hood and exhaust system. Gas would only operate when the kitchen hood exhaust system is operating.

3) Additional floor sinks and/or floor drains would be added to any new equipment design to ensure proper drainage throughout the kitchen.

4) A new three-compartment sink with new grease trap should be included per state code requirements.

5) A new dishwasher with accompanying grease trap should also be provided per state code requirements.

6) A new exterior grease trap, located underground, outside of the kitchen portion of the building will also need to be considered as part of any new design or renovation to the kitchen. Venting of this exterior grease trap should enter back into the school building and exit to the atmosphere above the roof.

M. Science Wing

1) The lab waste system should be removed in its entirety and replaced with a new polypropylene acid resistant piping system that empties into a central acid neutralization tank and system. This system would balance the pH of the lab waste and then safely discharge it into the regular sanitary waste system before it connects back to the town's sanitary waste system.

2) The existing hot and cold water systems serving the science wing should also be removed in their entirety. New protected hot and cold water systems should be created to serve the renovated science wing by installing reduced pressure backflow preventers on the hot and cold water piping designated to serve this area.

3) New gas piping to each science classroom should feed an emergency shut-off valve located in a valve box on the wall near the classroom exit door. Piping from this valve would then feed any gas turrets within that classroom only.

4) New emergency showers and eyewashes should be installed in each science classroom. A new tempered water system should be created to serve these fixtures. A new gas-fired water heater should be installed somewhere within the science wing and be dedicated to the new tempered water system. Water should be stored at 140°F and a master mixing valve should be mounted nearby and set to deliver tempered water to this wing at approximately 70°F-90°F per state plumbing code requirements. A tempered water return system will also be required to keep this system from becoming stagnant per state plumbing code requirements as well.

N. Pipe Materials

1) Below grade sanitary and storm drainage piping will be service weight bell and spigot cast iron with neoprene gasketed joints. Above grade sanitary and storm piping will be service weight hubless cast iron with Massachusetts approved stainless steel and neoprene no-hub connector assemblies.

2) All water supply and return piping shall be Type "L" copper.

3) All water supply and return piping insulation shall be in accordance with the Energy Code.

4) All gas piping will be threaded black steel piping up to 2 ½" size. Piping 3" and larger shall be welded.

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

F. BUILDING SYSTEMS / HVAC - OPTION 2.1

BELMONT HIGH SCHOOL

HEATING, VENTILATING, AND AIR CONDITIONING

MAJOR RENOVATION / MINOR ADDITION / C.2.1

A. General:

1. This description applies to the Major Renovation / Minor Addition option (C.2.1) where large parts of the existing building remain. The existing boiler room and main electrical room also remain. New construction is built in three major phases from west to east with the existing building largely remaining in operation initially and then newly renovated parts of the building being phased in after the initial phase is complete.

2. The recommended HVAC systems assume that the existing windows will be replaced and the walls and roof areas to remain will be insulated to meet or exceed the MA energy code.

3. Heating, air conditioning and ventilation systems shall be high-efficiency systems that allow for the ability towards achieving a Net Zero Energy facility.

B. Ground Loop Geo-Exchange System:

1. A vertical borehole well field area consisting of (400) 6-inch diameter boreholes spaced 20 feet apart shall be provided. Each borehole shall be 375 to 450 feet deep. Actual depth to be determined based on thermal conductivity testing performed on a test well. The number of boreholes may be increased or decreased based on thermal testing results and/or determination of the final heating and cooling loads.

2. Provide a 1-1/4 inch supply and return pipe within each borehole with a U-bend at the bottom. Piping shall be high density polyethylene (HDPE) with DR9 wall thickness. Polyethylene pipe and fittings shall be heat fused by butt, socket, sidewall, or electrofusion in accordance with pipe manufacturer's procedures. Underground supply and return piping from boreholes shall collect to four buried circuit vaults constructed of HDPE or concrete. Supply and return circuit piping in each vault shall combine to 8 inch main header piping which shall be routed into the building.

3. Steel sleeve casings shall be provided for the upper section of each borehole down to bedrock. Each borehole shall be filled with a bentonite based thermally enhanced grout mixture.

C. Central Heating and Cooling System:

1. Central geothermal heating and cooling shall be provided by four high efficiency 300 ton (approx. nominal capacity) heat recovery chiller-heaters or (40) 30 ton modular chiller-heaters connected to the ground loop system.

2. The ground loop circulation system shall be filled with 25% propylene glycol solution and shall be served by three 1000 GPM pumps with variable frequency drives.

3. Chiller-heater condenser water shall be constant flow primary with zero pressure bypass connections to the ground loop distribution and the building heating distribution. There shall be three primary condenser water pumps at 1,000 GPM each.

4. Secondary condenser/heating pumps shall be variable flow with variable frequency drives. There shall be three secondary heating pumps at 1,000 GPM each.

5. Chilled water distribution from chiller evaporators to building distribution shall be variable primary flow with three 750 GPM pumps.

6. The building circulation loop shall consist of a four-pipe distribution. The main distribution to heating/cooling terminal units in the building shall be four-pipe. Rooftop air handling units, heat recovery air handling units, and central air handling units shall be two-pipe configuration.

7. The building loop piping system shall contain a 25% propylene glycol solution for freeze protection and corrosion protection.

8. The building terminal heating units will be designed to utilize low temperature heating supply water (130°F maximum). Heating terminal units such as fin tube radiation and heating coils may require larger surface areas due to the low water temperature. In areas with high heating loads, two-row fin-tube and heating coils may be required.

D. Exterior Classrooms - Induction Units with Displacement:

1. The system serving heating, cooling and ventilation for typical exterior classrooms shall utilize four-pipe floor mounted chilled beam induction units with displacement supply air. Four 5 ft. long units shall be provided for each typical classroom mounted along the exterior wall. Units shall be served by two 7-inch diameter primary ventilation supply air ducts.

2. The primary supply air serving each classroom shall be provided with a modulating supply air volume control terminal to control supply air when the room is occupied.

3. Systems will be interfaced to the local space vacancy sensor to reduce ventilation air and reset the space cooling and heating set point temperatures when the room is unoccupied.

4. A carbon dioxide sampling sensing system will be provided in classrooms to provide monitoring and occupied control of ventilation air.

E. Interior Classrooms and Other Spaces – Ceiling Induction Units:

1. Interior classrooms and other interior occupied spaces will be served with ventilation supply air from a rooftop heat recovery ventilation unit connected to ceiling mounted chilled beam induction terminals. Induction terminals shall be provided with four-pipe supply and return water connections.

2. Individual classrooms shall be provided with a supply air volume control terminal to control ventilation air when the room is occupied. A carbon dioxide sampling sensing system shall be provided for classrooms to monitor and control ventilation air.

F. Classroom and Interior Ventilation Systems:

1. Outside ventilation air for classrooms and interior spaces will be provided by roof mounted dedicated outside air heat recovery units (HRU).

2. The HRU's will be variable air volume and will include supply and exhaust fans with variable frequency drives, total energy recovery wheels and secondary sensible reheat wheels to allow for a low level of dehumidification control. The units will be provided with two-pipe dual temperature water connections to a single combination pre-heat and cooling coil. Changeover between hot water and chilled water supply shall be provided with the use of changeover valves connected to the hot water and chilled water systems. Each unit shall include 100% recirculation dampers for morning warm-up mode and after-hours night setback heating.

4. Variable supply air will be based on demand from classrooms and interior spaces. Return/exhaust air shall be controlled by air flow measurement and tracking of the supply and exhaust air with limited volume control terminals in the exhaust air system.

5. Corridors will be provided with ventilation air from the HRU system. Air quantities in excess of basic ventilation requirements will be provided for building exhaust makeup air as required. Corridors will not be fully air conditioned with the exception of areas that have direct solar loads.

G. Existing Gymnasium:

1. The existing heating and ventilating units in the gym shall be replaced with new HVAC units in Phase 02. The units shall include a hydronic coil for heating and cooling using hot water and chilled water. Units shall also include a heat recovery section with an enthalpy wheel for outdoor air heat recovery meeting the requirements of the MA energy code due to the level of outdoor air required.

2. Two units shall be provided, which shall be located indoors or outdoors depending on structural and architectural requirements. Units be provided with a round ductwork distribution exposed within the space.

3. The units shall be provided with variable frequency drives for the supply and return fans to reduce the fan speed during times of low demand. Supply, return, and outside air flow measurement and control shall be provided.

4. Provide a new H&V unit with plate heat exchanger to serve the existing locker rooms.

H. Existing Swimming Pool:

1. The existing heating and ventilating unit serving the pool shall be replaced with a new H&V unit in Phase 02. The unit shall include a hydronic coil for heating using hot water. The unit shall also include an air-to-air flat plate heat exchanger for exhaust air sensible heat recovery.

2. The pool deck exhaust system shall remain, but the existing exterior mounted exhaust fan shall be relocated to the roof due to the Phase 02 construction. Exhaust duct shall be extended up through the building in a ne duct shaft.

3. Provide a new H&V unit with flat plate heat exchanger to serve the new locker rooms.

I. Miscellaneous Areas:

1. All normally occupied areas will be air conditioned except for corridors, the kitchen, and culinary classrooms with kitchen hoods (if applicable). The kitchen and culinary areas are partially tempered by using transfer air from the commons for make-up air.

2. The Auditorium, Stage, Media Center, Cafeteria, and Administration areas, will be served by rooftop air conditioning units (RTU). Separate occupancy scheduling for each unit will provide operational flexibility.

3. Rooftop air conditioning units (RTU) will include supply fan, return fan, hot water heating coil, chilled water cooling coil, filters, and variable frequency drives. Units serving Administration, Media Center, Band/Chorus, and the Cafeteria will be variable air volume (VAV) with local variable air volume boxes for zone temperature control.

4. The Auditorium and Gymnasium units will be single zone with a variable frequency drive to modulate the supply air during periods of low demand and occupancy.

5. The Auditorium, Gymnasium, Cafeteria, and Media Center systems will be provided with space carbon dioxide (CO_2) sensors to provide modulation of outside air based on occupancy demand.

6. Areas such as the Cafeteria, Black Box, parts of the Media Center, main lobby and open group learning spaces may alternatively be provided with a radiant floor cooling and heating system. System shall include connections to the hot water and chilled water piping, circulation pumps, circuit headers, controls, and under-slab PEX piping distribution.

J. Building Management System (BMS):

1. Provide direct digital control (DDC) BMS with local and unitary controls and web interface for remote access, alarms, and monitoring of all HVAC equipment in the building including; chillers, pumps, heat recovery units, rooftop units, fans and terminal units shall be controlled and mapped to a central monitoring station. System shall be based on the Niagara Framework open protocol for interoperability between manufacturers.

2. BMS system shall be interfaced to the building electrical and gas sub-meters. Daily, weekly, and annual energy use shall be reported for each meter.

K. Carbon Dioxide Sensing System:

1. Provide an Aircuity, or equal, carbon dioxide air sampling and sensing system consisting of room sensors, cabling, tubing, room probes, air routers, and vacuum pumps.

2. Air tubing from room sensors shall be collected through air routers to sensing stations.

3. The system shall include an information management system and shall be integration with the building management system.

4. Building management system input shall provide control input for modulating supply air terminal units or automatic dampers.

L. Electrical and BTU Metering:

1. Electrical metering shall be provided for collection of historical and real-time performance data. Separate meter groups shall be provided for the upper school areas and lower school areas consisting of meters for the measurement of lighting and plug loads for each classroom group by wing, floor or classroom type.

2. Individual metering of lighting and plug loads shall be provided for the Kitchen, Media Center, Auditorium/Stage, Gymnasium, and Administration areas.

3. Electrical metering shall be provided for each air handling system, central system pumps (by each group type), and each chiller-heater.

4. Provide BTU metering of chilled water, hot water, ground loop circulation systems and domestic hot water system.

M. Phasing Considerations:

1. Construction of the new facility is in three major phases (Phases 02, 04 and 06). Phase 02 of construction allows for the existing building to remain occupied, while a large part of the new construction is completed. Therefore, the existing boiler room must remain active and the new chiller-heater plant must be constructed to support the new construction in several phases.

room in the first phase to provide space for the new equipment. One of the steam boilers may also be phased out and demolished in this first phase.

2. Installation of the entire geothermal borehole field may be accomplished in Phase 02. The entire array may be installed in the area to the west of the building including the soccer and baseball fields, parking and drive lanes.

3. At least one steam boiler must remain active until at least the start of Phase 05 to provide continued steam service to the Auditorium and surrounding areas. An active steam supply and condensate return line to the Auditorium end of the building must be maintained through Phase 04.

4. The existing gym and pool areas will be renovated in Phase 02, including replacement and upgrade of the existing HVAC equipment.

5. Completion of the new central chiller-heater plant construction may begin in Phase 05 with the removal of the remainder of the existing boiler plant.

F. BUILDING SYSTEMS / Electrical - OPTION 2.1

Belmont High School

ELECTRICAL

2.1 Major Renovation / Minor Addition

A. Existing Electric Services:

1. Based on the proposed renovation/addition scope to maintain the Field House and Pool, existing services will be required to be maintained to deal with construction phasing and maintaining existing systems while renovations and new additions are completed.

2. The intent is that upon completion, there will be new services throughout the entire renovated facility and new additions.

3. The Main Electric Room housing the main electric switchboard is located adjacent the Boiler Room, these rooms are located at the northwest corner of the facility adjacent the Fieldhouse.

4. Scope will include maintaining and/or providing new feeders to existing panelboards and mechanical equipment to be kept operational during renovation and new construction.

5. Coordinate with Utility Company for the relocation of any utility poles and overhead pole lines associated with new construction and scheduled demolition of the existing school building.

6. All existing services shall be maintained for the complete operation of existing school building until the scheduled date of demolition of the existing building. Upon substantial completion, coordinate with the respective utility company and include all work required for the removal of all existing utility services that become abandoned including power, telephone, cable TV, and fire alarm services.

7. Include the removal of all existing roadway, parking, and walkway lighting structures. At the scheduled time of demolition of the existing buildings include disconnecting all services and making safe the existing structure for complete demolition.

8. Include maintaining the operation of existing site equipment such as irrigation pumps. Provide new services to all equipment affected by new construction.

B. New Main Electric Service:

1. A new primary service will be provided from utility company primary services via an underground ductbank and manhole system to a new utility company pad mounted transformer.

2. Secondary service from the new pad mounted transformer will be underground to a new main switchboard at 480/277V, 3-phase, 4-wire. Switchboard will be located in a new main electric room.

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

F. BUILDING SYSTEMS / Electrical - OPTION 2.1

C. New Normal Distribution System:

1. Main switchboard will be provided with surge protection (SPD) and ground fault protection on main and feeder devices.

2. Surge protection will be provided in all 120/208V panelboards.

D. New Emergency Distribution System:

1. Natural gas/diesel (fuel source to be determined) emergency generator will power emergency egress lighting and exit lighting in corridors, assembly areas, and stairwells. Miscellaneous systems to include the following:

   a. Kitchen walk-in coolers and freezers.

   b. Telephone system.

   c. Security system.

   d. District and school IT head-end equipment (located in the MDF Room).

   e. Cooling equipment for school and district IT equipment.

   f. Fire alarm system.

   g. Circulator pumps and controls.

2. Separate automatic transfer switches shall be provided for emergency and non-emergency loads.

3. In addition to the equipment and systems listed above, the following equipment and systems will be fed from the generator.

   a. Additional lighting in Gymnasium, Cafeteria, Kitchen, and associated toilets and corridors.

   b. HVAC ventilation equipment (no air-conditioning) associated with the Gymnasium, Cafeteria, Kitchen, and associated toilets and corridors.

   c. Receptacles in Gymnasium and Cafeteria.

4. Generator will be ground mounted at the exterior of the building in a self-contained sound attenuated enclosure with an integral base mounted fuel tank (if diesel). Generator will be mounted on an elevated concrete platform for survivability.

5. Emergency panels will be located in new two-hour rated electric closets.

6. Non-emergency (standby) loads will be located in separate closets via separate automatic transfer switch and panelboards.

7. Emergency feeders run outside two-hour electric rooms and shafts and not in or under floor slab will utilize MI Cables.

8. A portable generator connection will be provided to meet National Electric Code Article 700 requirements to have a portable generator available while servicing the building generator.

E. Sustainable Design Intent LEED 4.0:

1. Sustainable Design Intent compliance will include:

a. Advanced measurement and verification of air conditioning, fans, lighting, and receptacle power via electronic sub-meters equal to E-Mon, D-Mon Class 2000 3-phase kWh and demand meters. Measurement and verification metering will be monitored by the Building Management System (BMS).

b. Plug and process load reductions through the use of vacancy/occupancy sensor controls for local convenience outlets in classrooms, offices, library and resource rooms. Open areas such as Media Center, Auditorium and Kitchen will be equipped with relay panels controlled via the lighting control system, to reduce loads on a time schedule basis.

c. Advanced lighting controls include a low voltage lighting control system with time schedule control for common areas, vacancy/occupancy sensors, and photocells for daylight harvesting.

d. Empty conduit provisions will be provided for future green vehicles charger stations based on two percent of the available parking.

e. Empty conduits and space provisions will be provided for photovoltaic (PV) installations. Include conduits and space provisions for inverters at a minimum of three locations on Level 3 and/or Level 4 electric closets.

F. Lighting:

1. New luminaires will be provided throughout all renovated areas as well as new construction. Luminaires will be dimmable LED. All luminaires will be suitable for respective utility rebate incentives.

2. Exterior building mounted around the entire building including all canopies, all entry drives, parking areas, and all walkways will be full cutoff LED type. All exterior lighting will be controlled via the building low voltage lighting control system.

3. Athletic field lighting will be provided at the Softball and Baseball fields.

G. Lighting Controls:

1. A low voltage lighting control system will be provided for common areas such as corridors and other areas not controlled by occupancy sensors.

2. Manual low voltage override switches to override the time of day lighting control schedules shall be provided. Override switches will permit extension of lighting control program as well as ON-OFF override for exiting the facility.

3. Lighting program for time of day schedules shall permit all lighting, including exterior to be turned off during non-occupied hours, reducing sky glow and light trespass. Activation of either fire alarm or intrusion detection system shall override the lighting program.

4. Vacancy and occupancy sensors will control lighting in most spaces including classrooms, offices, and utility type spaces. In addition, all spaces will be provided with local low voltage dimmable switching.

5. Daylight harvesting will be employed in all perimeter classrooms, offices, and other spaces with substantial daylight utilizing daylight sensors in each space.

H. Auditorium:

1. A professional theatrical lighting system will be provided.

I. Convenience Power:

1. Safety type duplex receptacles will be provided throughout the building in quantities to suit space programming.

2. Plug load reduction will be achieved by vacancy/occupancy sensors in classrooms, offices, and staff spaces, and circuits routed via relay panels, controlled via lighting control system time schedule for open areas such as Commons/Café, Kitchen and culinary areas.

J. Fire Alarm:

1. Existing automatic, fully supervised, analog addressable, voice evacuation system will be maintained and utilized where applicable.

   a. Manual pull stations (with tamperproof covers if applicable), at points of egress, and other locations as required to meet code.

   b. Audible/visual units in corridors, classrooms, and throughout the building to meet code.

   c. Visual only units in conference rooms, meeting rooms and small toilets.

   d. Smoke detectors in corridors, stairwells, electric, and telecommunications rooms, elevator lobbies, and elevator machine rooms.

   e. Smoke duct detectors in HVAC units over 2,000 CFM, and within five feet of smoke dampers including connections to all smoke/fire dampers.

   f. Connections to all Fire Protection devices and Kitchen hood.

   g. Connections to audio/visual systems, sound systems, and dimmed lighting controls.

   h. Remote annunciator at main entrance and secondary entrances as directed by Belmont Fire Department.

   i. 24 VDC magnetic hold open devices at smoke doors.

   j. Master box and exterior beacon (quantity of beacons per Belmont Fire Department.

   k. Wiring will be fire alarm MC cable.

K. Technology per Technology Section.

F. BUILDING SYSTEMS / Electrical - OPTION 2.1

L. Integrated Intrusion, Access Control, CCTV, and Alarm System:

1. Intrusion alarm system will provide magnetic switches on perimeter doors, motion sensors in all perimeter rooms on first floor with susceptible access from grade. Motion sensors will be provided in first, second, and third floor corridors. System will have secure-access zoning. Zoning will be provided to suit all proposed off hours usage including community programs.

2. CCTV coverage will be provided at main and secondary entries as well as all other perimeter entries to be used by students and staff on a daily basis and for off hours community programs, including Gymnasium and Cafeteria entries.

3. Exterior CCTV coverage will be provided to cover the entire perimeter of the building.

4. Access control via card access system will be provided at all exterior doors.

5. CCTV system will be IP based with minimal 30 day recording capacity. System will be web based to allow viewing by Belmont Police Department.

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

F. BUILDING SYSTEMS / Information Technology - OPTION 2.1

Structured Cabling System:

The School Department is responsible for the fiber network for both the schools and the Town (including the light department and TV Studio). The fiber network handles general data as well as Phone (VoIP) and security for the school district and the Town. There are three centralization points for the fiber – the high school, Chenery Middle School, and the Town Library. Internet services and wireless controllers in the existing high school MDF provide connectivity at all the school facilities and the Town. These systems must remain operational during construction. Therefore, the MDF and the existing district fiber must be protected during construction.

A new MDF will be created. The MDF will be the central location of all head end equipment including but not limited to servers, storage, switch electronics, security equipment, video equipment, telephone system, public address system and security system. It will be a dedicated space with proper ventilation, environmental treatment and emergency power. The new MDF will be built-out and cutover during an early phase of construction. The district fiber will be re-routed or extended to the new MDF location. Existing Telco lines, which terminate in the Main Office area will need to be protected and re-routed or extended. Temporary cabling and services may be necessary to maintain functionality of existing systems during demo work.

New IDFs will be created. The IDF locations will serve as intermediate closets for local cabling and equipment. The IDFs will be dedicated spaces with proper ventilation, environmental treatment and emergency power. Each closet will connect to the MDF with backbone cabling. IDFs will be built-out and come on line in conjunction with construction phasing. Existing IDFs will be brought offline in conjunction with construction phasing. Temporary cabling and services may be necessary to maintain functionality of existing systems during demo work.

Equipment racks will be installed in the MDF and IDFs for patch panels and network hardware. Two-post and four-post racks will be provided. Racks will be 19" EIA floor mount racks with wide floor mounting flanges, vertical cables guides and horizontal cable managers. Power for rack equipment will be installed in cable tray above the racks. Power will consist of both 20A and 30A twist-lock receptacles.

The existing Category 5 horizontal cabling will be replaced. The new data cabling infrastructure will be based on a Category 6A, or most up to date standard at the time of bid. The data channel will be comprised of the passive components including cabling, connectors, patch panel port, and patch cords capable of supporting 10 Gigabit per second networking. Category 6A data cabling will be provided to all equipment requiring data and voice connectivity, including but not limited to data outlets, voice outlets, video surveillance cameras, access control network connections, and other related equipment. This cabling will support computer network requirements, wireless connectivity, telephone system (VoIP) and IP-based security needs. Cabling will terminate in the MDF or one of the IDFs. Temporary cabling may be necessary to maintain functionality of existing systems during demo work.

The existing fiber backbone within the school will be replaced. The new fiber backbone will connect the MDF and all IDFs. It will consist of twelve strands of multi-mode and six strands of single-mode fiber optic cables. All multimode fiber optic cables will use multimode, graded-index fibers with 50-micron cores only. Fiber will be laser-enhanced and guaranteed for transmission distances in 10 Gigabit Ethernet of up to 500 Meters. All single-mode fiber optic cables will be OS2, tight buffered, high flexibility. Temporary cabling and services may be necessary to maintain functionality of existing systems during demo work.

Data and Voice Communication Systems:

Updated networking hardware will be provided for the MDF and IDFs consisting of network switch electronics for the data and voice communication systems, distributed communication system, audio-video communication system, security system, wireless LAN and other Owner equipment. Components will consist of PoE+ chassis and power supplies, 10/100/1000 PoE+ modules, fiber transceivers, patch cables and UPS equipment. The switches will be fully configured according to network requirements and VLANs will be created according to best practice and equipment requirements. Backbone will be 10Gb minimum.

Updated VoIP server and hardware will be provided. The existing NEC 8300 will be upgraded to the 9300 platform, or current standard at the time of bid. Several elementary schools in the district depend on the existing VoIP system for connectivity, so it must remain operational during

F. BUILDING SYSTEMS / Information Technology - OPTION 2.1

construction. The new system must be compatible with existing VoIP equipment in the district.

Audio/Visual Communication System

Digital signage will be provided in gathering areas and large group instruction spaces. The system will consist of LED displays, media players, and a server or cloud based digital signage solution.

Classrooms and general instruction spaces will be equipped with a local audio system consisting of ceiling speaker, amplification, wireless microphones and auxiliary inputs. There will be an input available for FM assistive listening systems.

Distributed Communication System

The existing Simplex Building Communication System will be replaced with a new system. The new system should be built-out with the new MDF during an early phase of construction so that newly renovated or constructed areas can come online. The new distributed communication system will consist of a fully operational IP platform public address system for district and school internal communications system incorporating school safety notifications and general communications. It will provide complete internal communications using state of the art IP technology with two-way loud speaker internal communication, bell event notification, emergency announcements that will override any pre-programmed zones assuring that all emergency/lockdown announcements are heard at all locations, and atomic time synchronization. The system will connect directly to the high school's LAN and have the future capability of expanding to connect to other intercom systems in the school district over the WAN for district-wide, emergency, and live voice announcements in the future (additional hardware will be required at the other school facilities for this feature). Configuration of zoning, bell schedules, calendars, and emergency sequences will be accomplished using a browser-based interface.

ACENTECH

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BELMONT HIGH SCHOOL FEASIBILITY STUDY
AUDIOVISUAL SYSTEMS, OPTION C.2.1

SUBMITTED TO: **PERKINS + WILL**

CONSULTANT: ACENTECH

JANUARY 23, 2018

ACENTECH PROJECT NO. 629341

We visited Belmont High School on August 28, 2017 with the school and the entire design team to assess the existing conditions at the school. The following are our comments related to the audiovisual systems for the school.

BACKGROUND

Acentech is an independent consulting firm specializing in architectural acoustics, noise and vibration control, and the design of advanced sound, audiovisual, multimedia, and videoconferencing systems. In order to provide unbiased consulting and design services, Acentech does not sell or install equipment and does not represent any dealer, distributor, or manufacturer.

ROOM SCHEDULE

Unless otherwise noted, the focus of this project is limited to the following spaces and/or systems.

- Auditorium
- Music Classrooms
- Cafeteria
- Entry Hall
- Classrooms (including Art Classrooms)
- Lecture Hall (aka Little Theater)
- Book Rooms
- Gymnasium

EXISTING CONDITION EVALUATION

During our site visit, the existing audiovisual systems were reviewed. In general, the technology being used in the school is outdated and does not support current standards. Additionally, there did not appear to be consistency in the system components from room to room. Standardization is generally desirable so that technical staff can more easily troubleshoot and correct any problems with the systems, and also so that they can stock common replacement parts (such as projector lenses and filters).

Consistency from system to system also allows them to be easier for the end users. If an end user needs to use the audiovisual system in a space that they do not typically use, the user can feel comfortable and confident that they will understand how to use the system in that room since it will be exactly the same as the one they typically use.

In all of the classrooms that we observed, the video projection systems included analog video (VGA) connections, but not digital video (HDMI). Analog video systems are rapidly being phased out. Fewer source devices support this connectivity, and the cost to support the older technology is increasing due to low supply of the components needed to support this. While some adapters allow users to connect digital video sources

to analog displays (projectors and video display panels), the adapters are not reliable and do not always work.

Portable assistive listening systems were observed in some classrooms. These portable systems ("Redcat Lightspeed") are generally used for speech amplification. They do not typically connect to the audiovisual systems. In spaces with installed amplified sound systems, assistive listening systems are required in order to comply with the ADA (Americans with Disabilities Act). Further information about this requirement is listed later in this report.

It did not appear that audiovisual control system interfaces were used in most of the systems we observed. A control system interface (either as a touch screen control panel, or a button panel) will make the audiovisual system easier to use for the end user. The controls will always be available and in the same location (will not need to look for remote controls that can easily be lost).

The existing audiovisual equipment rack for the Auditorium is located on the downstage left corner. It is located next to electrical equipment and lighting dimmer racks. Unless the dimmer racks are using newer technologies, locating these racks in close proximity to one another should be avoided. Electrical "noise" (RF) from the lighting dimmers can create interference and create audible hum or buzz in the sound system.

Finally, current audiovisual system technologies allow the systems to connect to the data network. This allows the systems to automatically alert technicians about problems. For example, a system can alert a technician when a video projector's lamp has been used for a set number of hours. This allows the technician to know ahead of time that the lamp will need to be replaced soon, and give them time to order replacement parts before the lamp no longer works.

BUDGET SUMMARY

This report describes the functionality of the proposed audiovisual systems and does not include cost estimates. A programming meeting with key users is recommended to confirm the features described in this report, and a more accurate narrative and budget can be developed to cover this. Please note that audiovisual technology cost estimates do not cover construction items traditionally carried in the mechanical and electrical engineers' budgets. These items include, but are not limited to, conduit, junction boxes, structural supports, electrical power, and data network cabling.

TOTAL COST OF OWNERSHIP

The total cost of ownership of the audiovisual systems, in addition to the installation costs of the systems, includes several on-going costs:

Support Staff Costs:
The increase in the use of audiovisual systems carries with it the need to provide additional support for the users of the systems. This is balanced by network tools that allow support staff to work more efficiently. Specifically, the network-based management software will allow the staff to turn systems on and off, verify the operation of the equipment, schedule events for automatic operation, and receive automatic notification of system failures, projector lamp replacement, etc., without visiting the room. Without a detailed study of the current and anticipated support staff requirements, it is not possible to predict the staffing costs following the completion of the project; however, AV system management software is key to minimizing the support staff costs.

AV System Service:
The installation contract should require the installing contractor to provide a service contract for all systems for an additional three years beyond the initial one-year P&L warranty. The cost of a service contract for the period following the expiration of the initial contract is likely to be approximately 10% of the cost of the initial installation per year. In addition, there will be charges associated with the actual repair of equipment that may fail during the life of the service contract.

Equipment Replacement:

The useful life of audiovisual system equipment varies with the type of equipment. In general, the useful life of most AV equipment is 5 - 10 years. Replacing individual items of equipment will be necessary during the life of the systems. Complete upgrades of the systems may be appropriate after ten years, as much because of the progress of technology and because of equipment usable life.

INFRASTRUCTURE VS. EQUIPMENT

The distinction between infrastructure and equipment must be emphasized: Infrastructure is part of the building construction including, but not limited to, conduit, raceways, junction and device boxes, and is not outlined in this program. Other infrastructure provisions, such as electrical power and grounding specified exclusively for audiovisual systems cabling and equipment may be required and should be carried in the electrical budget. Properly designed AV infrastructure allows for not only the installation of the initially specified equipment, but for the evolution of the systems over many years. If proper infrastructure is provided, additional capabilities and equipment can be added later as technology progresses.

Equipment refers to the devices that can be connected through the infrastructure. Equipment includes microphones, loudspeakers, mixers, signal processing gear, video projectors, flat panel displays, cameras, AV control systems, equipment racks, and many other devices that comprise an AV system. One thing is certain – equipment will change over the life of the room as user needs and technology change. For this reason, infrastructure is the key to the long-term success of a thoughtfully conceived AV design project because it governs what can and cannot be easily installed in the future.

EQUIPMENT NOTES AND DEFINITIONS

This program is not a technical specification and is insufficient to bid or build an AV system. Except where useful to illustrate a standard of performance or a specific user requirement, equipment manufacturers and model numbers are not used.

- Permanently installed refers to equipment that is part of the room systems and cannot easily be removed for use elsewhere.
- Portable refers to equipment that is available for connection at one or more locations, but is not hard-wired to the system. Portable equipment can be disconnected by the user or technical personnel and stored or used with systems elsewhere in the facility.
- Future Provisions refers to equipment that may be purchased and used or installed at a future date.
- Options refer to equipment or systems that are not at this point considered to be central to the needs of the Owner but may be chosen if desired. Optional equipment is not included in the budget estimate totals.
- OFE (Owner Furnished Equipment) refers to equipment that is either already owned by the Owner, or may be purchased in the future as needs arise. FBO (Furnished by Others), or “by others” refers to any service or equipment (e.g. lighting) required but not a part of the AV system design or installation.

SYSTEM CLASSIFICATIONS:

Presentation Systems

Presentation systems are the source, routing, and display devices that provide highly intelligible communication of speech, music, information, and graphics to groups of people. This includes equipment such as microphones, loudspeakers, video projectors, plasma displays, computers, and the interfacing, mixing, routing, and control equipment that connects these devices together and allows the user to select the appropriate sources and operate the system.

Assistive Listening Systems

Permanently installed Assistive Listening Systems (ALS) are required by the ADA (Americans with Disabilities Act), a 1990 federal law that forbids discrimination against persons who are handicapped. A 2010 revision states, “In each assembly area where audible communication is integral to the use of the space, an assistive listening system shall be provided” in the following quantities and versions:

Receivers for Assistive Listening Systems		
Capacity of Seating in Assembly Area	**Minimum Number of Required Receivers**	**Minimum Number of Required Receivers Required to be Hearing-aid Compatible**
50 or less	2	2
51 to 200	2, plus 1 per 25 seats over 50 seats[1]	2
201 to 500	2, plus 1 per 25 seats over 50 seats[1]	1 per 4 receivers*
501 to 1000	20, plus 1 per 33 seats over 500 seats[1]	1 per 4 receivers*
1001 to 2000	35, plus 1 per 50 seats over 1000 seats[1]	1 per 4 receivers*
2001 and over1	55 plus 1 per 100 seats over 2000 seats[1]	1 per 4 receivers*
		1 "Or Fraction thereof"

The term "assembly area" includes facilities used for entertainment, educational, or civic gatherings. Additionally, courtrooms are required to support Assistive Listening systems regardless of whether or not an installed sound system exists.

Audiovisual Control System

Audiovisual (AV) control systems are required to centralize the operation of the various functions of the AV system. This includes environmental controls such as lighting presets and shade and drape controls, as well as audiovisual functions such as system and projector power, source device selection and media transport controls, audio volume controls, and many other operational functions identified by the design team before the equipment is installed.

Advanced functions of the AV control system may include multi-level password protection for system operation to prevent unauthorized use, control of automatic system shut-down sequences (to reduce unnecessary wear and tear), and a help system interface for user experiencing technical problems (see below).

Remote Management

Permanently-installed AV control systems can be connected to the Owner LAN to enable remote control and diagnostics of the AV systems. An asset management hardware / software suite allows monitoring and operation of AV systems via the Owner's LAN. These products allow technical personnel to operate audiovisual systems in remote locations from any computer with a web browser. The features of remote management systems include:

- Real-time monitoring of system status, including notification of imminent problems in certain devices before they fail.
- Mobile management.
- A method of asset management by tracking equipment usage in real time.
- Will integrate with other control system hardware/software.

Video Conferencing/Distance Learning

Videoconferencing equipment (HD CODECs, software codecs, cameras, echo cancellers, telephone interfaces and related devices) is equipment specifically designed to transmit and receive audio and video signals over local and wide area networks. This capability is not currently planned for this project.

Broadcast Systems
Broadcast quality equipment and systems generally refer to audio and video devices (cameras, recorders, and editing equipment) of the highest quality, specifically designed for the recording, editing, and production at the commercial level, such as in network television studios. Broadcast equipment is an order of magnitude more expensive than “professional” quality equipment, and is not planned for this project.

PROPOSED AUDIOVISUAL SYSTEM DESCRIPTIONS

AUDITORIUM
The auditorium will be used for live music and theater performances, multimedia presentations with audio and video, lectures, and panel discussion. It is anticipated that the following will be required:

Sound System
- Microphones:
    - Wired Microphones: The system will include a stereo microphone that is hung in the room and used for audio recordings. Another microphone will be permanently installed over the stage/performance area and used for backstage monitoring. A gooseneck microphone will be provided for connection to a lectern (lectern, by others). Connections for wired microphones will be available at the sides of the stage, above the stage performance area, and along the side walls of the seating area.
    - Wireless Microphones: The system will include 4 wireless microphone systems. Each will include an interchangeable handheld and lavalier (clip-on) microphone transmitter.
- Audio Mixers: The system will operate in one of two microphone mixing modes; automatic or manual. These modes will be selectable from a control panel.
    - Automatic Microphone Mixing Mode: This mode will allow an end-user to simply connect a microphone to the system at one of multiple designated microphone receptacle locations. Master volume control will be accessible from the control panels. This will be the system's default setting and will be used for presentations, movies, and lectures.
    - Manual Microphone Mixing Mode: For events when more complex operation of the sound system is required, the automatic microphone-mixing can be bypassed and the system can be run by a trained operator. Volume levels of microphones and other audio playback sources will be controlled from a 32-channel digital mixing console; providing a flexible variety of audio outputs that can be used for special effects, recording, and speech reinforcement. The mixing console will be permanently located at a "tech position" within the house. The mixing location will require ample space for operation of the console and other items such as scripts required for rehearsals or performances. The mixing console will connect to the IT network and will have the capability of being controlled from an Owner-furnished tablet computer (such as an Apple iPad) that is connected via Wi-Fi to the same IT network.
- Audio Recorder: An audio recorder will used for recording events from the stereo microphone. The recorder will be capable of connecting to the IT network and can upload recorded audio tracks to another computer or server. The USB connection will allow recordings to be transferred to a thumb drive.
- Audio Signal Processing: A digital audio signal processor will be used for automatic microphone mixing, and equalizing the loudspeakers. The signal processor will be expandable so that, if required, additional input and output capacity can be added to the system in the future.
- Production Communications: A two-channel intercom system will be used for communication between production crew members at control locations, and the backstage spaces. AV connection panels within the performance space will include receptacles for the connection of intercom belt-packs. Wall-mounted speaker stations will be located in the music classrooms and other backstage spaces. The system will be provided with eight dual-channel belt-packs, headsets, and cables.
- Loudspeakers:

  - Installed Auditorium System: The loudspeaker system will provide uniform audio coverage through the audience area allowing the system to provide high levels of speech intelligibility and musical clarity.
  - The loudspeaker configuration will consist of a central loudspeaker cluster above and in-line with the primary stage area. It will be used for speech reinforcement and playback of audio. Supplementary "delay" loudspeakers will be provided to cover the rear seating areas. Front-fill loudspeakers will be used in the stage apron. Subwoofers will also be provided. Left and right loudspeakers will be used for stereo audio playback, and for sound effects; which can be panned across the left, center, and right loudspeakers. Amplifiers will be provided to power the loudspeakers.
  - Control Room: A pair of wall-mounted loudspeakers will be installed in the Control Booth and will be used by technicians in the booth to monitoring audio from the stage performance/event. Amplifiers will be provided to power the loudspeakers.
  - Portable: Four portable self-powered loudspeakers will be provided for use on stage as "wedge" monitor loudspeakers. These loudspeakers can also be used in the house or on stage as sound effects speakers. Additionally, the loudspeakers will slant for use as a "wedge" or fold back monitor loudspeaker for use on stage.
  - Backstage and Front of House: In addition to the Auditorium's loudspeakers, ceiling-mounted loudspeakers will be provided in backstage areas, dressing rooms, etc. for audio monitoring (for cues, etc.). Amplifiers will be provided to power the loudspeakers.
- Assistive Listening System: An FM-based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers (i.e., headphones) will be stored centrally and issued to participants as required. These receivers are intended to be used by patrons with hearing impairments.

Display System

- Video Projector: The system will display computer and motion video using a high brightness video projector with appropriate lens. The projector will be installed at the rear of the Auditorium in the control booth.
- Projection Screen: A motorized video projection screen with a high-contrast screen material will hang from above the stage.
- AV Sources: AV sources will include an Owner-furnished computer. Inputs for portable AV devices, such as a laptop computer or portable audio player, will be available at three locations (one on one side of the stage, one at the in-house audio mix location, and one in the Control Booth).
- Video Cameras: A high-definition video camera with integral pan/tilt head will be installed in the Theater. In addition, a night vision camera will also be provided for viewing of dark scenes. The cameras will be used to feed images of events in the space to backstage and front-of-house areas with video displays. Control of the cameras will be via presets on the touchscreen control panel.
- Video Routing and Processing: A matrix type switcher will be used to route video and audio sources to the displays and sound system. This will include video signal transmitters and receivers that are needed to send digital video signals longer distances. It will support playback and distribution of digital and analog video formats and the transport system will be compatible with newer generation 4K sources. Fiber optic transmitter outputs will be provided to send signals to the backstage areas with video displays, such as the Music Classrooms.

System Control

The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of three 10" LCD touch screens (one at the side of the stage, one at the in-house audio mix location, and one in the Control Booth). The control panels will be able to control all functions of the audiovisual system; including source selection and media transport controls, volume control, and can interface with other operational functions including lighting and HVAC.

Miscellaneous

Miscellaneous equipment will include a floor-standing and lockable equipment rack(s), AC power distribution, and sequencers in the racks, custom connection panels at the stage/performance area and

house mix position, audio press feed connections to locations within the room, and all cable, connectors, and additional hardware and labeling required to install the system.

MUSIC CLASSROOMS

The Music Classrooms will include the Band Room and Chorus Room. These spaces will be used for musical instruction and rehearsal for choir, jazz band, orchestra, and band groups. Each audiovisual system will comprise the following sub-systems:

Sound System

- Microphones: A stereo microphone will be provided and will hang from the ceiling. This microphone will tie into the AV system and can be used for recording performances.
- Audio Signal Processing: A digital audio signal processor will be used for signal routing and equalizing the loudspeakers.
- Audio Recording: A network USB/SD audio recorder will be provided.
- Loudspeakers: Wall-mounted loudspeakers will be wall-mounted at the front of the room for program audio playback. Amplifiers will be provided to power the loudspeakers.
- Assistive Listening System: An FM-based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers (i.e., headphones) will be stored centrally and issued to participants as required. These receivers are intended to be used by patrons with hearing impairments.

Display System

- Video Projector: The system will display computer and motion video using short-throw, 3,300 ANSI lumen video projectors (1280 x 800 WXGA resolution). The projectors will be installed on the wall above the whiteboard/projection screens in each room (whiteboard material to be provided by Others). Note that the whiteboard material should be of a projection quality and should not create reflections or hot spots from the projector.
- AV Sources: AV sources will include connectivity for an Owner-furnished computer. Inputs for portable AV devices, such as a laptop computer or portable audio player, will be available at locations at the front of the room. An overflow audio and video feed from the Auditorium will also be provided.
- Video Routing and Processing: A matrix type switcher will be used to route video and audio sources to the display and sound system. This will include video signal transmitters and receivers that are needed to send digital video signals longer distances. It will support playback and distribution of digital and analog video formats and the transport system will be compatible with newer generation 4K sources.

System Control

The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of a 7”LCD touch screen at the presentation area. The control panel will be able to control all functions of the audiovisual system; including source selection and media transport controls, and volume control. Control system processing will be embedded in the video matrix switch.

Miscellaneous

Miscellaneous equipment will include a floor-standing and lockable equipment rack, AC power distribution and sequencers in the racks, custom connection panels, and all cable, connectors, and additional hardware and labeling required to install the system.

CAFETERIA

The Cafeteria will include seating for a large number of students. An audiovisual system will be provided for lectures and will serve as an area to view and hear overflow AV feeds from the Auditorium. The audiovisual system will comprise the following sub-systems:

Sound System

- Microphones:

  - Wired Microphones: Connections for wired microphones will be available.
  - Wireless Microphones: The system will include a wireless microphone system. This will include lavalier (clip-on) microphone transmitter.
- Audio Signal Processing: A digital audio signal processor will be used for automatic microphone mixing and equalizing the loudspeakers.
- Loudspeakers: The loudspeaker configuration will consist of distributed ceiling-mounted loudspeakers and will be used for program audio and speech reinforcement. Amplifiers will be provided to power the loudspeakers.
- Assistive Listening System: An FM-based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers (i.e., headphones) will be stored centrally and issued to participants as required. These receivers are intended to be used by patrons with hearing impairments.

Video System

- Video Displays: Two wall-mounted video display panels will be provided to display computer and motion video. These can be used for digital signage with owner provided PC, local AV presentations, or overflow video feeds from the auditorium.
- AV Sources: Inputs for portable AV devices, such as a laptop computer or portable audio player, will be available at one location in the Cafeteria area.
- Video Routing and Processing: A matrix type switcher will be used to route video and audio sources to the display and sound system. This will include video signal transmitters and receivers that are needed to send digital video signals longer distances. It will support playback and distribution of digital and analog video formats and the transport system will be compatible with newer generation 4K sources.

System Control

The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of a 7” LCD touch screen. The control panel will be able to control all functions of the audiovisual system; including source selection and media transport controls, and volume control.

Miscellaneous

Miscellaneous equipment will include a floor-standing and lockable equipment rack, AC power distribution and sequencers in the racks, custom connection panels, and all cable, connectors, and additional hardware and labeling required to install the system.

ENTRY HALL

The Entry Hall is a public area where large murals are hung. A digital video wall will be used to display electronic artwork, and can also be used to display other images and announcements. The audiovisual system will comprise of the following sub-systems:

Display System:

- Video Display: The system will display computer and motion video using a wall-mounted video wall consisting of nine (9) x 55" video display panels arranged in a 3 x 3 grid. The overall image size will be approximately 81" high x 143.5" wide.
- AV Sources: Inputs for portable AV devices, such as a laptop computer, will be available at a wall-mounted receptacle panel in the main office area of the school. An Owner-furnished computer will connect to the system.
- Video Routing: A switcher will be used to route video and audio sources to the display and sound system. This will include video signal transmitters and receivers that are needed to send digital video signals longer distances. The video routing equipment will be compliant with newer generation digital video sources (4K).

System Control:

The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of a wall-mounted 7” LCD

touch screen. It will be able to control all functions of the audiovisual system; including source selection and media transport controls.

Miscellaneous:
Miscellaneous equipment will include an equipment rack, AC power distribution and sequencing, custom connection panels, and all cable, connectors, and additional hardware and labeling that are required to install the system.

CLASSROOMS
The classrooms (including the art classrooms) will be used for lectures and presentations. The audiovisual systems will each comprise of the following sub-systems:

Sound System
- Loudspeakers: A pair of wall-mounted loudspeakers will be used for program audio playback. Amplifiers will be provided to power the loudspeakers.
- Assistive Listening System: An infrared-based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers (i.e., headphones) will be stored centrally and issued to participants as required. These receivers are intended to be used by patrons with hearing impairments.

Display System
- Video Projector: The system will display computer and motion video using a wall-mounted short-throw video projector (1920 x 1200 WUXGA minimum resolution). The projector will display content on a wall-mounted white board suitable for projection (white board, by Others).
- AV Sources: AV sources will include inputs for portable AV devices, such as a laptop computer or portable audio player. It will be available at the front of the room on a wall-mounted receptacle panel.

System Control
The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of a wall-mounted button panel. It will be able to control all functions of the audiovisual system; including source selection, volume control, and power.

Miscellaneous
Miscellaneous equipment will include custom connection panels, and all cable, connectors, and additional hardware and labeling required to install the system.

LECTURE HALL (AKA LITTLE THEATER)
The Lecture Hall will be used for multimedia presentations with audio and video, lectures, panel discussions, and community events.

Sound System
- Microphones:
  - Wired Microphones: A gooseneck and handheld microphone will be provided for connection to a lectern (lectern, by others). Connections for additional wired microphones will be available.
  - Wireless Microphones: The system will include a wireless microphone system. The system will include handheld and lavalier (clip-on) microphone transmitters.
- Audio Signal Processing: A digital audio signal processor will be used for automatic microphone mixing and equalizing the loudspeakers.
- Loudspeakers: Loudspeakers will be provided for speech reinforcement and audio playback. Amplifiers will be provided to power the loudspeakers.
- Assistive Listening System: An FM-based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers (i.e., headphones) will be

stored centrally and issued to participants as required. These receivers are intended to be used by patrons with hearing impairments.

Display System:

- Video Projector: The system will display computer and motion video using a high-brightness video projector (1920 x 1200 WUXGA minimum resolution).
- Projection Screen: A motorized video projection screen with a high-contrast screen material will hang from the presentation wall.
- AV Sources: AV sources will an Owner-furnished computer. Inputs for portable AV devices, such as a laptop computer or portable audio player, will be available at two locations at the front of the room.
- Video Cameras: One high-definition video camera with integral pan/tilt head will be installed in the Lecture Hall on the rear wall. Control of the camera will be via presets on the touchscreen control panel.
- Video Routing and Processing: A matrix type switcher will be used to route video and audio sources to the display and sound system. This will include video signal transmitters and receivers that are needed to send digital video signals longer distances. It will support playback and distribution of digital and analog video formats and the transport system will be compatible with newer generation 4K sources.

System Control

The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of a 10" LCD touch screen at the presentation area. The control panel will be able to control all functions of the audiovisual system; including source selection and media transport controls, volume control, and can interface with other operational functions including lighting and HVAC. Control system processing will be embedded in the video matrix switch.

Miscellaneous

Miscellaneous equipment will include a floor-standing and lockable equipment rack, AC power distribution and sequencers in the racks, custom connection panels, and all cable, connectors, and additional hardware and labeling required to install the system.

Book Rooms

The Book Rooms will be used for workgroups and tutorial sessions. The audiovisual systems will each comprise of the following sub-systems:

Sound System

- Loudspeakers: A pair of wall-mounted loudspeakers will be used for program audio playback. Amplifiers will be provided to power the loudspeakers.
- Assistive Listening System: An infrared-based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers (i.e., headphones) will be stored centrally and issued to participants as required. These receivers are intended to be used by patrons with hearing impairments.

Display System

- Video Display Panel: The system will display computer and motion video using a wall-mounted video display panel.
- AV Sources: AV sources will include inputs for portable AV devices, such as a laptop computer or portable audio player. It will be available at the front of the room on a wall-mounted receptacle panel.

System Control

The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of a wall-mounted button panel. It will be able to control all functions of the audiovisual system; including source selection, volume control, and power.

Miscellaneous
Miscellaneous equipment will include custom connection panels, and all cable, connectors, and additional hardware and labeling required to install the system.

GYMNASIUM
The Gymnasium will be used for practice, large games, presentations, and events. The audiovisual system will comprise of a number of sub-systems that include the following:

Sound System
- Microphones: The system will include one wireless handheld microphone transmitter. Connections for wired microphones will be available at wall-mounted receptacle panels and on a portable equipment rack.
- Audio Processing and Mixing: A digital audio signal processor will be used for automatic microphone mixing, and equalizing the loudspeakers. An 8-channel audio mixer in the portable equipment rack will be used to mix microphones and other audio sources.
- Loudspeakers: Distributed ceiling-mounted loudspeakers will be provided for speech reinforcement and program audio playback. Loudspeakers will be zoned so that they can be used over the entire Gymnasium floor, or over the individual courts (please note that we not anticipate sufficient acoustical isolation between the courts, and it is not recommended to use the two courts simultaneously for different audio playback or reinforcement). For larger events and games, additional loudspeakers will be used to provide coverage to the bleacher seating area. Amplifiers will be used to power the loudspeakers.
- Assistive Listening System: An FM or infrared based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers, intended for use by patrons with hearing impairments, will be stored centrally and issued to participants as required. Inductive neck loop adapters will be provided along with the receivers for compatibility with telecoil-enabled hearing aids.

System Control
The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of one wall-mounted 5” LCD touch screen, and an additional 5” LCD touch screen in the portable equipment rack. The control panel will be able to control all functions of the audiovisual system; including source selection and media transport controls, and volume control.

Miscellaneous:
Miscellaneous equipment will include a floor-standing and lockable equipment rack, a portable equipment rack for use during events and games, AC power distribution and sequencers in the rack(s), custom connection panels, and all cable, connectors, and additional hardware and labeling required to install the system.

ARCHITECTURAL, MECHANICAL, AND ELECTRICAL CONSIDERATIONS

1. Architectural: The following items should be considered for proper coordination between audiovisual system components and other trades:
   a. Loudspeaker coverage must not be obstructed.
   b. Structure will be necessary to ensure that loudspeakers and the projection screen can be ceiling-mounted at recommended locations.
   c. Antennas for the assistive listening system and wireless microphones will be mounted on the wall.
   d. Wall-mounted connection panel locations will require coordination.
   e. Ceiling-mounted video projectors must be free from vibration.
2. AV Equipment Racks:
   a. Equipment racks will require coordination for space and cooling/airflow requirements. This will include floor-standing equipment racks, and any small equipment racks that may be installed within millwork.

i. Floor-standing AV equipment racks shall be fixed in position and will require front access for day-to-day operational needs. They will also require rear access for service. Clearances must be maintained around the AV equipment racks (36") to comply with the requirements of the Americans with Disabilities Act.
ii. AV equipment rack rooms may require oversized doors.

3. Auditorium Mixing Console:
   a. The Control Booth's mixing position will require ample space for operation of the console and other items such as scripts required for rehearsals or performances. The audio console is 48" wide by 36" deep.
   b. Control Booth:
      i. Please note the following guidelines:
         1. Coordination will be required with the acoustical consultant to maintain proper acoustical isolation between the Auditorium and the Control Booth.
         2. The glass in front of the video projector should be low iron. It should also be tilted between 2 and 5 degrees. Coordinate direction of tilt with the acoustical consultant.
4. Video Projection:
   a. In order to optimize the viewing experience and achieve the minimum recommended video display contrast ratio, ambient lighting within the spaces with projection will need to be reviewed. Additionally, overhead lighting should be zoned so that lighting areas directly above the projection screen surfaces can be switched off during presentations.
   b. Whiteboards & marker boards that are used as a projection surfaces shall be of projection quality so that they minimize reflections and projection hotspots.
5. Blocking will be required at all wall-mounted video display panel and loudspeaker locations.
6. Mechanical/Electrical: The following items should be considered for proper coordination between the audiovisual system components and other trades:
   a. The AC power system will be designed and specified by the electrical engineer and will include a dedicated power panel, transient voltage surge suppression, and AC outlets.
   b. Electrical outlets will be required at the equipment racks, mix location floor-box, and wall-mounted receptacle panels.
   c. IT data drops are strongly recommended at the equipment racks and all AV receptacle panels.
   d. If lighting control is desired from the audiovisual system control touch panel, the lighting system will require an interface for communication with the control system.
   e. Equipment Rack Locations:
      i. AC power requirements and heat loads will need to be considered at each equipment rack and video projector location.

* * * * * *

End of Feasibility Study

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

OPTION 2.3 - MINOR RENOVATION / MAJOR ADDITION

SUMMARY

Option 2.3 would be a substantial addition and phased renovation to the existing high school to create a new 7-12 high school. This option creates an L shaped building footprint that organizes the majority of the program around a multi-story and tiered commons that embraces the Pond edge. In the first phase, a substantial new addition would be constructed at the west side of the existing high school fieldhouse. The addition would include the entirety of the upper school grade configuration including a new theater, commons space and cafeteria. The upper school students would fully occupy this new addition when complete enabling a second phase that includes the demolition of the existing high school building and the completion of the additional space. The eastern portion of the existing building structure including caissons, foundations, concrete floor and roof slabs would be demolished in a phased manner allowing for the lower school grade spaces, including a new, independent lower school entry to be constructed east of the existing fieldhouse. The existing fieldhouse, pool, and associated athletic spaces would be renovated and displaced athletic fields would be constructed east of the completed high school. Common amenity spaces would be organized in a tiered series of bridges that bring the entire school community together overlooking the site's scenic Clay Pit Pond area, allowing for outdoor learning and community use.

DESIGN STRATEGY

In this scheme the building mass is placed away from the existing rail bed with most academic teaching spaces overlooking fields to the north and west which may not be ideal for daylighting and site noise reduction. The stepped commons looks sout hover the pond giving preference to academic community spaces. This option, like the others, proposes two separate entry and exit points to the site helping to disperse traffic congestion during the drop-off and pick-up periods. It also provides separate building entry points allowing for a sensitivity to scale for lower and upper grades. In this option many of the athletic fields become collocated on the eastern half of the site allowing for more overlap and as a result higher use of the site. This colocation also helps in both the efficiency of maintenance and the ability to manage storm water in a sustainable, cost effective manner.

SUSTAINABILITY AND BUILDING PERFORMANCE

The following sustainability and resiliency attributes have been considered in evaluating this option:

ENVELOPE – Aggressive performance will be pursued in the new wall make-up including a goal of R-28 and minimized thermal bridging with the intent of minimizing air and vapor movement

ORIENTATION- This scheme orients the majority of teaching spaces to the north with the intent of eliminating glare and the majority of public and common spaces to the south.

SKIN TO VOLUME RATIO- The skin to volume ratio of the minor renovation- major addition schemes are similar and attempt to form a concise footprint while maximizing daylight.

WINDOW TO WALL RATIO- The window to wall ratio of the scheme will attempt to achieve 30-40 glazing balancing heat gain with effective daylighting.

PV POTENTIAL- This scheme stacks in massing to the north creating roof surfaces that do not shade themselves and optimizes roof top yield by orienting itself in the east-west direction.

SITE ENVIRONMENTAL PERFORMANCE- This scheme allows for one contiguous large geo-exchange field and allows for more performative landscape adjacent to the pond allowing outdoor teaching space to overlap with site sustainable strategies at the water edge.

PROSPECTIVE SITE ANALYSIS - OPTION 2.3

SITE

This narrative provide an analysis of the option including natural site limitations, building footprint(s), athletic fields, parking areas and drives, bus and parent drop-off areas, site access, and surrounding site features. This narrative excludes temporary site facilities, phasing implications, site drainage, utilities and permitting requirements addressed

A. PROSPECTIVE SITE ANALYSIS - OPTION 2.3

separately. All addition renovation and new building options include complete reconstruction of the site east of Harris Field to accommodate the site program requirements except tennis which will be accommodated at other existing courts in Town.

Harris Field including the track and supporting facilities are existing to remain. Spatial accommodations have been made in the site planning for the school project to accommodate a multi-modal community path along the north property line abutting the MBTA right-of-way and a multigenerational path around Clay Pit Pond – both with separate funding and implementation timelines. The school building project site design is anticipated to incorporate the portion of the multigenerational path that connects across the north side of Clay Pit Pond, as that will serve as a vital link between the school's site program elements and circulation through the campus.

The existing school building is located on higher ground north of Claypit Pond towards the rear (north) of the site. The primary vehicular (car and bus) circulation and drop-off is a one-way loop from east (Hittinger Street) to west (Concord Avenue). The main pedestrian entrances are the south sides of the building. Buses drop off and pick up students along the south side of the building. The site has three primary parking areas. The largest parking lot (292 spaces) is located to the east of the school building. Small lots are located to the south (36 spaces) and north (21 spaces) of the building. Nine buses currently park along the far east side of the east parking lot. All parking areas contain accessible parking.

Most of the school's athletic facilities are located west of the school building including two baseball fields (varsity is played on Grant Memorial Field which includes bleacher seating, dugout shelters and a prominent gateway) with rectangular field layouts (for soccer and field hockey) overlapping their outfields, a rugby/football practice field and Harris Field which includes a running track and synthetic turf field, home and away bleachers and sports lighting. An indoor skating rink in poor condition and a football field house separate these fields from the varsity softball field further west with lighting and a soccer/lacrosse field overlapping the outfield. Ten tennis courts are located adjacent to the east parking area and the junior varsity softball field is located further east of the primary east parking area.

BUILDING FOOTPRINT

In Option C2.3, the only portion of the existing building to remain and be renovated is the field house, gym, pool and supporting facilities. The new school building is an addition to this structure expanding the building footprint to the south and west toward Concord Avenue.

ATHLETIC FIELDS

The athletic fields except Harris Field are reconfigured as follows:

- One softball and baseball combination field overlap with a soccer/field hockey field west of the rink.
- A football/rugby field is located between the field house and Harris Field just north of the new building construction.
- One softball and baseball combination field overlap with a soccer field at the east end of the site.
- A lacrosse/soccer field is located between the east softball/baseball combination field and the school building.

TRAFFIC CIRCULATION

The driveway between the building and Clay Pit Pond is eliminated, and a new 2-way driveway is located around the rear of the building with new access points across from Trowbridge and Goden Streets. Building entrances to the upper and lower school program have separate entrances and drop off loops at the east and west ends of the building. The multigenerational path connecting along the north side of the pond links the site and building program elements and provides pedestrian, bicycle and emergency vehicle access through the site.

PARKING

This site plan meets the school's parking need for 420-430 spaces. Parking is redistributed with a large lot between the school building and the east athletic field with the remaining parking spaces located along the driveway across the north side of the site between the MBTA rail line and the rest of the school campus.

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

B. CONSTRUCTION IMPACT - OPTION 2.3

Option 2.3 would require minor renovations within the existing occupied school and would be undertaken in 2 or 3 phases. Modular classrooms are not anticipated to be required on site during renovations. Scheduling work over summer or holiday breaks may alleviate some of the disruption but would need to be carefully managed. The anticipated construction schedule is 42 months.

Work under this would be less disruptive to students and staff. Students would be forced to move only once to accommodate the construction phases. Disruption from noise, dust, odors and construction traffic could be anticipated.

The detailed plan for phasing and swing space would be determined during schematic design to best coordinate with the educational programs to minimize the impact on students and staff.

OPTION 2.3 - I. DESIGN AND CONSTRUCTION SCHEDULE

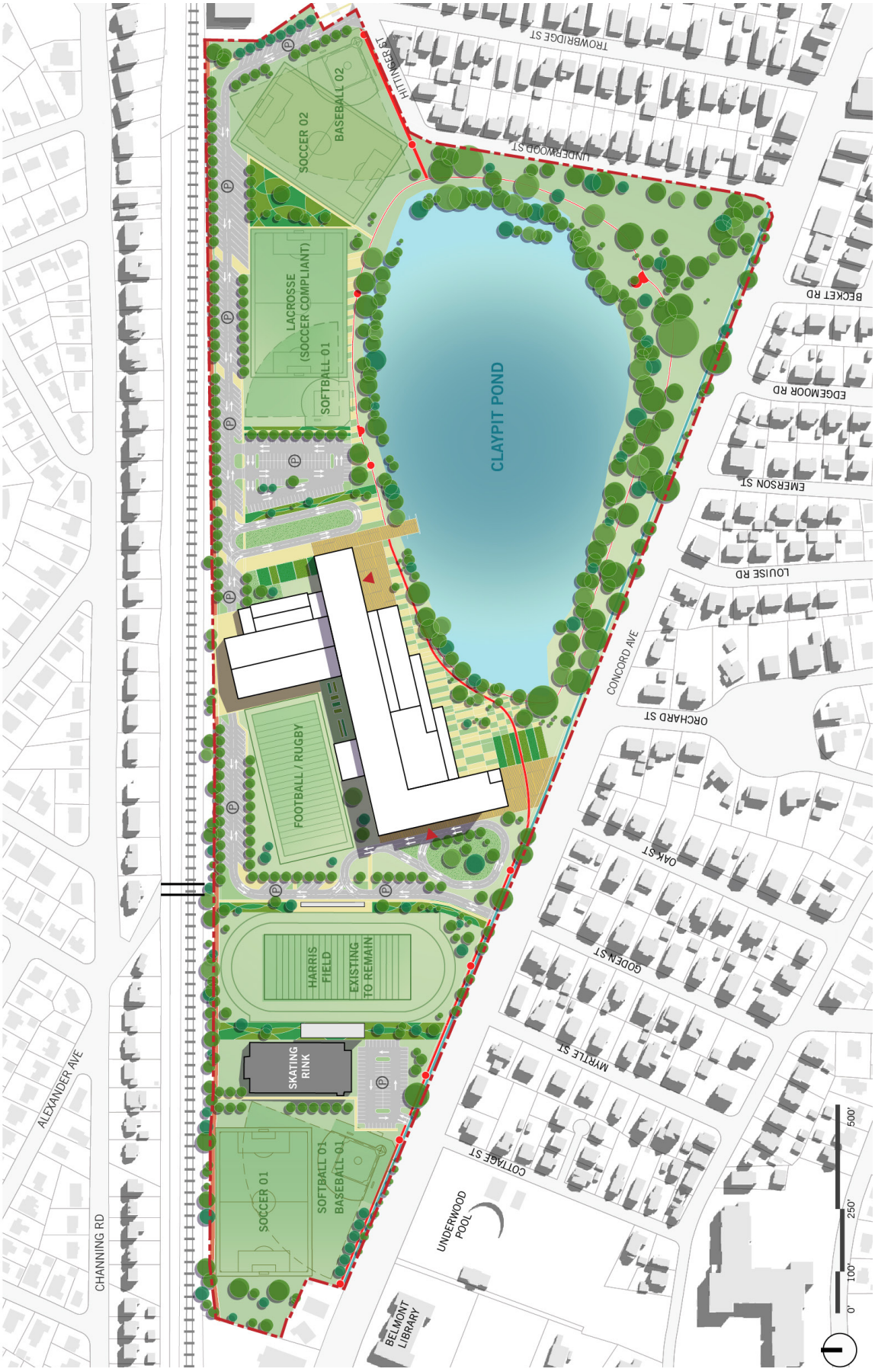
Anticipated MSBA Approval of PSR	April 10th, 2018 (MSBA Board Meeting)
Anticipated MSBA Approval of SD	August 29th, 2018 (MSBA Board Meeting)
Special Town Meeting/Ballot Vote	November 2018
Design Development Complete	November 2018 - April 2019
Construction Documents Complete	May 2019 – January 2020
Bid and Award	February 2020 - March 2020
Construction (multiple phases)	April 2020 – October 2023 (42 months)

B. CONSTRUCTION IMPACT - OPTION 2.3 / Phasing Diagrams

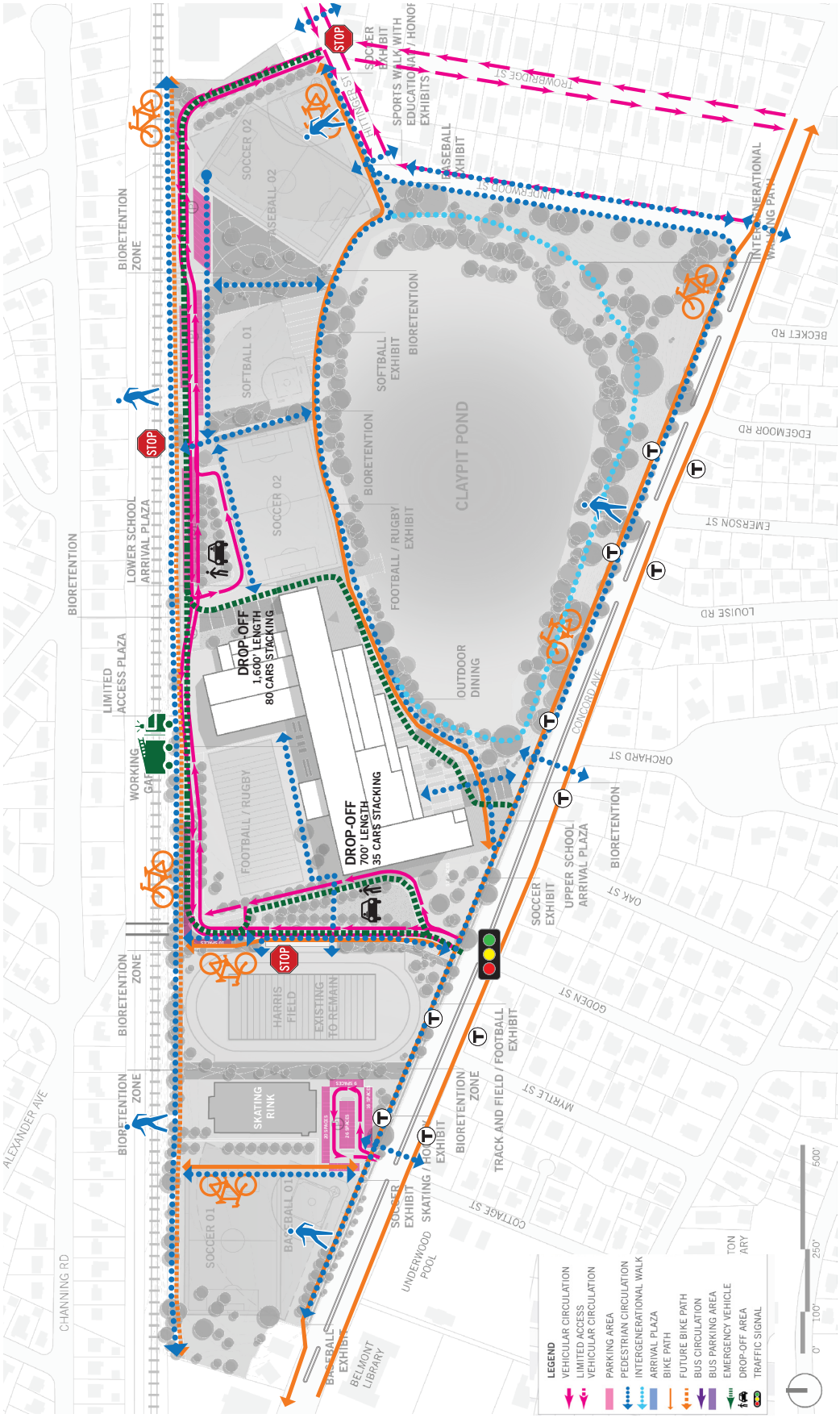
PERKINS+WILL

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

C. CONCEPT DRAWING - OPTION 2.3 / Site

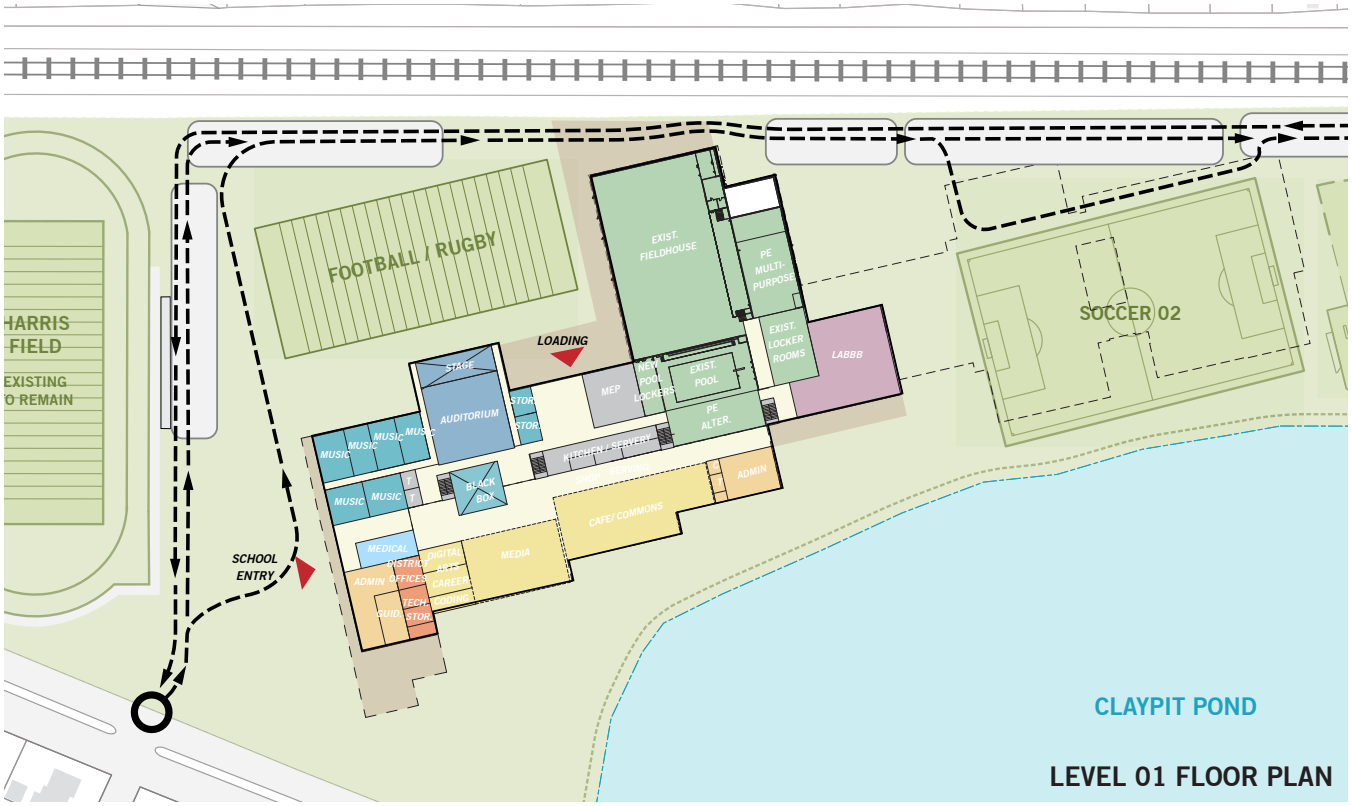


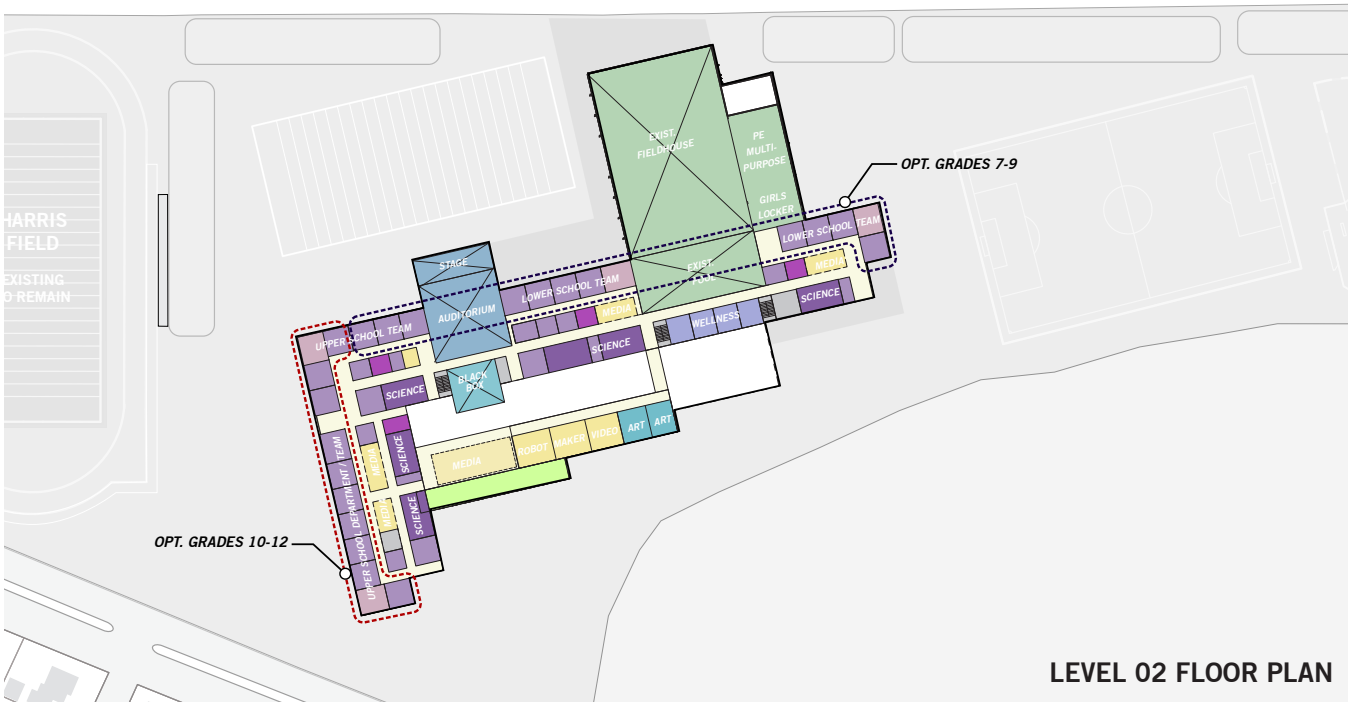
C. CONCEPT DRAWING - OPTION 2.3 / Traffic Site Plan



3.3.3 - FINAL EVALUATION OF ALTERNATIVES

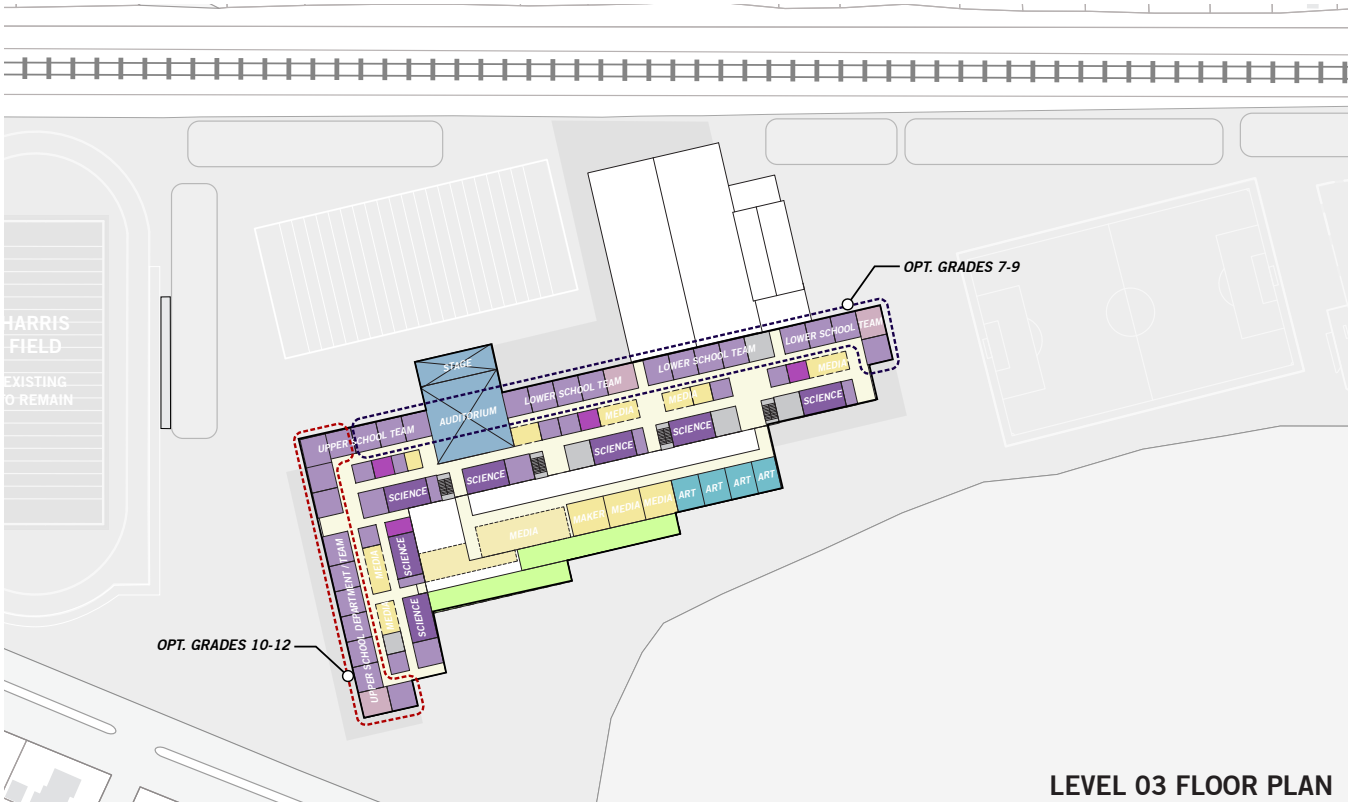
C. CONCEPT DRAWING - OPTION 2.3 / Architectural



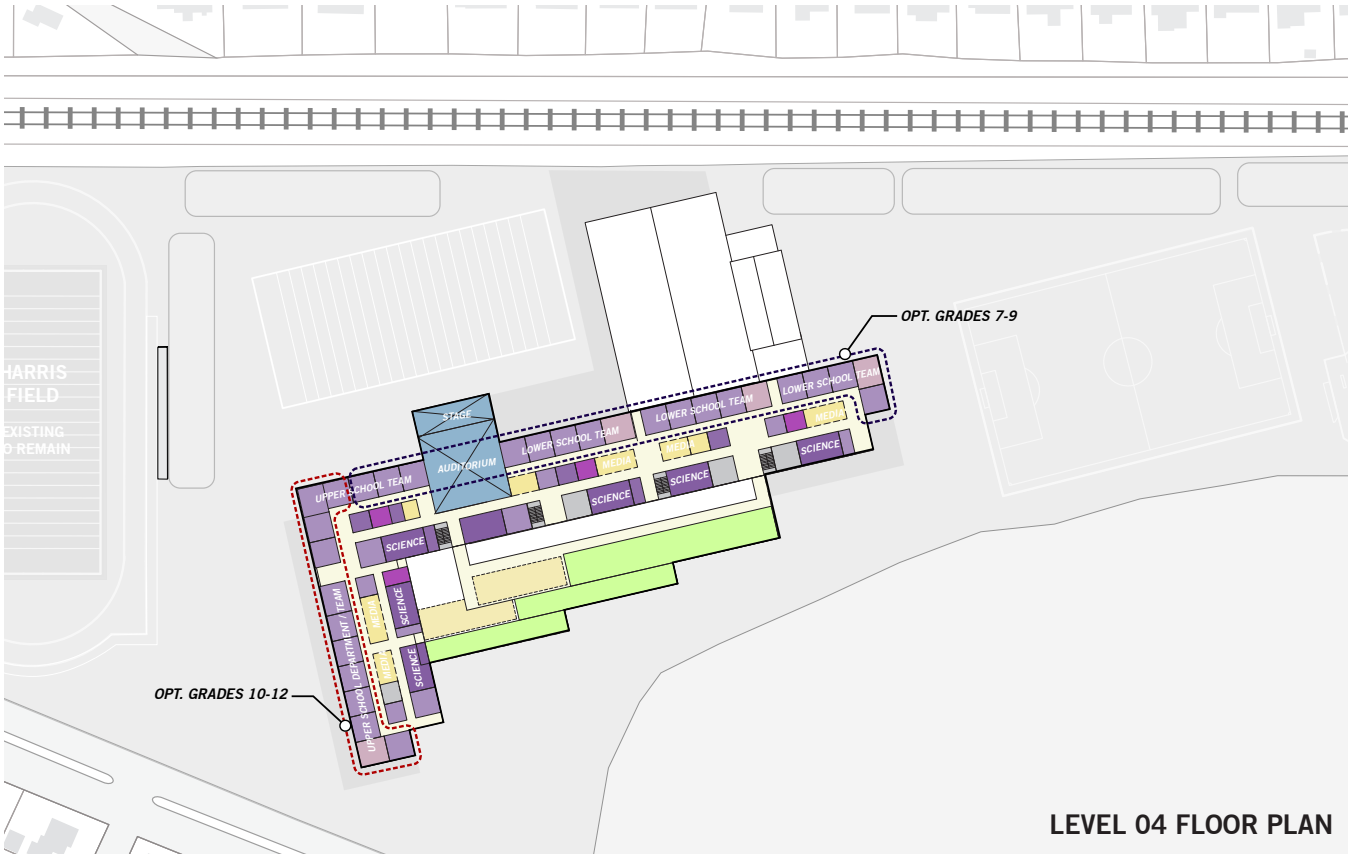


C. CONCEPT DRAWING - OPTION 2.3 / Architectural

Core Academic
Art & Music
Admin./ Guidance
Health & PE
Media Center
Auditorium & Drama
Dining/ Food Service
Medical
Circulation
Custodial/ Maint.
District Offices
Special Education



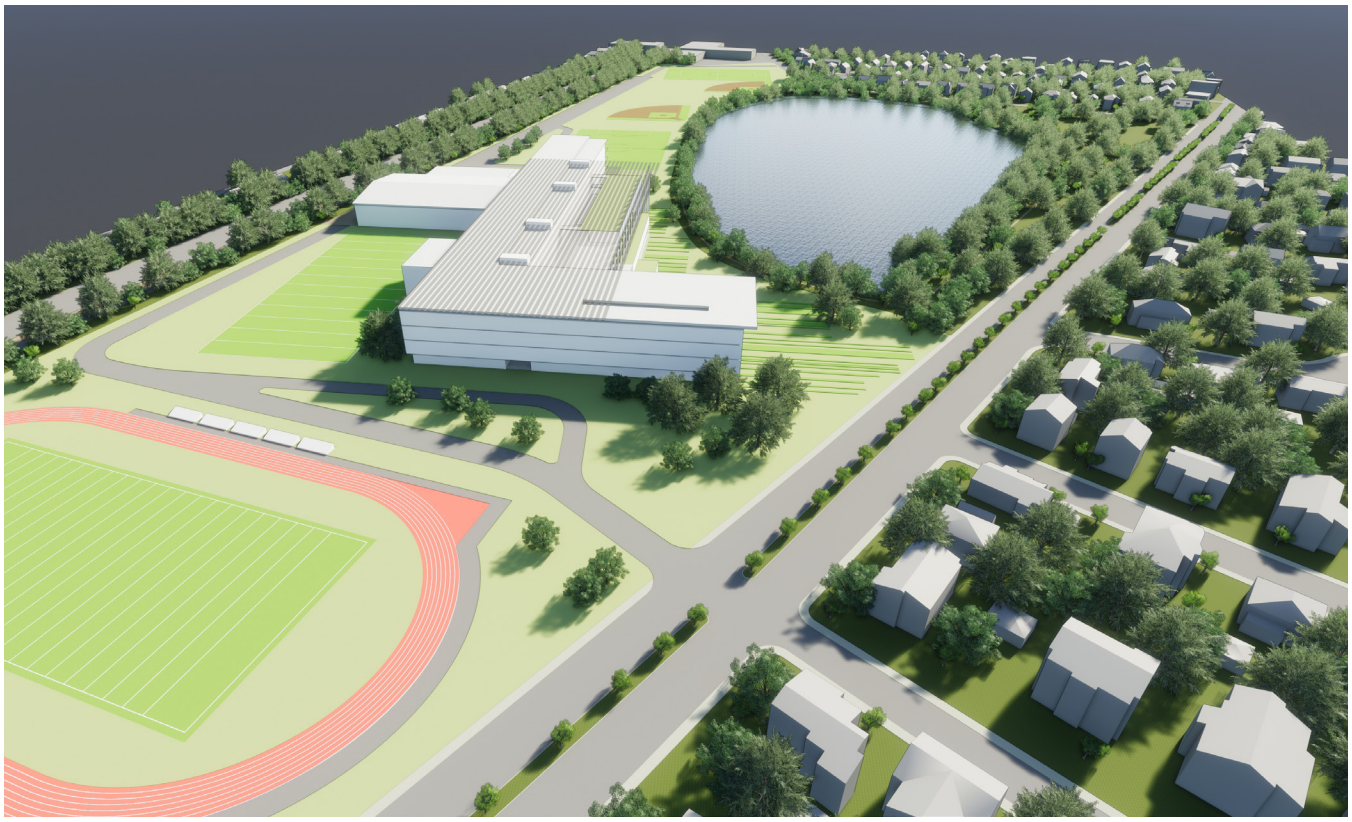
LEVEL 03 FLOOR PLAN



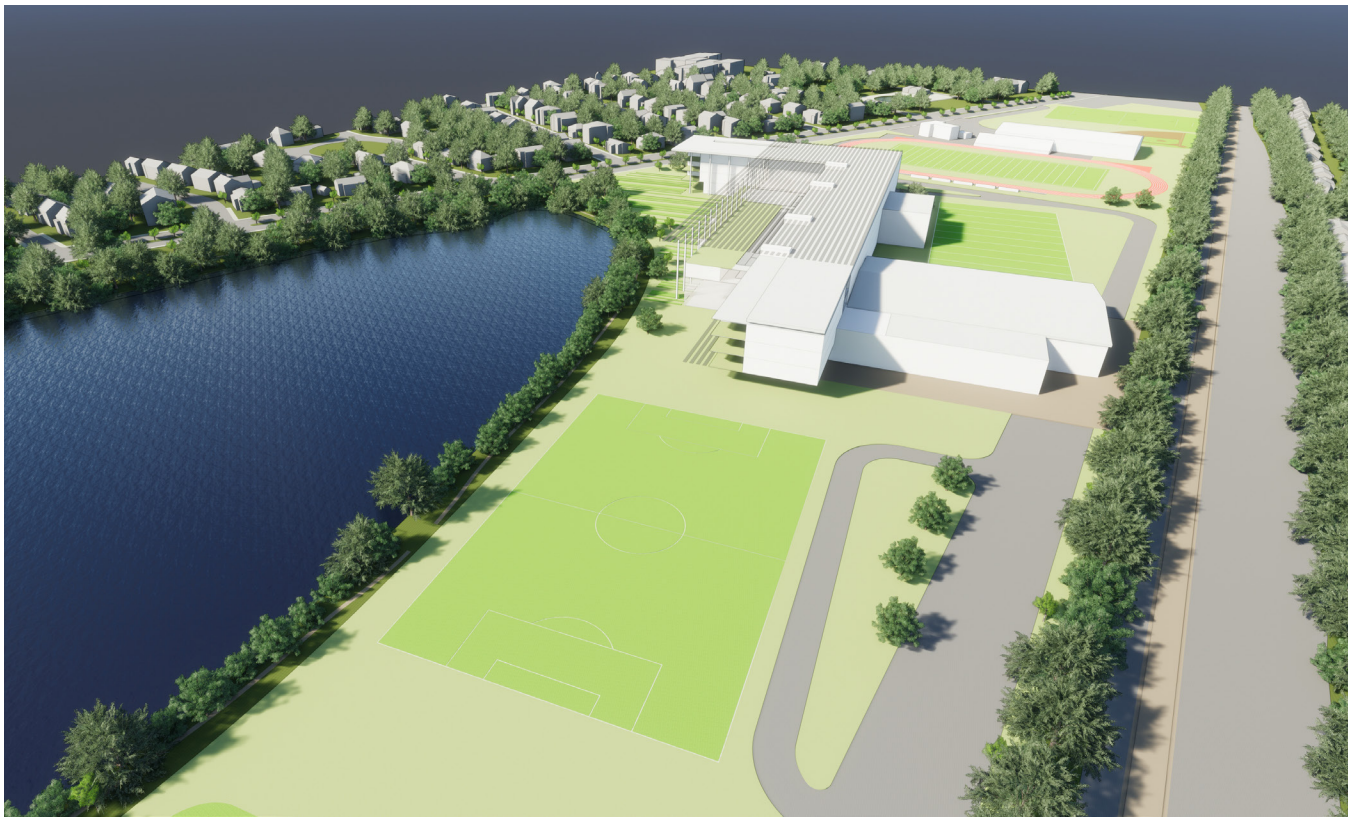
LEVEL 04 FLOOR PLAN

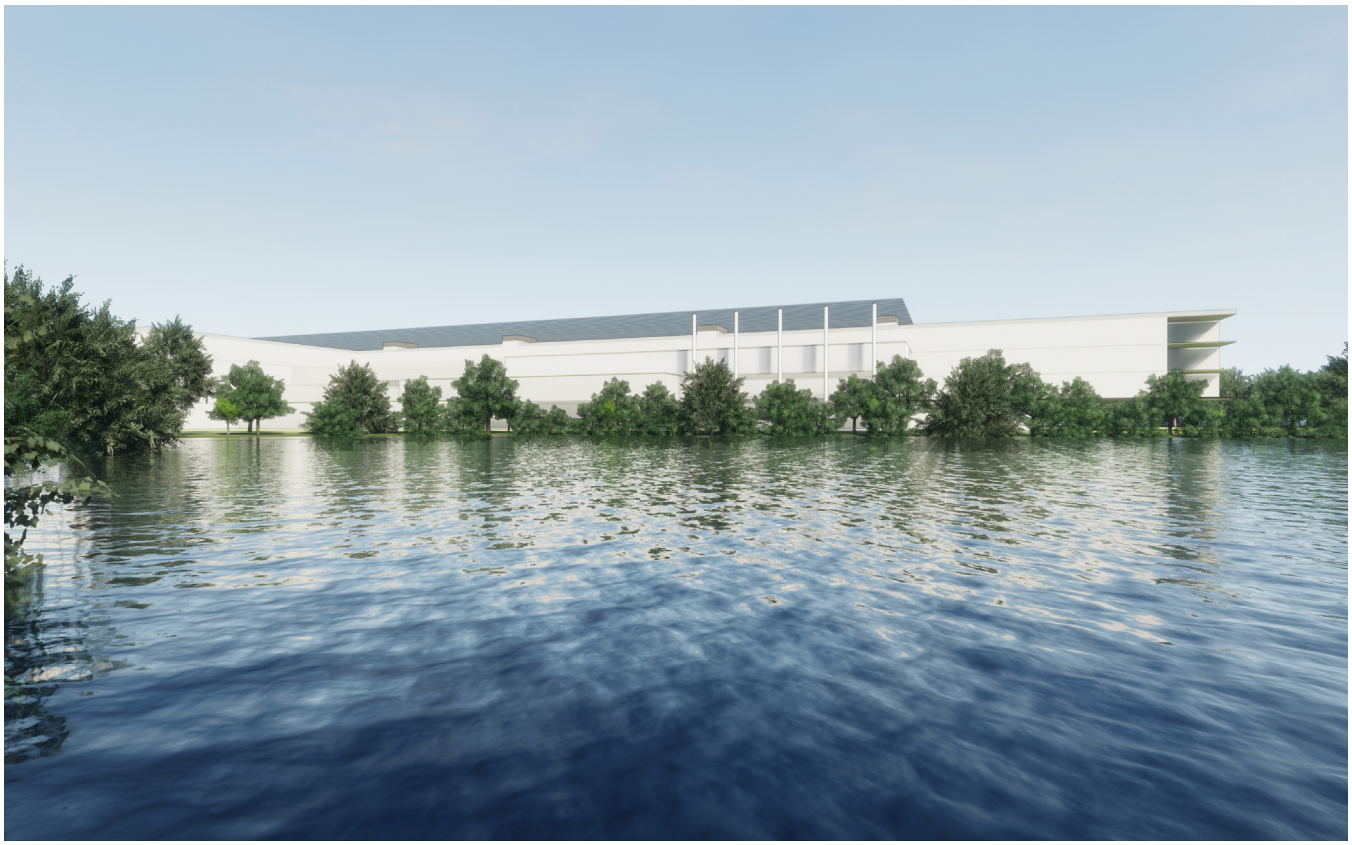
3.3.3 - FINAL EVALUATION OF ALTERNATIVES

C. CONCEPT DRAWING - OPTION 2.3



C. CONCEPT DRAWING - OPTION 2.3





BELMONT HIGH SCHOOL
Structural Narrative – Option 2.3
Minor Renovation and Major Additions to the Existing School

January 22, 2018

PROPOSED SCHEME

The proposed scheme calls for phased renovations, demolition of portions of the existing school and construction of new additions. In the first phase, a substantial new addition will be constructed at the west side of the existing school building. The addition will house the entire upper school, including a new theatre, commons space and a cafeteria. The next phase will include demolition of the eastern portion of the existing school and construction of a new addition that would house the lower school grade spaces, including a new small gymnasium. The existing field house, pool and associated spaces will be renovated in the last phase.

PRIMARY STRUCTURAL CODE ISSUES RELATED TO THE EXISTING STRUCTURE

If any repairs, renovations, additions or change of occupancy or use are made to the existing structure, a check for compliance with 780 CMR, Chapter 34 "Existing Structures" (Massachusetts Amendments to The International Existing Building Code 2015) of the Massachusetts Amendments to the International Building Code 2015 (IBC 2015) and reference code "International Existing Building Code 2015" (IEBC 2015) is required. The intent of the IEBC and the related Massachusetts Amendments to IEBC is to provide alternative approaches to alterations, repairs, additions and/or a change of occupancy or use without requiring full compliance with the code requirements for new construction.

The IEBC provides three compliance methods for the repair, alteration, change of use or additions to an existing structure. Compliance is required with only one of the three compliance alternatives. Once the compliance alternative is selected, the project will have to comply with all requirements of that particular method. The requirements from the three compliance alternatives cannot be applied in combination with each other.

The three compliance methods are as follows:

1. Prescription Compliance Method.
2. Work Area Compliance Method.
3. Performance Compliance Method.

Comment
The approach is to evaluate the compliance requirements for each of the three methods and select the method that would yield the most cost effective solution for the structural scope of the project. The selection of the compliance method may have to be re-evaluated after the impact of the selected method is understood and after analyzing the compliance requirements of the other disciplines, Architectural, Mechanical, Fire Protection, Electrical and Plumbing.
Since portions of the existing building are considered un-reinforced masonry bearing wall structures, the analysis and reinforcement of the existing structure would be governed by the requirements of Appendix A1 "Seismic Strengthening Provisions for Un-reinforced Masonry Bearing Wall Buildings" in the IEBC.

D. STRUCTURAL SYSTEMS - OPTION 2.3

1. PRESCRIPTIVE COMPLIANCE METHOD

In this method, compliance with Chapter 3 of the IEBC is required. As part of the scope of this report, the extent of the compliance requirements identified are limited to the structural requirements of this chapter.

Additions
Based on the project scope, the following structural issues have to be addressed:

- All additions should comply with the code requirements for new construction in the IBC.
- For additions that are not structurally independent of the existing structure, the existing structure and its addition, acting as a single structure, shall meet the requirements of the code for new construction for resisting lateral loads, except for the existing lateral load carrying structural elements whose demand-capacity ratio is not increased by more than 10 percent, these elements can remain unaltered.
- Any existing gravity, load-carrying structural element for which an addition or its related alterations causes an increase in the design gravity load of more than 5 percent shall be strengthened, supplemented or replaced.

Alterations

- Any existing gravity, load-carrying structural element for which an addition or its related alterations causes an increase in the design gravity load of more than 5 percent shall be strengthened, supplemented or replaced.
- For alterations that would increase the design lateral loads or cause a structural irregularity or decrease the capacity of any lateral load carrying structural element, the structure of the altered building shall meet the requirements of the code for new construction, except for the existing lateral load carrying structural elements whose demand-capacity ratio is not increased by more than 10 percent, these elements can remain unaltered.

2. WORK AREA COMPLIANCE METHOD

In this method, compliance with Chapter 5 through 13 of the IEBC is required. As part of the scope of this report, the extent of the compliance requirements identified are limited to the structural requirements of these chapters.
In this method, the extent of alterations has to be classified into LEVELS OF WORK based on the scope and extent of the alterations to the existing structure. The LEVEL OF WORK can be classified into LEVEL 1, LEVEL 2 or LEVEL 3 Alterations. In addition, there are requirements that have to be satisfied for additions to the existing structure.
The extent of the renovations (includes Architectural, FP and MEP renovations) for this project will exceed 50 percent of the aggregate area of the building, thus the LEVEL OF WORK for this project would be classified as LEVEL 3 Alterations. This would require compliance with provision of Chapter 7, 8 and 9 of the IEBC. The scope of the project includes new additions to the existing structure; this would trigger compliance with provisions in Chapter 11 of the IEBC.

Level 3 Alterations

- Any existing gravity, load-carrying structural element for which an alteration causes an increase in the design gravity load of more than 5 percent shall be strengthened, supplemented or replaced.
- For alterations where more than 30 percent of the total floor area and roof areas of the building or structure have been or proposed to be involved in structural alterations within a 12 month period, the evaluation and analysis shall demonstrate that the altered building complies with the full design wind loads as per the code requirements for new construction and with reduced IBC level seismic forces.
- For alterations where not more than 30 percent of the total floor and roof areas of the building are involved in structural alterations within a 12 month period, the evaluation and analysis shall demonstrate that the altered building or structure complies with the loads at the time of the original construction or the most recent

substantial alteration (more than 30 percent of total floor and roof area). If these alterations increase the seismic demand-capacity ratio on any structural element by more than 10 percent, that particular structural element shall comply with reduced IBC level seismic forces.

- For alterations that involve structural alterations to more than 30 percent of the total floor and roof area of the building within a 12 month period, the evaluation and analysis shall demonstrate that the altered building structure complies with IBC for wind loading and with reduced IBC level seismic forces.
- For alterations where more than 25 percent of the roof is replaced for buildings assigned to seismic design category B, C, D, E or F, all un-reinforced masonry walls shall be anchored to the roof structure and un-reinforced masonry parapets shall be braced to the roof structure.

Additions

- All additions shall comply with the requirements for the code for new construction in the IBC.
- Any existing gravity, load-carrying structural element for which an addition or its related alterations cause an increase in design gravity load of more than 5 percent shall be strengthened, supplemented or replaced.
- For additions that are not structurally independent of the existing structure, the existing structure and its addition, acting as a single structure, shall meet the requirements of the code for new construction in the IBC for resisting wind loads and IBC Level Seismic Forces (may be lower than loads from the Code for New Construction in the IBC), except for small additions that would not increase the lateral force story shear in any story by more than 10 percent cumulative. In this case, the existing lateral load resisting system can remain unaltered.

3. PERFORMANCE COMPLIANCE METHOD

Following the requirements of this method for the alterations and additions may be onerous on the project because this method requires that the altered existing structure and the additions meet the requirements for the code for new construction in the IBC.

PARTICULAR REQUIREMENTS OF COMPLIANCE METHODS

For our project, in order to meet compliance with one of the two compliance methods “Prescriptive Compliance Method” or the “Work Area Compliance Method”, we have to address the following:

1. PRESCRIPTIVE COMPLIANCE METHOD

Additions
The proposed additions will be designed structurally independent of the existing structure, thus, would not impart any additional lateral loads on the existing structure.

If the proposed alterations are such that the alterations increase the design lateral loads on the existing building or cause any structural irregularity of decrease the lateral load carrying capacity of the building, the structure of the altered building shall meet the requirements of the Code for New Construction in the IBC.

If the proposed additions increase the design gravity load on portions of the existing roof members, these members would have to be reinforced and this incidental structural alteration of the existing structure would have to be accounted for in the scope of the alterations to the existing school and would trigger requirements for alterations.

Alterations
Alterations that would increase the design gravity loads by more than 5 percent on any structural members would have to be reinforced.

If the proposed alterations of the structure increase the effective seismic weight on the existing structure due to the greater snow loads from the drifted snow against any proposed addition, or, by addition of equipment on the roof, the increase of the effective seismic weight from the drifted snow and the equipment would require that the existing lateral load resisting system comply with the requirements of the Code for New Construction in the IBC and it would increase the demand-capacity ratio on certain structural elements of the existing lateral load resisting system.

2. WORK AREA COMPLIANCE METHOD

Level 3 Alterations
If the proposed structural alterations of the existing structure are less than 30 percent of the total floor and roof areas of the existing structure, we have to demonstrate that the altered structure complies with the loads applicable at the time of the original construction and that the seismic demand-capacity ratio is not increased by more than 10 percent on any existing structural element. Those structural elements whose seismic demand-capacity ratio is increased by more than 10 percent shall comply with reduced IBC level seismic forces. The percentage increase in seismic demand-capacity ratio on any particular structural element from the added snowdrift load against the proposed addition would be fairly low, thus, this would not have any major impact on the existing lateral load resisting system, though we would have to verify that the increase in seismic demand-capacity ratio on any of those particular structural elements is not greater than 10 percent.

If the proposed structural alterations of the existing structure exceed 30 percent of the total floor and roof areas of the existing structure, we have to demonstrate that the altered structure complies with the IBC for wind loading and with reduced IBC level seismic forces.

Existing anchorage of all unreinforced masonry walls have to be evaluated. If the existing anchorage of the walls is deficient, the tops of the masonry walls will require new connections to the structure.

Additions
The proposed additions will be designed structurally independent of the existing structure; thus, it would not impart any additional lateral loads on the existing structure.

Comment
The compliance requirements of the two methods, in most respects, are very similar. The Work Area Compliance Method would trigger anchorage of un-reinforced masonry walls, if re-roofing of the existing structure is included as part of the scope for this project. The Prescriptive Compliance Method would require that the existing lateral load resisting system meet the requirements of the code for new construction of the IBC, even for small increases of design lateral loads. We are required to comply with requirements of Appendix A1 of IEBC for either method, which requires anchorage of all existing masonry walls. Based on this, we would recommend the Work Area Compliance Method for the project.

Summary of Renovations to the existing structure
Based on the scope of the proposed scheme for renovations of the existing school, we have determined that the existing structure would essentially have to comply with the Code for New Construction which would require the addition of new lateral load resisting elements such as structural steel braced beams on masonry shear walls throughout the floor plates at every level. All of the un-reinforced masonry walls are required to be anchored to the floor and roof structure and all of the roof diaphragms have to be reinforced, to resist uplift loads per the Code for New Construction. The addition of braces will require modifications to the existing column foundations at the brace locations and will require the addition of new piles. At the locations of existing slabs-on-grade, new tie beams will be required to connect the existing column foundations.

Belmont High School *Structural Narrative*
Belmont, Massachusetts Option 2.3 – Minor Renovation and Major Additions

Proposed Scheme for the Proposed Additions

SUBSTRUCTURE

FOUNDATIONS

Based on the construction of the existing school and the recommendations of the Geotechnical Engineer, the entire addition will be supported on pile foundations. The columns of the proposed structure would bear on 4 ft. – 0 in. deep reinforced concrete pile caps on structural steel piles. The exterior walls will be supported on 5 ft. – 0 in. deep grade beams spanning between pile caps with intermediate piles at 10 ft. – 0 in. on center. Based on an assumed pile capacity of 50 tons, a typical interior column in the four story classroom wings would be supported on 8 ft. – 0 in. x 8 ft. – 0 in. x 4 ft. 0 in. deep pile caps on a four pile group and a typical exterior column would be supported on 8 ft. – 0 in. x 8 ft. – 0 in. x 4 ft. 0 in. deep pile caps on a three pile group. The columns supporting the long span structure of the single story gymnasium, cafeteria, music spaces and other ancillary spaces would be supported on 8 ft. – 0 in. x 8 ft. – 0 in. x 4 ft. – 0 in. deep pile caps on three pile groups. In addition, the ground floor slab would be supported on single piles with a 2 ft. – 0 in. x 2 ft. – 0 in. x 2 ft. – 0 in. deep pile caps spaced out approximately 15 ft. – 0 in. (including interior and exterior pile caps supporting the columns.) All of the interior and exterior pile caps will be tied to the supported concrete slab.

SLAB ON GRADE

Based on the construction of the existing school and the recommendations of the Geotechnical Engineer, the lowest level of the proposed addition would be a 12 in. thick reinforced concrete slab reinforced with 6 psf reinforcing over a vapor barrier on 2 in. thick rigid insulation on compacted granular structural fill supported on piles.

SUPERSTRUCTURE

FLOOR CONSTRUCTION

Typical Floor Construction
A 5 ¼ in. light weight concrete composite metal deck slab reinforced with welded wire fabric on wide flange steel beams spanning between steel girders and columns. The weight of the structural steel is estimated to be 15 psf for the typical framing.

ROOF CONSTRUCTION

Typical Roof Construction
The roof construction would be galvanized, corrugated 1 ½ in. deep, Type 'B' metal roof deck spanning between wide flanged steel beams and girders. At locations of roof supported mechanical equipment, a concrete slab will be provided similar to the typical supported floor slab. The weight of the structural steel is estimated to be 13 psf.

Low Roof Structure above the Kitchen, Mechanical Room and the Utility Areas
The roof would be a continuation of the adjacent second floor and would be similar to the typical floor construction of 5 ¼ in. light weight concrete composite metal deck slab reinforced with welded wire fabric on wide flange steel beams spanning between steel girders and columns. This roof will be supporting the mechanical units. The units would be screened by a screen comprised of structural steel posts and beams. The weight of the structural steel is estimated to be 15 psf.

Alt. PE and Media Center Roof Framing
The roof construction would be acoustic, galvanized corrugated 3 in. deep, Type 'NA' metal roof deck spanning between long span metal joists and hollow structural steel columns. The weight of the structural steel is estimated to be 13 psf.

D. STRUCTURAL SYSTEMS - OPTION 2.3

VERTICAL FRAMING ELEMENTS

Columns

Columns would be hollow structural steel columns. Typical columns would be HSS 8 x 8 columns and the columns at the double story spaces at the Gymnasium and Lobby would be HSS 12 x 12.

Lateral Load-Resisting System

The proposed addition would be separated from the existing building by way of an expansion joint. The typical lateral load resisting system for the other parts of the school would be concentric steel braced frames comprised of hollow structural steel sections.

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

E. SITE UTILITIES - OPTION 2.3

SITE UTILITIES

Storm Drainage

Stormwater from the site will continue to be directed to Clay Pit Pond. Outside of the existing stormwater outfalls into Clay Pit Pond it is expected that the entire stormwater system will have to be reconstructed so that the new stormwater system can effectively mitigate stormwater quality, rate and volumes from the project site. Runoff generated by the new parking and driveway areas would be collected in a catch-basin to manhole closed drainage system. Water quality from these areas would be addressed by directing those flows through Stormceptor water quality units (or similar). Volume and rates of stormwater from the site would then be addressed by directing these flows to subsurface infiltration systems located beneath the parking areas. The infiltration systems would consist of galleys of 36-inch perforated pipe in crushed stone bedding. Overflows from these infiltration systems would then be directed through the new closed drainage system to the existing outfalls to Clay Pit Pond.

Roof drainage from the building is not required to be treated for water quality, therefore it can be tied directly into the new closed drainage system prior to discharge from the existing outfalls. A portion of the roof drainage could be daylighted to a raingarden or stormwater demonstration area that is incorporated into the landscape design. This landscaped area would consist of an area with variable topography to direct the stormwater through it, plantings to provide treatment and nutrient uptake, walkways or boardwalks that allow students to observe the processes and possibly even hardscape stormwater features such as runnels or small falls to provide aeration.

The new and reconstructed athletic fields would have sub-drainage located below the topsoil layer, as is typical of turf field construction. The sub-drains can be connected directly into the new closed drainage system.

Sewer

Building placement in this scheme appears to conflict with a portion of the existing sewer main which bisects the site, running west to east approximately under the sidewalk, adjacent to the existing access drive in front of the school. Approximately 500 linear feet of 24-inch sewer main would need to be relocated to accommodate the new building location. Portions of the existing 24-inch sewer not in conflict with the new building would be maintained. Sanitary sewer service connections from the new school would be connected to the new/maintained 24-inch main. Lab waste flows would be directed through a pH neutralization system prior to connection to the sanitary sewer system. Flows from the cafeteria would be directed through a new, 10,000-gallon, external grease trap.

Water

It appears that portions of the new construction would conflict with the existing water main that is routed around the rear of the existing building. A new 8-inch water main, approximately 2,500 feet long, would be installed in the first phase of the construction, along the rear property line, out of the way of any future phases. New 4-inch domestic water and 6-inch fire services would be provided to the building from the new 8-inch main. Six new fire hydrants, located along the main, would also be provided as directed by the Belmont Fire Department

Natural Gas

The existing gas service conflicts with the proposed construction. A new gas service, located to the west of the proposed building would be provided from the existing gas main in Concord Avenue to the mechanical area located at the rear of the proposed building.

Electrical

A new ductbanck consisting of four 4-inch, concrete encased conduits would be installed from the existing substation located just east of the site on Hittinger Street to the new electric room located to the rear of the proposed building.

PRELIMINARY PERMITTING CONSIDERATIONS

Wetlands Protection Act (310 CMR 10.00)

A Notice of Intent would need to be filed with the Town of Belmont Conservation Commission for any work within 100-feet of Clay Pit Pond. In addition, a Stormwater Pollution Prevention Plan (SWPPP) would need to be prepared and an application filed with the Environmental Protection Agency under the National Pollutions Discharge Elimination System (NPDES) program for the construction related activities. Erosion control measures will need to be installed and maintained in good working order around the perimeter of the site. Due to the phase nature of the construction, the perimeter controls will have to be re-installed several times over the duration of the project.

E. SITE UTILITIES - OPTION 2.3

Flood Plain

Based on the Flood Insurance Rate Map (FIRM), Community Panel Number 25017C0418E dated June 4, 2010, the portions of the existing High School site are located within Zone X (Areas determined to be outside the 0.2% annual chance floodplain). There is no regulatory requirement for working within a Zone X. The Zone AE, which is associated with the 100-year flood area, is located in close proximity to the banks of Clay Pit Pond. None of the proposed building or any critical infrastructure is being proposed within the Zone AE.

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

F. BUILDING SYSTEMS / PFP - OPTION 2.3

FIRE PROTECTION

A. General

1) A minor renovation and major addition to the building will require a new sprinkler system to be installed.

B. To comply with current codes, this existing building and addition will require a complete sprinkler system installation per the Massachusetts State Building Code, Chapter 34. The Fire Protection system would be designed to meet the requirements of NFPA 13 "Installation of Sprinkler Systems" and Chapter 9 of the Massachusetts State Building Code, 780 CMR, "Fire Protection Systems".

C. A new dedicated 8" sprinkler service, connected to the town water system in the street, should be brought into the building. The exact entrance location will need to be coordinated with the Architect. As the sprinkler service enters the building a Massachusetts approved double check valve backflow preventer assembly, complete with OS&Y valves on the inlet and outlet, will be required.

D. The building will be protected by three types of sprinkler systems and each will protect the following areas:

- Wet sprinkler system – base building system
- Dry sprinkler system – to protect areas subject to freezing; i.e. loading docks and outdoor walkways covered by building overhangs, etc.
- Pre-action sprinkler system – to protect the MDF room

E. The alarm check valves for the wet and dry sprinkler systems will be installed on separate risers after the double check valve assembly in the water service entrance room. The alarm check valves will be complete with standard trim packages including pressure gauges, retard chamber, 2" main drain, water flow indicator and supervisory switches. The dry alarm valve will be supplied with an air compressor and associated appurtenances.

F. Fire protection piping main feeds to the fire protection systems from the alarm check valves will extend out to the building through the first-floor ceiling space. The piping will then extend to all areas of the building to provide complete sprinkler cover age throughout. Potential sprinkler zoning will be coordinated with any new fire wall layouts.

G. The fire protection design will include a combination standpipe system located in all egress stairways. These standpipes will feed the sprinkler system as well as provide a fire department hose connection at each level of the building.

H. The sprinkler system standpipes will feed the sprinkler system at each floor level. Each floor will be a separate zone. The floor control valve assembly at the riser that feeds each floor will contain a flow switch and tamper switch. An inspector's test connection will be installed on the floor control valve station. If the auditorium stage is greater than 1,000 square feet, fire department valves will be required on each side of the stage.

I. Sprinkler heads installed in gypsum or suspended ceilings will be glass bulb, quick response, chrome plated semi-recessed type. In areas without ceilings, brass upright sprinklers will be installed. Where upright sprinklers are subject to potential damage, such as in storage rooms, protective cages will be installed. In areas where it is not possible to run piping above the ceiling the use of sidewall sprinkler heads would be recommended.

J. The MDF room will be protected by a pre-action sprinkler system. A pre-action alarm valve with all required appurtenances will need to be located next to or near the MDF. Piping from this valve will extend into the room and connect to sprinkler heads. The piping system will be filled with compressed air. Once a sprinkler head activates, the air will discharge and open the pre-action alarm valve to allow water into the system and through the open sprinkler head.

K. Sprinkler piping for the system will be as follows:

- Piping 2" and smaller shall be schedule 40 black steel with cast iron fittings with threaded joints.
- Piping 2 ½" and larger shall be Schedule 10 black steel with malleable iron fittings with rolled grooved joints.
- Dry sprinkler systems will be supplied with Schedule 10 galvanized piping throughout.

F. BUILDING SYSTEMS / PFP - OPTION 2.3

L. All tamper and flow switches installed on the sprinkler system will be connected to the buildings fire alarm system. Each tamper and flow switch will be a dedicated point on the fire alarm system.

M. The exterior fire department connection for the sprinkler system will be a flush type mounted on the exterior of the building within 100' of a fire hydrant. The exact type of connection (storz or siamese) will be coordinated with the Belmont Fire Department. Final location and number of fire department connections will also be coordinated with the Belmont Fire Department.

N. The hydraulic requirements for the building will be as follows:

- Light Hazard - All offices, corridors and the auditorium hydraulically calculated to deliver 0.1 gpm per square foot over the most remote 1,500 square feet.
- Ordinary Hazard - All storage rooms and mechanical rooms hydraulically calculated to deliver 0.15 gpm per square foot over the most remote 1,500 square feet.
- Ordinary Hazard Group II - The stage area hydraulically calculated to deliver 0.2 gpm per square foot over the most remote 1,500 square feet.

PLUMBING

A. General

1) A minor renovation and major addition to the building would require that all existing systems be modified to comply with current codes. The following recommendations to the plumbing systems should also be considered.

2) All existing plumbing systems, or portions thereof, that were capable of remaining and being maintained should also be removed or modified to meet the requirements of any planned renovations.

3) All existing plumbing systems to be removed as part of the select building demolition should be removed back to the nearest point of connection of their respective system.

4) New above ground sanitary waste piping should be installed throughout remaining portions of the existing building to replace the existing older system that is currently in place.

5) New above ground domestic hot and cold water piping should be installed throughout remaining portions of the existing building to replace the existing older systems that are currently in place.

6) Install new waste outlets as required to accept HVAC condensate and sprinkler waste discharge.

B. Plumbing Fixtures

1) All water closets, urinals and lavatories in the existing building are old and not current water conserving type. Removal of all fixtures is required as the existing fixtures have reached the end of their serviceable life. Water closets should be replaced with new dual flush valve fixtures. A full flush will discharge at a rate of 1.6 gallons per flush (gpf). When only flushing liquid waste and paper, the reduced flush rate will be 1.1 gpf. Urinals should be replaced with 0.25 gpf fixtures. Lavatories should be replaced and new low-flow type faucets (0.5 gpm or less) added with temperature limit stops which will deliver water with a maximum temperature of 110°F. ADA requirements for fixture spacing, mounting heights and protection of any exposed piping will also need to be met during a renovation to the bathrooms.

2) The state plumbing code dictates the number of plumbing fixtures required in a building. Minimum plumbing fixture requirements will be determined once the total occupancy numbers for the building have been established based on the final plan layout.

C. Domestic Cold-Water System

1) The existing 6" domestic water line that enters the building is the original service to the building. Although the existing 6" domestic water service appears to be adequate to meet the current building water requirements, consideration should be given to replacing it with a new 6" dedicated domestic water service since a new 8" water service would also be brought in at this time to feed the new sprinkler system. The installation of a water meter on the new service will be provided to allow the town to be able to monitor water usage as may be required.

D. Domestic Hot Water System

1) The existing steam water heaters serving the larger portions of the building are original to the building and have passed their useful life expectancy. Also with the use of these steam water heaters, the boilers are required to operate during the summer months to allow hot water to be created for the building. It is recommended to install new gas-fired storage type water heaters in the same locations as the existing. It is also recommended that redundant water heaters be included in the new system design. This would allow the system to continue to deliver hot water if one of the water heaters were to need service. The water heaters would be sized to provide hot water to all fixtures within the building.

2) The existing electric water heaters serving the various wings of the building are older and have passed their useful life expectancy. These should be removed. The new gas-fired water heaters should provide hot water to all fixtures that these units currently serve.

E. Sanitary Waste and Vent System

1) The sanitary system in the existing building appears to be in fair condition but replacement may be required because of a possible fixture count change and probable relocation of fixtures in the renovation plan. Any new piping would connect to the existing waste and vent piping at a convenient point to be determined by further investigation.

F. Storm Drainage

1) The existing building roof drainage appears to be in good condition and no replacement is required. The roof itself appears to be in good condition and leaks around the roof drains themselves have not been reported.

2) New roof drains and storm water piping system will need to be added to the new addition. Discharge of the storm water will be coordinated with the civil engineer.

3) Backwater valves should be installed on all interior storm system piping originating from roof drains on lower roof sections as per the state plumbing code.

G. Natural Gas System

1) Currently the existing gas service is more than adequate to meet the school's demand requirements and should remain. Gas piping should be reconfigured to serve all mechanical equipment that will require gas. Any new gas-fired kitchen equipment should also be connected to this service. It is recommended that gas sub-metering be used to separately meter gas consumption for the mechanical equipment and kitchen uses.

H. Insulation

1) The pipe insulation that currently exists should be tested to determine the extent of any hazardous materials. The insulation should be removed and replaced with new fiberglass insulation with an all service jacket. Domestic water and horizontal storm drainage piping that is not currently insulated should have new insulation installed. New domestic water piping and horizontal storm drainage piping installed throughout the new building addition will be insulated.

2) Insulation will also need to be provided on waste piping and water piping below handicapped lavatories and sinks.

I. Hose Bibbs and Wall Hydrants

1) During any renovation done to the building, the existing hose bibbs in the toilet rooms should be removed and new wall mounted hose bibbs with an integral vacuum breaker and removable tee handle installed. In the new addition, hose bibbs will be provided in all bathrooms and mechanical spaces. New wall hydrants will be provided on the exterior of the building and their locations coordinated with the architect.

J. Cross Connection Control

1) The existing hose bibbs and wall hydrants do not have backflow prevention devices. Backflow devices should be integral to all new hose bibbs and wall hydrants installed during the renovation.

2) All service sink faucets installed during a renovation and in the new addition, will also be supplied with integral vacuum breakers.

3) A new reduced pressure backflow preventer assembly should also be installed on the existing 6" domestic water service (or on a new service if this is the preferred option) to further protect the town's domestic water system.

K. Boys, Girls and Pool Locker Room/Shower Areas

F. BUILDING SYSTEMS / PFP - OPTION 2.3

1) All locker room/shower areas should be completely renovated. Floor drains within any new shower stalls should be arranged so that the water from one shower does not enter the adjacent shower area. New shower valves should be installed with code compliant shower heads. Master mixing valves should be installed at each shower location. Valves shall be provided with limiting stops set to a maximum water temperature delivery of 112°F.

2) All plumbing fixtures will be replaced as discussed in the "Plumbing Fixture" section of this report.

L. Kitchen

1) The new cafeteria kitchen will include the addition of new gas-fired equipment. This equipment can be connected to the new gas service located outside the building as noted above.

2) Any new gas equipment would be fed by gas piping connecting to a master shut-off valve that would be interconnected with the kitchen hood and exhaust system. Gas would only operate when the kitchen hood exhaust system is operating.

3) Additional floor sinks and/or floor drains would be added to any new equipment design to ensure proper drainage throughout the kitchen.

4) A new three-compartment sink with new grease trap should be included per state code requirements.

5) A new dishwasher with accompanying grease trap may also be provided per state code requirements.

6) A new exterior grease trap, located underground, outside of the kitchen portion of the building will also need to be considered as part of any new kitchen design. Venting of this exterior grease trap should enter back into the school building and exit to the atmosphere above the roof.

M. Science Wing

1) New science classrooms will include new sinks and faucets. Faucets should be low-flow type fixtures with a maximum delivery rate of 0.5 gpm.

2) All new science classroom sinks will connect to a new polypropylene acid resistant piping system that empties into a central acid neutralization tank and system. This system would balance the pH of the lab waste and then safely discharge it into the regular sanitary waste system before it connects back to the town's sanitary waste system.

3) New protected hot and cold-water systems should be created to serve the new science classrooms by installing reduced pressure backflow preventers on the hot and cold-water piping designated to serve this area.

4) Gas piping to each science classroom should first feed an emergency shut-off valve located in a valve box on the wall near the classroom exit door. Piping from this valve would then feed any gas turrets within that classroom only.

5) New emergency showers and eyewashes will be installed in each science classroom. A new tempered water system should be created to serve these fixtures. A new gas-fired water heater should be installed somewhere within the science wing and be dedicated to the new tempered water system. Water should be stored at 140°F and a master mixing valve should be mounted nearby and set to deliver tempered water to this wing at approximately 70°F-90°F per state plumbing code requirements. A tempered water return system will also be required to keep this system from becoming stagnant per state plumbing code requirements as well.

N. Pipe Materials

1) Below grade sanitary and storm drainage piping will be service weight bell and spigot cast iron with neoprene gasketed joints. Above grade sanitary and storm piping will be service weight hubless cast iron with Massachusetts approved stainless steel and neoprene no-hub connector assemblies.

2) All water supply and return piping shall be Type "L" copper.

3) All water supply and return piping insulation shall be in accordance with the Energy Code.

4) All gas piping will be threaded black steel piping up to 2 ½" size. Piping 3" and larger shall be welded.

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

F. BUILDING SYSTEMS / HVAC - OPTION 2.3

BELMONT HIGH SCHOOL

HEATING, VENTILATING, AND AIR CONDITIONING

MINOR RENOVATION / MAJOR ADDITION / C.2.3

A. General:

1. This description applies to the Minor Renovation / Major Addition option (C.2.3) where the existing fieldhouse and associated locker rooms and the swimming pool and associated locker rooms remain. The existing boiler and main electrical room also remain. New construction is built in two phases from west to east with the existing building largely remaining in operation initially and then being phased out after the initial phase is complete.

2. Heating, air conditioning and ventilation systems shall be high-efficiency systems that allow for the ability towards achieving a Net Zero Energy facility.

B. Ground Loop Geo-Exchange System:

1. A vertical borehole well field area consisting of (400) 6-inch diameter boreholes spaced 20 feet apart shall be provided. Each borehole shall be 375 to 450 feet deep. Actual depth to be determined based on thermal conductivity testing performed on a test well. The number of boreholes may be increased or decreased based on thermal testing results and/or determination of the final heating and cooling loads.

3. Provide a 1-1/4 inch supply and return pipe within each borehole with a U-bend at the bottom. Piping shall be high density polyethylene (HDPE) with DR9 wall thickness. Polyethylene pipe and fittings shall be heat fused by butt, socket, sidewall, or electrofusion in accordance with pipe manufacturer's procedures. Underground supply and return piping from boreholes shall collect to four buried circuit vaults constructed of HDPE or concrete. Supply and return circuit piping in each vault shall combine to 8 inch main header piping which shall be routed into the building.

4. Steel sleeve casings shall be provided for the upper section of each borehole down to bedrock. Each borehole shall be filled with a bentonite based thermally enhanced grout mixture.

C. Central Heating and Cooling System:

1. Central geothermal heating and cooling shall be provided by four high efficiency 300 ton (approx. nominal capacity) heat recovery chiller-heaters or (40) 30 ton modular chiller-heaters connected to the ground loop system.

2. The ground loop circulation system shall be filled with 25% propylene glycol solution and shall be served by three 1000 GPM pumps with variable frequency drives.

3. Chiller-heater condenser water shall be constant flow primary with zero pressure bypass connections to the ground loop distribution and the building heating distribution. There shall be three primary condenser water pumps at 1,000 GPM each.

4. Secondary condenser/heating pumps shall be variable flow with variable frequency drives. There shall be three secondary heating pumps at 1,000 GPM each.

5. Chilled water distribution from chiller evaporators to building distribution shall be variable primary flow with three 750 GPM pumps.

6. The building circulation loop shall consist of a four-pipe distribution. The main distribution to heating/cooling terminal units in the building shall be four-pipe. Rooftop air handling units, heat recovery air handling units, and central air handling units shall be two-pipe configuration.

7. The building loop piping system shall contain a 25% propylene glycol solution for freeze protection and corrosion protection.

8. The building terminal heating units will be designed to utilize low temperature heating supply water (130°F maximum). Heating terminal units such as fin tube radiation and heating coils may require larger surface areas due to the low water temperature. In areas with high heating loads, two-row fin-tube and heating coils may be required.

D. Exterior Classrooms - Induction Units with Displacement:

1. The system serving heating, cooling and ventilation for typical exterior classrooms shall utilize four-pipe floor mounted chilled beam induction units with displacement supply air. Four 5 ft. long units shall be provided for each typical classroom mounted along the exterior wall. Units shall be served by two 7-inch diameter primary ventilation supply air ducts.

2. The primary supply air serving each classroom shall be provided with a modulating supply air volume control terminal to control supply air when the room is occupied.

3. Systems will be interfaced to the local space vacancy sensor to reduce ventilation air and reset the space cooling and heating set point temperatures when the room is unoccupied.

4. A carbon dioxide sampling sensing system will be provided in classrooms to provide monitoring and occupied control of ventilation air.

E. Interior Classrooms and Other Spaces – Ceiling Induction Units:

1. Interior classrooms and other interior occupied spaces will be served with ventilation supply air from a rooftop heat recovery ventilation unit connected to ceiling mounted chilled beam induction terminals. Induction terminals shall be provided with four-pipe supply and return water connections.

2. Individual classrooms shall be provided with a supply air volume control terminal to control ventilation air when the room is occupied. A carbon dioxide sampling sensing system shall be provided for classrooms to monitor and control ventilation air.

F. Classroom and Interior Ventilation Systems:

1. Outside ventilation air for classrooms and interior spaces will be provided by roof mounted dedicated outside air heat recovery units (HRU).

2. The HRU's will be variable air volume and will include supply and exhaust fans with variable frequency drives, total energy recovery wheels and secondary sensible reheat wheels to allow for a low level of dehumidification control. The units will be provided with two-pipe dual temperature water connections to a single combination pre-heat and cooling coil. Changeover between hot water and chilled water supply shall be provided with the use of changeover valves connected to the hot water and chilled water systems. Each unit shall include 100% recirculation dampers for morning warm-up mode and after-hours night setback heating.

3. All unit energy recovery wheels and coils shall be sized for low face velocity to increase unit and system efficiency.

4. Variable supply air will be based on demand from classrooms and interior spaces. Return/exhaust air shall be controlled by air flow measurement and tracking of the supply and exhaust air with limited volume control terminals in the exhaust air system.

5. Corridors will be provided with ventilation air from the HRU system. Air quantities in excess of basic ventilation requirements will be provided for building exhaust makeup air as required. Corridors will not be fully air conditioned with the exception of areas that have direct solar loads.

G. Existing Gymnasium:

1. The existing heating and ventilating units in the gym shall be replaced with new HVAC units in Phase 02. The units shall include a hydronic coil for heating and cooling using hot water and chilled water. Units shall also include a heat recovery section with an enthalpy wheel for outdoor air heat recovery meeting the requirements of the MA energy code due to the level of outdoor air required.

2. Two units shall be provided, which shall be located indoors or outdoors depending on structural and architectural requirements. Units be provided with a round ductwork distribution exposed within the space.

3. The units shall be provided with variable frequency drives for the supply and return fans to reduce the fan speed during times of low demand. Supply, return, and outside air flow measurement and control shall be provided.

4. Provide a new H&V unit with plate heat exchanger to serve the existing locker rooms.

H. Existing Swimming Pool:

1. The existing heating and ventilating unit serving the pool shall be replaced with a new H&V unit in Phase 02. The unit shall include a hydronic coil for heating using hot water. The unit shall also include an air-to-air flat plate heat exchanger for exhaust air sensible heat recovery.

2. The pool deck exhaust system shall remain, but the existing exterior mounted exhaust fan shall be relocated to the roof due to the Phase 02 construction. Exhaust duct shall be extended up through the building in a ne duct shaft.

3. Provide a new H&V unit with flat plate heat exchanger to serve the new locker rooms.

I. Miscellaneous Areas:

1. All normally occupied areas will be air conditioned except for corridors, the kitchen, and culinary classrooms with kitchen hoods (if applicable). The kitchen and culinary areas are partially tempered by using transfer air from the commons for make-up air.

2. The Auditorium, Stage, Media Center, Cafeteria, and Administration areas, will be served by rooftop air conditioning units (RTU). Separate occupancy scheduling for each unit will provide operational flexibility.

3. Rooftop air conditioning units (RTU) will include supply fan, return fan, hot water heating coil, chilled water cooling coil, filters, and variable frequency drives. Units serving Administration, Media Center, Band/Chorus, and the Cafeteria will be variable air volume (VAV) with local variable air volume boxes for zone temperature control.

4. The Auditorium and Gymnasium units will be single zone with a variable frequency drive to modulate the supply air during periods of low demand and occupancy.

5. The Auditorium, Gymnasium, Cafeteria, and Media Center systems will be provided with space carbon dioxide (CO_2) sensors to provide modulation of outside air based on occupancy demand.

6. Areas such as the Cafeteria, Black Box, parts of the Media Center, main lobby and open group learning spaces may alternatively be provided with a radiant floor cooling and heating system. System shall include connections to the hot water and chilled water piping, circulation pumps, circuit headers, controls, and under-slab PEX piping distribution.

J. Building Management System (BMS):

1. Provide direct digital control (DDC) BMS with local and unitary controls and web interface for remote access, alarms, and monitoring of all HVAC equipment in the building including; chillers, pumps, heat recovery units, rooftop units, fans and terminal units shall be controlled and mapped to a central monitoring station. System shall be based on the Niagara Framework open protocol for interoperability between manufacturers.

2. BMS system shall be interfaced to the building electrical and gas sub-meters. Daily, weekly, and annual energy use shall be reported for each meter.

K. Carbon Dioxide Sensing System:

1. Provide an Aircuity, or equal, carbon dioxide air sampling and sensing system consisting of room sensors, cabling, tubing, room probes, air routers, and vacuum pumps.

2. Air tubing from room sensors shall be collected through air routers to sensing stations.

3. The system shall include an information management system and shall be integration with the building management system.

4. Building management system input shall provide control input for modulating supply air terminal units or automatic dampers.

L. Electrical and BTU Metering:

1. Electrical metering shall be provided for collection of historical and real-time performance data. Separate meter groups shall be provided for the upper school areas and lower school areas consisting of meters for the measurement of lighting and plug loads for each classroom group by wing, floor or classroom type.

2. Individual metering of lighting and plug loads shall be provided for the Kitchen, Media Center, Auditorium/Stage, Gymnasium, and Administration areas.

3. Electrical metering shall be provided for each air handling system, central system pumps (by each group type), and each chiller-heater.

4. Provide BTU metering of chilled water, hot water, ground loop circulation systems and domestic hot water system.

M. Phasing Considerations:

1. Construction of the new facility is in two phases (Phase 02 and Phase 04). Phase 02 of construction allows for the existing building to remain occupied, while a large part of the new construction is completed. Therefore, the existing boiler room must remain active during Phase 02 and the new chiller-heater plant must be constructed to support the new construction. Approximately 900 SF of new mechanical space will need to be constructed next to the boiler

room in the first phase to provide space for the new equipment. One of the steam boilers may also be phased out and demolished in this first phase.

2. Construction phasing will require that the geothermal borehole field be installed in two phases. The first phase may be constructed in the area of the new football field, parking and drive lanes to the west of the fieldhouse. The second phase may be constructed in the area of the Soccer 02 field, and parking and drive lanes to the east.

3. The existing gym and pool areas will be renovated in Phase 02, including replacement and upgrade of the existing HVAC equipment.

4. Completion of the new central chiller-heater plant construction may begin in Phase 03 with the removal of the remainder of the existing boiler plant.

F. BUILDING SYSTEMS / Electrical - OPTION 2.3

Belmont High School

ELECTRICAL

2.3 Minor Renovation / Major Addition

A. Existing Electric Services:

1. Based on the proposed renovation/addition scope to maintain the Field House and Pool, existing services will be required to be maintained to deal with construction phasing and maintaining existing systems while renovations and new additions are completed.

2. The intent is that upon completion, there will be new services throughout the entire renovated facility and new additions.

3. The Main Electric Room housing the main electric switchboard is located adjacent the Boiler Room, these rooms are located at the northwest corner of the facility adjacent the Fieldhouse.

4. Scope will include maintaining and/or providing new feeders to existing panelboards and mechanical equipment to be kept operational during renovation and new construction.

5. Coordinate with Utility Company for the relocation of any utility poles and overhead pole lines associated with new construction and scheduled demolition of the existing school building.

6. All existing services shall be maintained for the complete operation of existing school building until the scheduled date of demolition of the existing building. Upon substantial completion, coordinate with the respective utility company and include all work required for the removal of all existing utility services that become abandoned including power, telephone, cable TV, and fire alarm services.

7. Include the removal of all existing roadway, parking, and walkway lighting structures. At the scheduled time of demolition of the existing buildings include disconnecting all services and making safe the existing structure for complete demolition.

8. Include maintaining the operation of existing site equipment such as irrigation pumps. Provide new services to all equipment affected by new construction.

B. New Main Electric Service:

1. A new primary service will be provided from utility company primary services via an underground ductbank and manhole system to a new utility company pad mounted transformer.

2. Secondary service from the new pad mounted transformer will be underground to a new main switchboard at 480/277V, 3-phase, 4-wire. Switchboard will be located in a new main electric room.

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

F. BUILDING SYSTEMS / Electrical - OPTION 2.3

C. New Normal Distribution System:

1. Main switchboard will be provided with surge protection (SPD) and ground fault protection on main and feeder devices.

2. Surge protection will be provided in all 120/208V panelboards.

D. New Emergency Distribution System:

1. Natural gas/diesel (fuel source to be determined) emergency generator will power emergency egress lighting and exit lighting in corridors, assembly areas, and stairwells. Miscellaneous systems to include the following:

   a. Kitchen walk-in coolers and freezers.

   b. Telephone system.

   c. Security system.

   d. District and school IT head-end equipment (located in the MDF Room).

   e. Cooling equipment for school and district IT equipment.

   f. Fire alarm system.

   g. Circulator pumps and controls.

2. Separate automatic transfer switches shall be provided for emergency and non-emergency loads.

3. In addition to the equipment and systems listed above, the following equipment and systems will be fed from the generator.

   a. Additional lighting in Gymnasium, Cafeteria, Kitchen, and associated toilets and corridors.

   b. HVAC ventilation equipment (no air-conditioning) associated with the Gymnasium, Cafeteria, Kitchen, and associated toilets and corridors.

   c. Receptacles in Gymnasium and Cafeteria.

4. Generator will be ground mounted at the exterior of the building in a self-contained sound attenuated enclosure with an integral base mounted fuel tank (if diesel). Generator will be mounted on an elevated concrete platform for survivability.

5. Emergency panels will be located in new two-hour rated electric closets.

6. Non-emergency (standby) loads will be located in separate closets via separate automatic transfer switch and panelboards.

7. Emergency feeders run outside two-hour electric rooms and shafts and not in or under floor slab will utilize MI Cables.

8. A portable generator connection will be provided to meet National Electric Code Article 700 requirements to have a portable generator available while servicing the building generator.

E. Sustainable Design Intent LEED 4.0:

1. Sustainable Design Intent compliance will include:

a. Advanced measurement and verification of air conditioning, fans, lighting, and receptacle power via electronic sub-meters equal to E-Mon, D-Mon Class 2000 3-phase kWh and demand meters. Measurement and verification metering will be monitored by the Building Management System (BMS).

b. Plug and process load reductions through the use of vacancy/occupancy sensor controls for local convenience outlets in classrooms, offices, library and resource rooms. Open areas such as Media Center, Auditorium and Kitchen will be equipped with relay panels controlled via the lighting control system, to reduce loads on a time schedule basis.

c. Advanced lighting controls include a low voltage lighting control system with time schedule control for common areas, vacancy/occupancy sensors, and photocells for daylight harvesting.

d. Empty conduit provisions will be provided for future green vehicles charger stations based on two percent of the available parking.

e. Empty conduits and space provisions will be provided for photovoltaic (PV) installations. Include conduits and space provisions for inverters at a minimum of three locations on Level 3 and/or Level 4 electric closets.

F. Lighting:

1. New luminaires will be provided throughout all renovated areas as well as new construction. Luminaires will be dimmable LED. All luminaires will be suitable for respective utility rebate incentives.

2. Exterior building mounted around the entire building including all canopies, all entry drives, parking areas, and all walkways will be full cutoff LED type. All exterior lighting will be controlled via the building low voltage lighting control system.

3. Athletic field lighting will be provided at the Softball and Baseball fields.

G. Lighting Controls:

1. A low voltage lighting control system will be provided for common areas such as corridors and other areas not controlled by occupancy sensors.

2. Manual low voltage override switches to override the time of day lighting control schedules shall be provided. Override switches will permit extension of lighting control program as well as ON-OFF override for exiting the facility.

3. Lighting program for time of day schedules shall permit all lighting, including exterior to be turned off during non-occupied hours, reducing sky glow and light trespass. Activation of either fire alarm or intrusion detection system shall override the lighting program.

4. Vacancy and occupancy sensors will control lighting in most spaces including classrooms, offices, and utility type spaces. In addition, all spaces will be provided with local low voltage dimmable switching.

5. Daylight harvesting will be employed in all perimeter classrooms, offices, and other spaces with substantial daylight utilizing daylight sensors in each space.

H. Auditorium:

1. A professional theatrical lighting system will be provided.

I. Convenience Power:

1. Safety type duplex receptacles will be provided throughout the building in quantities to suit space programming.

2. Plug load reduction will be achieved by vacancy/occupancy sensors in classrooms, offices, and staff spaces, and circuits routed via relay panels, controlled via lighting control system time schedule for open areas such as Commons/Café, Kitchen and culinary areas.

J. Fire Alarm:

1. Existing automatic, fully supervised, analog addressable, voice evacuation system will be maintained and utilized where applicable.

   a. Manual pull stations (with tamperproof covers if applicable), at points of egress, and other locations as required to meet code.

   b. Audible/visual units in corridors, classrooms, and throughout the building to meet code.

   c. Visual only units in conference rooms, meeting rooms and small toilets.

   d. Smoke detectors in corridors, stairwells, electric, and telecommunications rooms, elevator lobbies, and elevator machine rooms.

   e. Smoke duct detectors in HVAC units over 2,000 CFM, and within five feet of smoke dampers including connections to all smoke/fire dampers.

   f. Connections to all Fire Protection devices and Kitchen hood.

   g. Connections to audio/visual systems, sound systems, and dimmed lighting controls.

   h. Remote annunciator at main entrance and secondary entrances as directed by Belmont Fire Department.

   i. 24 VDC magnetic hold open devices at smoke doors.

   j. Master box and exterior beacon (quantity of beacons per Belmont Fire Department.

   k. Wiring will be fire alarm MC cable.

K. Technology per Technology Section.

F. BUILDING SYSTEMS / Electrical - OPTION 2.3

L. Integrated Intrusion, Access Control, CCTV, and Alarm System:

1. Intrusion alarm system will provide magnetic switches on perimeter doors, motion sensors in all perimeter rooms on first floor with susceptible access from grade. Motion sensors will be provided in first, second, and third floor corridors. System will have secure-access zoning. Zoning will be provided to suit all proposed off hours usage including community programs.

2. CCTV coverage will be provided at main and secondary entries as well as all other perimeter entries to be used by students and staff on a daily basis and for off hours community programs, including Gymnasium and Cafeteria entries.

3. Exterior CCTV coverage will be provided to cover the entire perimeter of the building.

4. Access control via card access system will be provided at all exterior doors.

5. CCTV system will be IP based with minimal 30 day recording capacity. System will be web based to allow viewing by Belmont Police Department.

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

F. BUILDING SYSTEMS / Information Technology - OPTION 2.3

Structured Cabling System:

The School Department is responsible for the fiber network for both the schools and the Town (including the light department and TV Studio). The fiber network handles general data as well as Phone (VoIP) and security for the school district and the Town. There are three centralization points for the fiber – the high school, Chenery Middle School, and the Town Library. Internet services and wireless controllers in the existing high school MDF provide connectivity at all the school facilities and the Town. These systems must remain operational during construction. Therefore, the MDF and the existing district fiber must be protected during construction.

A new MDF will be created. The MDF will be the central location of all head end equipment including but not limited to servers, storage, switch electronics, security equipment, video equipment, telephone system, public address system and security system. It will be a dedicated space with proper ventilation, environmental treatment and emergency power. The new MDF will be built-out and cutover during an early phase of construction. The district fiber will be re-routed or extended to the new MDF location. Existing Telco lines, which terminate in the Main Office area will need to be protected and re-routed or extended. Temporary cabling and services may be necessary to maintain functionality of existing systems during demo work.

New IDFs will be created. The IDF locations will serve as intermediate closets for local cabling and equipment. The IDFs will be dedicated spaces with proper ventilation, environmental treatment and emergency power. Each closet will connect to the MDF with backbone cabling. IDFs will be built-out and come on line in conjunction with construction phasing. Existing IDFs will be brought offline in conjunction with construction phasing. Temporary cabling and services may be necessary to maintain functionality of existing systems during demo work.

Equipment racks will be installed in the MDF and IDFs for patch panels and network hardware. Two-post and four-post racks will be provided. Racks will be 19" EIA floor mount racks with wide floor mounting flanges, vertical cables guides and horizontal cable managers. Power for rack equipment will be installed in cable tray above the racks. Power will consist of both 20A and 30A twist-lock receptacles.

The existing Category 5 horizontal cabling will be replaced. The new data cabling infrastructure will be based on a Category 6A, or most up to date standard at the time of bid. The data channel will be comprised of the passive components including cabling, connectors, patch panel port, and patch cords capable of supporting 10 Gigabit per second networking. Category 6A data cabling will be provided to all equipment requiring data and voice connectivity, including but not limited to data outlets, voice outlets, video surveillance cameras, access control network connections, and other related equipment. This cabling will support computer network requirements, wireless connectivity, telephone system (VoIP) and IP-based security needs. Cabling will terminate in the MDF or one of the IDFs. Temporary cabling may be necessary to maintain functionality of existing systems during demo work.

The existing fiber backbone within the school will be replaced. The new fiber backbone will connect the MDF and all IDFs. It will consist of twelve strands of multi-mode and six strands of single-mode fiber optic cables. All multimode fiber optic cables will use multimode, graded-index fibers with 50-micron cores only. Fiber will be laser-enhanced and guaranteed for transmission distances in 10 Gigabit Ethernet of up to 500 Meters. All single-mode fiber optic cables will be OS2, tight buffered, high flexibility. Temporary cabling and services may be necessary to maintain functionality of existing systems during demo work.

Data and Voice Communication Systems:

Updated networking hardware will be provided for the MDF and IDFs consisting of network switch electronics for the data and voice communication systems, distributed communication system, audio-video communication system, security system, wireless LAN and other Owner equipment. Components will consist of PoE+ chassis and power supplies, 10/100/1000 PoE+ modules, fiber transceivers, patch cables and UPS equipment. The switches will be fully configured according to network requirements and VLANs will be created according to best practice and equipment requirements. Backbone will be 10Gb minimum.

Updated VoIP server and hardware will be provided. The existing NEC 8300 will be upgraded to the 9300 platform, or current standard at the time of bid. Several elementary schools in the district depend on the existing VoIP system for connectivity, so it must remain operational during

construction. The new system must be compatible with existing VoIP equipment in the district.

Audio/Visual Communication System

Digital signage will be provided in gathering areas and large group instruction spaces. The system will consist of LED displays, media players, and a server or cloud based digital signage solution.

Classrooms and general instruction spaces will be equipped with a local audio system consisting of ceiling speaker, amplification, wireless microphones and auxiliary inputs. There will be an input available for FM assistive listening systems.

Distributed Communication System

The existing Simplex Building Communication System will be replaced with a new system. The new system should be built-out with the new MDF during an early phase of construction so that newly renovated or constructed areas can come online. The new distributed communication system will consist of a fully operational IP platform public address system for district and school internal communications system incorporating school safety notifications and general communications. It will provide complete internal communications using state of the art IP technology with two-way loud speaker internal communication, bell event notification, emergency announcements that will override any pre-programmed zones assuring that all emergency/lockdown announcements are heard at all locations, and atomic time synchronization. The system will connect directly to the high school's LAN and have the future capability of expanding to connect to other intercom systems in the school district over the WAN for district-wide, emergency, and live voice announcements in the future (additional hardware will be required at the other school facilities for this feature). Configuration of zoning, bell schedules, calendars, and emergency sequences will be accomplished using a browser-based interface.

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BELMONT HIGH SCHOOL FEASIBILITY STUDY
AUDIOVISUAL SYSTEMS, OPTION C.2.3

SUBMITTED TO: PERKINS + WILL

CONSULTANT: ACENTECH

JANUARY 23, 2018

ACENTECH PROJECT NO. 629341

We visited Belmont High School on August 28, 2017 with the school and the entire design team to assess the existing conditions at the school. The following are our comments related to the audiovisual systems for the school.

BACKGROUND

Acentech is an independent consulting firm specializing in architectural acoustics, noise and vibration control, and the design of advanced sound, audiovisual, multimedia, and videoconferencing systems. In order to provide unbiased consulting and design services, Acentech does not sell or install equipment and does not represent any dealer, distributor, or manufacturer.

ROOM SCHEDULE

Unless otherwise noted, the focus of this project is limited to the following spaces and/or systems.

- Auditorium
- Music Classrooms
- Cafeteria
- Entry Hall
- Classrooms (including Art Classrooms)
- Lecture Hall (aka Little Theater)
- Book Rooms
- Field House

EXISTING CONDITION EVALUATION

During our site visit, the existing audiovisual systems were reviewed. In general, the technology being used in the school is outdated and does not support current standards. Additionally, there did not appear to be consistency in the system components from room to room. Standardization is generally desirable so that technical staff can more easily troubleshoot and correct any problems with the systems, and also so that they can stock common replacement parts (such as projector lenses and filters).

Consistency from system to system also allows them to be easier for the end users. If an end user needs to use the audiovisual system in a space that they do not typically use, the user can feel comfortable and confident that they will understand how to use the system in that room since it will be exactly the same as the one they typically use.

In all of the classrooms that we observed, the video projection systems included analog video (VGA) connections, but not digital video (HDMI). Analog video systems are rapidly being phased out. Fewer source devices support this connectivity, and the cost to support the older technology is increasing due to low supply of the components needed to support this. While some adapters allow users to connect digital video sources

to analog displays (projectors and video display panels), the adapters are not reliable and do not always work.

Portable assistive listening systems were observed in some classrooms. These portable systems ("Redcat Lightspeed") are generally used for speech amplification. They do not typically connect to the audiovisual systems. In spaces with installed amplified sound systems, assistive listening systems are required in order to comply with the ADA (Americans with Disabilities Act). Further information about this requirement is listed later in this report.

It did not appear that audiovisual control system interfaces were used in most of the systems we observed. A control system interface (either as a touch screen control panel, or a button panel) will make the audiovisual system easier to use for the end user. The controls will always be available and in the same location (will not need to look for remote controls that can easily be lost).

The existing audiovisual equipment rack for the Auditorium is located on the downstage left corner. It is located next to electrical equipment and lighting dimmer racks. Unless the dimmer racks are using newer technologies, locating these racks in close proximity to one another should be avoided. Electrical "noise" (RF) from the lighting dimmers can create interference and create audible hum or buzz in the sound system.

Finally, current audiovisual system technologies allow the systems to connect to the data network. This allows the systems to automatically alert technicians about problems. For example, a system can alert a technician when a video projector's lamp has been used for a set number of hours. This allows the technician to know ahead of time that the lamp will need to be replaced soon, and give them time to order replacement parts before the lamp no longer works.

BUDGET SUMMARY

This report describes the functionality of the proposed audiovisual systems and does not include cost estimates. A programming meeting with key users is recommended to confirm the features described in this report, and a more accurate narrative and budget can be developed to cover this. Please note that audiovisual technology cost estimates do not cover construction items traditionally carried in the mechanical and electrical engineers' budgets. These items include, but are not limited to, conduit, junction boxes, structural supports, electrical power, and data network cabling.

TOTAL COST OF OWNERSHIP

The total cost of ownership of the audiovisual systems, in addition to the installation costs of the systems, includes several on-going costs:

Support Staff Costs:
The increase in the use of audiovisual systems carries with it the need to provide additional support for the users of the systems. This is balanced by network tools that allow support staff to work more efficiently. Specifically, the network-based management software will allow the staff to turn systems on and off, verify the operation of the equipment, schedule events for automatic operation, and receive automatic notification of system failures, projector lamp replacement, etc., without visiting the room. Without a detailed study of the current and anticipated support staff requirements, it is not possible to predict the staffing costs following the completion of the project; however, AV system management software is key to minimizing the support staff costs.

AV System Service:
The installation contract should require the installing contractor to provide a service contract for all systems for an additional three years beyond the initial one-year P&L warranty. The cost of a service contract for the period following the expiration of the initial contract is likely to be approximately 10% of the cost of the initial installation per year. In addition, there will be charges associated with the actual repair of equipment that may fail during the life of the service contract.

Equipment Replacement:

The useful life of audiovisual system equipment varies with the type of equipment. In general, the useful life of most AV equipment is 5 - 10 years. Replacing individual items of equipment will be necessary during the life of the systems. Complete upgrades of the systems may be appropriate after ten years, as much because of the progress of technology and because of equipment usable life.

INFRASTRUCTURE VS. EQUIPMENT

The distinction between infrastructure and equipment must be emphasized: Infrastructure is part of the building construction including, but not limited to, conduit, raceways, junction and device boxes, and is not outlined in this program. Other infrastructure provisions, such as electrical power and grounding specified exclusively for audiovisual systems cabling and equipment may be required and should be carried in the electrical budget. Properly designed AV infrastructure allows for not only the installation of the initially specified equipment, but for the evolution of the systems over many years. If proper infrastructure is provided, additional capabilities and equipment can be added later as technology progresses.

Equipment refers to the devices that can be connected through the infrastructure. Equipment includes microphones, loudspeakers, mixers, signal processing gear, video projectors, flat panel displays, cameras, AV control systems, equipment racks, and many other devices that comprise an AV system. One thing is certain – equipment will change over the life of the room as user needs and technology change. For this reason, infrastructure is the key to the long-term success of a thoughtfully conceived AV design project because it governs what can and cannot be easily installed in the future.

EQUIPMENT NOTES AND DEFINITIONS

This program is not a technical specification and is insufficient to bid or build an AV system. Except where useful to illustrate a standard of performance or a specific user requirement, equipment manufacturers and model numbers are not used.

- Permanently installed refers to equipment that is part of the room systems and cannot easily be removed for use elsewhere.
- Portable refers to equipment that is available for connection at one or more locations, but is not hard-wired to the system. Portable equipment can be disconnected by the user or technical personnel and stored or used with systems elsewhere in the facility.
- Future Provisions refers to equipment that may be purchased and used or installed at a future date.
- Options refer to equipment or systems that are not at this point considered to be central to the needs of the Owner but may be chosen if desired. Optional equipment is not included in the budget estimate totals.
- OFE (Owner Furnished Equipment) refers to equipment that is either already owned by the Owner, or may be purchased in the future as needs arise. FBO (Furnished by Others), or “by others” refers to any service or equipment (e.g. lighting) required but not a part of the AV system design or installation.

SYSTEM CLASSIFICATIONS:

Presentation Systems

Presentation systems are the source, routing, and display devices that provide highly intelligible communication of speech, music, information, and graphics to groups of people. This includes equipment such as microphones, loudspeakers, video projectors, plasma displays, computers, and the interfacing, mixing, routing, and control equipment that connects these devices together and allows the user to select the appropriate sources and operate the system.

Assistive Listening Systems

Permanently installed Assistive Listening Systems (ALS) are required by the ADA (Americans with Disabilities Act), a 1990 federal law that forbids discrimination against persons who are handicapped. A 2010 revision states, “In each assembly area where audible communication is integral to the use of the space, an assistive listening system shall be provided” in the following quantities and versions:

Receivers for Assistive Listening Systems		
Capacity of Seating in Assembly Area	**Minimum Number of Required Receivers**	**Minimum Number of Required Receivers Required to be Hearing-aid Compatible**
50 or less	2	2
51 to 200	2, plus 1 per 25 seats over 50 seats[1]	2
201 to 500	2, plus 1 per 25 seats over 50 seats[1]	1 per 4 receivers*
501 to 1000	20, plus 1 per 33 seats over 500 seats[1]	1 per 4 receivers*
1001 to 2000	35, plus 1 per 50 seats over 1000 seats[1]	1 per 4 receivers*
2001 and over1	55 plus 1 per 100 seats over 2000 seats[1]	1 per 4 receivers*
		1 "Or Fraction thereof"

The term "assembly area" includes facilities used for entertainment, educational, or civic gatherings. Additionally, courtrooms are required to support Assistive Listening systems regardless of whether or not an installed sound system exists.

Audiovisual Control System

Audiovisual (AV) control systems are required to centralize the operation of the various functions of the AV system. This includes environmental controls such as lighting presets and shade and drape controls, as well as audiovisual functions such as system and projector power, source device selection and media transport controls, audio volume controls, and many other operational functions identified by the design team before the equipment is installed.

Advanced functions of the AV control system may include multi-level password protection for system operation to prevent unauthorized use, control of automatic system shut-down sequences (to reduce unnecessary wear and tear), and a help system interface for user experiencing technical problems (see below).

Remote Management

Permanently-installed AV control systems can be connected to the Owner LAN to enable remote control and diagnostics of the AV systems. An asset management hardware / software suite allows monitoring and operation of AV systems via the Owner's LAN. These products allow technical personnel to operate audiovisual systems in remote locations from any computer with a web browser. The features of remote management systems include:

- Real-time monitoring of system status, including notification of imminent problems in certain devices before they fail.
- Mobile management.
- A method of asset management by tracking equipment usage in real time.
- Will integrate with other control system hardware/software.

Video Conferencing/Distance Learning

Videoconferencing equipment (HD CODECs, software codecs, cameras, echo cancellers, telephone interfaces and related devices) is equipment specifically designed to transmit and receive audio and video signals over local and wide area networks. This capability is not currently planned for this project.

Broadcast Systems
Broadcast quality equipment and systems generally refer to audio and video devices (cameras, recorders, and editing equipment) of the highest quality, specifically designed for the recording, editing, and production at the commercial level, such as in network television studios. Broadcast equipment is an order of magnitude more expensive than “professional” quality equipment, and is not planned for this project.

PROPOSED AUDIOVISUAL SYSTEM DESCRIPTIONS

AUDITORIUM
The auditorium will be used for live music and theater performances, multimedia presentations with audio and video, lectures, and panel discussion. It is anticipated that the following will be required:

Sound System
- Microphones:
    - Wired Microphones: The system will include a stereo microphone that is hung in the room and used for audio recordings. Another microphone will be permanently installed over the stage/performance area and used for backstage monitoring. A gooseneck microphone will be provided for connection to a lectern (lectern, by others). Connections for wired microphones will be available at the sides of the stage, above the stage performance area, and along the side walls of the seating area.
    - Wireless Microphones: The system will include 4 wireless microphone systems. Each will include an interchangeable handheld and lavalier (clip-on) microphone transmitter.
- Audio Mixers: The system will operate in one of two microphone mixing modes; automatic or manual. These modes will be selectable from a control panel.
    - Automatic Microphone Mixing Mode: This mode will allow an end-user to simply connect a microphone to the system at one of multiple designated microphone receptacle locations. Master volume control will be accessible from the control panels. This will be the system's default setting and will be used for presentations, movies, and lectures.
    - Manual Microphone Mixing Mode: For events when more complex operation of the sound system is required, the automatic microphone-mixing can be bypassed and the system can be run by a trained operator. Volume levels of microphones and other audio playback sources will be controlled from a 32-channel digital mixing console; providing a flexible variety of audio outputs that can be used for special effects, recording, and speech reinforcement. The mixing console will be permanently located at a "tech position" within the house. The mixing location will require ample space for operation of the console and other items such as scripts required for rehearsals or performances. The mixing console will connect to the IT network and will have the capability of being controlled from an Owner-furnished tablet computer (such as an Apple iPad) that is connected via Wi-Fi to the same IT network.
- Audio Recorder: An audio recorder will used for recording events from the stereo microphone. The recorder will be capable of connecting to the IT network and can upload recorded audio tracks to another computer or server. The USB connection will allow recordings to be transferred to a thumb drive.
- Audio Signal Processing: A digital audio signal processor will be used for automatic microphone mixing, and equalizing the loudspeakers. The signal processor will be expandable so that, if required, additional input and output capacity can be added to the system in the future.
- Production Communications: A two-channel intercom system will be used for communication between production crew members at control locations, and the backstage spaces. AV connection panels within the performance space will include receptacles for the connection of intercom belt-packs. Wall-mounted speaker stations will be located in the music classrooms and other backstage spaces. The system will be provided with eight dual-channel belt-packs, headsets, and cables.
- Loudspeakers:

  - Installed Auditorium System: The loudspeaker system will provide uniform audio coverage through the audience area allowing the system to provide high levels of speech intelligibility and musical clarity.
  - The loudspeaker configuration will consist of a central loudspeaker cluster above and in-line with the primary stage area. It will be used for speech reinforcement and playback of audio. Supplementary "delay" loudspeakers will be provided to cover the rear seating areas. Front-fill loudspeakers will be used in the stage apron. Subwoofers will also be provided. Left and right loudspeakers will be used for stereo audio playback, and for sound effects; which can be panned across the left, center, and right loudspeakers. Amplifiers will be provided to power the loudspeakers.
  - Control Room: A pair of wall-mounted loudspeakers will be installed in the Control Booth and will be used by technicians in the booth to monitoring audio from the stage performance/event. Amplifiers will be provided to power the loudspeakers.
  - Portable: Four portable self-powered loudspeakers will be provided for use on stage as "wedge" monitor loudspeakers. These loudspeakers can also be used in the house or on stage as sound effects speakers. Additionally, the loudspeakers will slant for use as a "wedge" or fold back monitor loudspeaker for use on stage.
  - Backstage and Front of House: In addition to the Auditorium's loudspeakers, ceiling-mounted loudspeakers will be provided in backstage areas, dressing rooms, etc. for audio monitoring (for cues, etc.). Amplifiers will be provided to power the loudspeakers.
- Assistive Listening System: An FM-based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers (i.e., headphones) will be stored centrally and issued to participants as required. These receivers are intended to be used by patrons with hearing impairments.

Display System

- Video Projector: The system will display computer and motion video using a high brightness video projector with appropriate lens. The projector will be installed at the rear of the Auditorium in the control booth.
- Projection Screen: A motorized video projection screen with a high-contrast screen material will hang from above the stage.
- AV Sources: AV sources will include an Owner-furnished computer. Inputs for portable AV devices, such as a laptop computer or portable audio player, will be available at three locations (one on one side of the stage, one at the in-house audio mix location, and one in the Control Booth).
- Video Cameras: A high-definition video camera with integral pan/tilt head will be installed in the Theater. In addition, a night vision camera will also be provided for viewing of dark scenes. The cameras will be used to feed images of events in the space to backstage and front-of-house areas with video displays. Control of the cameras will be via presets on the touchscreen control panel.
- Video Routing and Processing: A matrix type switcher will be used to route video and audio sources to the displays and sound system. This will include video signal transmitters and receivers that are needed to send digital video signals longer distances. It will support playback and distribution of digital and analog video formats and the transport system will be compatible with newer generation 4K sources. Fiber optic transmitter outputs will be provided to send signals to the backstage areas with video displays, such as the Music Classrooms.

System Control

The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of three 10" LCD touch screens (one at the side of the stage, one at the in-house audio mix location, and one in the Control Booth). The control panels will be able to control all functions of the audiovisual system; including source selection and media transport controls, volume control, and can interface with other operational functions including lighting and HVAC.

Miscellaneous

Miscellaneous equipment will include a floor-standing and lockable equipment rack(s), AC power distribution, and sequencers in the racks, custom connection panels at the stage/performance area and

house mix position, audio press feed connections to locations within the room, and all cable, connectors, and additional hardware and labeling required to install the system.

MUSIC CLASSROOMS

The Music Classrooms will include the Band Room and Chorus Room. These spaces will be used for musical instruction and rehearsal for choir, jazz band, orchestra, and band groups. Each audiovisual system will comprise the following sub-systems:

Sound System

- Microphones: A stereo microphone will be provided and will hang from the ceiling. This microphone will tie into the AV system and can be used for recording performances.
- Audio Signal Processing: A digital audio signal processor will be used for signal routing and equalizing the loudspeakers.
- Audio Recording: A network USB/SD audio recorder will be provided.
- Loudspeakers: Wall-mounted loudspeakers will be wall-mounted at the front of the room for program audio playback. Amplifiers will be provided to power the loudspeakers.
- Assistive Listening System: An FM-based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers (i.e., headphones) will be stored centrally and issued to participants as required. These receivers are intended to be used by patrons with hearing impairments.

Display System

- Video Projector: The system will display computer and motion video using short-throw, 3,300 ANSI lumen video projectors (1280 x 800 WXGA resolution). The projectors will be installed on the wall above the whiteboard/projection screens in each room (whiteboard material to be provided by Others). Note that the whiteboard material should be of a projection quality and should not create reflections or hot spots from the projector.
- AV Sources: AV sources will include connectivity for an Owner-furnished computer. Inputs for portable AV devices, such as a laptop computer or portable audio player, will be available at locations at the front of the room. An overflow audio and video feed from the Auditorium will also be provided.
- Video Routing and Processing: A matrix type switcher will be used to route video and audio sources to the display and sound system. This will include video signal transmitters and receivers that are needed to send digital video signals longer distances. It will support playback and distribution of digital and analog video formats and the transport system will be compatible with newer generation 4K sources.

System Control

The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of a 7”LCD touch screen at the presentation area. The control panel will be able to control all functions of the audiovisual system; including source selection and media transport controls, and volume control. Control system processing will be embedded in the video matrix switch.

Miscellaneous

Miscellaneous equipment will include a floor-standing and lockable equipment rack, AC power distribution and sequencers in the racks, custom connection panels, and all cable, connectors, and additional hardware and labeling required to install the system.

CAFETERIA

The Cafeteria will include seating for a large number of students. An audiovisual system will be provided for lectures and will serve as an area to view and hear overflow AV feeds from the Auditorium. The audiovisual system will comprise the following sub-systems:

Sound System

- Microphones:

  - Wired Microphones: Connections for wired microphones will be available.
  - Wireless Microphones: The system will include a wireless microphone system. This will include lavalier (clip-on) microphone transmitter.
- Audio Signal Processing: A digital audio signal processor will be used for automatic microphone mixing and equalizing the loudspeakers.
- Loudspeakers: The loudspeaker configuration will consist of distributed ceiling-mounted loudspeakers and will be used for program audio and speech reinforcement. Amplifiers will be provided to power the loudspeakers.
- Assistive Listening System: An FM-based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers (i.e., headphones) will be stored centrally and issued to participants as required. These receivers are intended to be used by patrons with hearing impairments.

Video System

- Video Displays: Two wall-mounted video display panels will be provided to display computer and motion video. These can be used for digital signage with owner provided PC, local AV presentations, or overflow video feeds from the auditorium.
- AV Sources: Inputs for portable AV devices, such as a laptop computer or portable audio player, will be available at one location in the Cafeteria area.
- Video Routing and Processing: A matrix type switcher will be used to route video and audio sources to the display and sound system. This will include video signal transmitters and receivers that are needed to send digital video signals longer distances. It will support playback and distribution of digital and analog video formats and the transport system will be compatible with newer generation 4K sources.

System Control

The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of a 7” LCD touch screen. The control panel will be able to control all functions of the audiovisual system; including source selection and media transport controls, and volume control.

Miscellaneous

Miscellaneous equipment will include a floor-standing and lockable equipment rack, AC power distribution and sequencers in the racks, custom connection panels, and all cable, connectors, and additional hardware and labeling required to install the system.

ENTRY HALL

The Entry Hall is a public area where large murals are hung. A digital video wall will be used to display electronic artwork, and can also be used to display other images and announcements. The audiovisual system will comprise of the following sub-systems:

Display System:

- Video Display: The system will display computer and motion video using a wall-mounted video wall consisting of nine (9) x 55" video display panels arranged in a 3 x 3 grid. The overall image size will be approximately 81" high x 143.5" wide.
- AV Sources: Inputs for portable AV devices, such as a laptop computer, will be available at a wall-mounted receptacle panel in the main office area of the school. An Owner-furnished computer will connect to the system.
- Video Routing: A switcher will be used to route video and audio sources to the display and sound system. This will include video signal transmitters and receivers that are needed to send digital video signals longer distances. The video routing equipment will be compliant with newer generation digital video sources (4K).

System Control:

The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of a wall-mounted 7” LCD

touch screen. It will be able to control all functions of the audiovisual system; including source selection and media transport controls.

Miscellaneous:
Miscellaneous equipment will include an equipment rack, AC power distribution and sequencing, custom connection panels, and all cable, connectors, and additional hardware and labeling that are required to install the system.

CLASSROOMS
The classrooms (including the art classrooms) will be used for lectures and presentations. The audiovisual systems will each comprise of the following sub-systems:

Sound System
- Loudspeakers: A pair of wall-mounted loudspeakers will be used for program audio playback. Amplifiers will be provided to power the loudspeakers.
- Assistive Listening System: An infrared-based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers (i.e., headphones) will be stored centrally and issued to participants as required. These receivers are intended to be used by patrons with hearing impairments.

Display System
- Video Projector: The system will display computer and motion video using a wall-mounted short-throw video projector (1920 x 1200 WUXGA minimum resolution). The projector will display content on a wall-mounted white board suitable for projection (white board, by Others).
- AV Sources: AV sources will include inputs for portable AV devices, such as a laptop computer or portable audio player. It will be available at the front of the room on a wall-mounted receptacle panel.

System Control
The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of a wall-mounted button panel. It will be able to control all functions of the audiovisual system; including source selection, volume control, and power.

Miscellaneous
Miscellaneous equipment will include custom connection panels, and all cable, connectors, and additional hardware and labeling required to install the system.

LECTURE HALL (AKA LITTLE THEATER)
The Lecture Hall will be used for multimedia presentations with audio and video, lectures, panel discussions, and community events.

Sound System
- Microphones:
  - Wired Microphones: A gooseneck and handheld microphone will be provided for connection to a lectern (lectern, by others). Connections for additional wired microphones will be available.
  - Wireless Microphones: The system will include a wireless microphone system. The system will include handheld and lavalier (clip-on) microphone transmitters.
- Audio Signal Processing: A digital audio signal processor will be used for automatic microphone mixing and equalizing the loudspeakers.
- Loudspeakers: Loudspeakers will be provided for speech reinforcement and audio playback. Amplifiers will be provided to power the loudspeakers.
- Assistive Listening System: An FM-based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers (i.e., headphones) will be

stored centrally and issued to participants as required. These receivers are intended to be used by patrons with hearing impairments.

Display System:

- Video Projector: The system will display computer and motion video using a high-brightness video projector (1920 x 1200 WUXGA minimum resolution).
- Projection Screen: A motorized video projection screen with a high-contrast screen material will hang from the presentation wall.
- AV Sources: AV sources will an Owner-furnished computer. Inputs for portable AV devices, such as a laptop computer or portable audio player, will be available at two locations at the front of the room.
- Video Cameras: One high-definition video camera with integral pan/tilt head will be installed in the Lecture Hall on the rear wall. Control of the camera will be via presets on the touchscreen control panel.
- Video Routing and Processing: A matrix type switcher will be used to route video and audio sources to the display and sound system. This will include video signal transmitters and receivers that are needed to send digital video signals longer distances. It will support playback and distribution of digital and analog video formats and the transport system will be compatible with newer generation 4K sources.

System Control

The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of a 10" LCD touch screen at the presentation area. The control panel will be able to control all functions of the audiovisual system; including source selection and media transport controls, volume control, and can interface with other operational functions including lighting and HVAC. Control system processing will be embedded in the video matrix switch.

Miscellaneous

Miscellaneous equipment will include a floor-standing and lockable equipment rack, AC power distribution and sequencers in the racks, custom connection panels, and all cable, connectors, and additional hardware and labeling required to install the system.

Book Rooms

The Book Rooms will be used for workgroups and tutorial sessions. The audiovisual systems will each comprise of the following sub-systems:

Sound System

- Loudspeakers: A pair of wall-mounted loudspeakers will be used for program audio playback. Amplifiers will be provided to power the loudspeakers.
- Assistive Listening System: An infrared-based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers (i.e., headphones) will be stored centrally and issued to participants as required. These receivers are intended to be used by patrons with hearing impairments.

Display System

- Video Display Panel: The system will display computer and motion video using a wall-mounted video display panel.
- AV Sources: AV sources will include inputs for portable AV devices, such as a laptop computer or portable audio player. It will be available at the front of the room on a wall-mounted receptacle panel.

System Control

The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of a wall-mounted button panel. It will be able to control all functions of the audiovisual system; including source selection, volume control, and power.

Miscellaneous
Miscellaneous equipment will include custom connection panels, and all cable, connectors, and additional hardware and labeling required to install the system.

FIELD HOUSE
The Field House will be used for practice, large games, presentations, and events. The audiovisual system will comprise of a number of sub-systems that include the following:

Sound System
- Microphones: The system will include one wireless handheld microphone transmitter. Connections for wired microphones will be available at wall-mounted receptacle panels and on a portable equipment rack.
- Audio Processing and Mixing: A digital audio signal processor will be used for automatic microphone mixing, and equalizing the loudspeakers. An 8-channel audio mixer in the portable equipment rack will be used to mix microphones and other audio sources.
- Loudspeakers: Distributed ceiling-mounted loudspeakers will be provided for speech reinforcement and program audio playback. Loudspeakers will be zoned so that they can be used over the entire Field House floor, or only over the smaller sections. For larger events and games, additional loudspeakers will be used to provide coverage to the bleacher seating area. Amplifiers will be used to power the loudspeakers.
- Assistive Listening System: An FM or infrared based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers, intended for use by patrons with hearing impairments, will be stored centrally and issued to participants as required. Inductive neck loop adapters will be provided along with the receivers for compatibility with telecoil-enabled hearing aids.

System Control
The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of one wall-mounted 5” LCD touch screen, and an additional 5” LCD touch screen in the portable equipment rack. The control panel will be able to control all functions of the audiovisual system; including source selection and media transport controls, and volume control.

Miscellaneous:
Miscellaneous equipment will include a floor-standing and lockable equipment rack, a portable equipment rack for use during events and games, AC power distribution and sequencers in the rack(s), custom connection panels, and all cable, connectors, and additional hardware and labeling required to install the system.

ARCHITECTURAL, MECHANICAL, AND ELECTRICAL CONSIDERATIONS

1. Architectural: The following items should be considered for proper coordination between audiovisual system components and other trades:
    a. Loudspeaker coverage must not be obstructed.
    b. Structure will be necessary to ensure that loudspeakers and the projection screen can be ceiling-mounted at recommended locations.
    c. Antennas for the assistive listening system and wireless microphones will be mounted on the wall.
    d. Wall-mounted connection panel locations will require coordination.
    e. Ceiling-mounted video projectors must be free from vibration.
2. AV Equipment Racks:
    a. Equipment racks will require coordination for space and cooling/airflow requirements. This will include floor-standing equipment racks, and any small equipment racks that may be installed within millwork.
        i. Floor-standing AV equipment racks shall be fixed in position and will require front access for day-to-day operational needs. They will also require rear access for

service. Clearances must be maintained around the AV equipment racks (36") to comply with the requirements of the Americans with Disabilities Act.

ii. AV equipment rack rooms may require oversized doors.

3. Auditorium Mixing Console:
   a. The Control Booth's mixing position will require ample space for operation of the console and other items such as scripts required for rehearsals or performances. The audio console is 48" wide by 36" deep.
   b. Control Booth:
      i. Please note the following guidelines:
         1. Coordination will be required with the acoustical consultant to maintain proper acoustical isolation between the Auditorium and the Control Booth.
         2. The glass in front of the video projector should be low iron. It should also be tilted between 2 and 5 degrees. Coordinate direction of tilt with the acoustical consultant.
4. Video Projection:
   a. In order to optimize the viewing experience and achieve the minimum recommended video display contrast ratio, ambient lighting within the spaces with projection will need to be reviewed. Additionally, overhead lighting should be zoned so that lighting areas directly above the projection screen surfaces can be switched off during presentations.
   b. Whiteboards & marker boards that are used as a projection surfaces shall be of projection quality so that they minimize reflections and projection hotspots.
5. Blocking will be required at all wall-mounted video display panel and loudspeaker locations.
6. Mechanical/Electrical: The following items should be considered for proper coordination between the audiovisual system components and other trades:
   a. The AC power system will be designed and specified by the electrical engineer and will include a dedicated power panel, transient voltage surge suppression, and AC outlets.
   b. Electrical outlets will be required at the equipment racks, mix location floor-box, and wall-mounted receptacle panels.
   c. IT data drops are strongly recommended at the equipment racks and all AV receptacle panels.
   d. If lighting control is desired from the audiovisual system control touch panel, the lighting system will require an interface for communication with the control system.
   e. Equipment Rack Locations:
      i. AC power requirements and heat loads will need to be considered at each equipment rack and video projector location.

* * * * * *

End of Feasibility Study

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

OPTION 2.4 - MINOR RENOVATION / MAJOR ADDITION

SUMMARY

Option 2.4 proposes a substantial addition and phased renovation to the existing high school, creating a new 7-12 high school. This scheme creates an elongated building footprint (in the East-West direction) that organizes the program around a daylight multi-story internal 'street'. In the first phase, a substantial new addition would be constructed at the southwest side of the existing high school building that stretches along the Clay Pit Pond edge. The addition would include the entirety of the upper school configuration including the media commons and cafeteria. The upper school students would occupy this new addition and a second phase of construction would take place to demolish the existing high school building. A portion of the existing building structure including caissons, foundations, concrete floor and roof slabs would be demolished in a phased manner allowing for the lower school spaces, including a new entry, administration and wellness space to be constructed east of the existing fieldhouse. The fieldhouse, pool, and associated athletic spaces would be renovated including the existing small gymnasium. Upon completion all school classrooms and science labs could be integrated on opposite sides of each floor allowing lab spaces to be centrally located. Common amenity spaces would be organized at the base of the pond's edge to allow for a public expression of spaces that are highly used by the larger community. This configuration is unique within the options in that it allows for a balance between the needs for separate identities and scales for upper and lower school functions while achieving the synergies that allow both younger and more experienced students to engage in educationally beneficial ways at the buildings heart.

SITE STRATEGY

In this scheme the building mass is placed away from the existing rail bed with most academic teaching spaces overlooking the pond with optimal orientation for daylighting. This option proposes two separate entry and exit points to the site helping to disperse traffic congestion during the drop-off and pick-up periods. It also provides separate building entry points allowing for a sensitivity to scale for lower and upper grades. In this option many of the athletic fields become collocated on the eastern half of the site allowing for more overlap and as a result higher use of the site. This colocation also helps in both the efficiency of maintenance and the ability to manage storm water in a sustainable, cost effective manner.

SUSTAINABILITY AND BUILDING PERFORMANCE

The following sustainability and resiliency attributes have been considered in evaluating this option:

ENVELOPE – Aggressive performance will be pursued in the new wall make-up including a goal of R-28 and minimized thermal bridging with the intent of minimizing air and vapor movement

ORIENTATION- This scheme orients the majority of teaching spaces to the south and north with the intent of eliminating glare to the north and shading for glare control to the south. Public spaces will be day lit from above and through borrowed light

SKIN TO VOLUME RATIO- The skin to volume ratio of the minor renovation- major addition schemes are similar and attempt to form a concise footprint while maximizing daylight.

WINDOW TO WALL RATIO-The window to wall ratio of the scheme will attempt to achieve 30-40 glazing balancing heat gain with effective daylighting.

PV POTENTIAL- This scheme creates a simple continuous roof surface that does not shade its selves and optimizes roof top yield by orienting itself in the east-west direction.

SITE ENVIRONMENTAL PERFORMANCE- This scheme allows for one contiguous large geo-exchange field and allows for more performative landscape adjacent to the pond allowing outdoor teaching space to overlap with site sustainable strategies at the water edge.

PROSPECTIVE SITE ANALYSIS - OPTION 2.4

SITE

This narrative provide an analysis of the option including natural site limitations, building footprint(s), athletic fields, parking areas and drives, bus and parent drop-off areas, site access, and surrounding site features. This narrative excludes temporary site facilities, phasing implications, site drainage, utilities and permitting requirements addressed separately. All addition renovation and new building options include complete reconstruction of the site east of Harris Field to accommodate the site program requirements except tennis which will be accommodated at other existing courts in

A. PROSPECTIVE SITE ANALYSIS - OPTION 2.4

Town.

Harris Field including the track and supporting facilities are existing to remain. Spatial accommodations have been made in the site planning for the school project to accommodate a multi-modal community path along the north property line abutting the MBTA right-of-way and a multigenerational path around Clay Pit Pond – both with separate funding and implementation timelines. The school building project site design is anticipated to incorporate the portion of the multigenerational path that connects across the north side of Clay Pit Pond, as that will serve as a vital link between the school's site program elements and circulation through the campus.

The existing school building is located on higher ground north of Claypit Pond towards the rear (north) of the site. The primary vehicular (car and bus) circulation and drop-off is a one-way loop from east (Hittinger Street) to west (Concord Avenue). The main pedestrian entrances are the south sides of the building. Buses drop off and pick up students along the south side of the building. The site has three primary parking areas. The largest parking lot (292 spaces) is located to the east of the school building. Small lots are located to the south (36 spaces) and north (21 spaces) of the building. Nine buses currently park along the far east side of the east parking lot. All parking areas contain accessible parking.

Most of the school's athletic facilities are located west of the school building including two baseball fields (varsity is played on Grant Memorial Field which includes bleacher seating, dugout shelters and a prominent gateway) with rectangular field layouts (for soccer and field hockey) overlapping their outfields, a rugby/football practice field and Harris Field which includes a running track and synthetic turf field, home and away bleachers and sports lighting. An indoor skating rink in poor condition and a football field house separate these fields from the varsity softball field further west with lighting and a soccer/lacrosse field overlapping the outfield. Ten tennis courts are located adjacent to the east parking area and the junior varsity softball field is located further east of the primary east parking area.

BUILDING FOOTPRINT

In Option C2.4, the only portion of the existing building to remain and be renovated is the field house, gym, pool and supporting facilities. The new school building is an addition to this structure expanding the building footprint to the south stretching east and west along the north side of Clay Pit Pond. The new building construction is positioned in the middle of the site set back from both Concord Avenue and the railroad right-of-way.

ATHLETIC FIELDS

The athletic fields except Harris Field are reconfigured as follows:

- One softball and baseball combination field overlap with a soccer/field hockey field west of the rink.
- A football/rugby field is located between the field house and Harris Field just north of the new building construction.
- The varsity baseball field (to replace the Brendan Grant Memorial Field) is located at the east end of the site with an overlapping soccer field.
- The varsity softball field is adjacent to the varsity baseball field. The soccer field also overlaps the softball outfield.
- A lacrosse/soccer field is located between the east softball and baseball fields and the school building.

TRAFFIC CIRCULATION

The driveway between the building and Clay Pit Pond is eliminated, and a new 2-way driveway is located around the rear of the building with new access points across from Trowbridge and Goden Streets. Building entrances to the upper and lower school program have separate entrances and drop off loops at the east and west ends of the building. The multigenerational path connecting along the north side of the pond links the site and building program elements and provides pedestrian, bicycle and emergency vehicle access through the site.

PARKING

This site plan meets the school's parking need for 430 spaces. Parking is redistributed along the entire length of the campus driveway providing convenient access to the school building and fields. This parking configuration also serves as a buffer between the school campus and MBTA rail line as well as the future multi-modal Community Path planned along the north border of the site.

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

B. CONSTRUCTION IMPACT - OPTION 2.4

Option 2.4 would require minor renovations within the existing occupied school and would be undertaken in 2 or 3 phases. Modular classrooms are not anticipated to be required on site during renovations. Scheduling work over summer or holiday breaks may alleviate some of the disruption but would need to be carefully managed. The anticipated construction schedule is 42 months.

Work under this option would be less disruptive to students and staff. Students would be forced to move only once to accommodate the construction phases. Disruption from noise, dust, odors and construction traffic could be anticipated.

The detailed plan for phasing and swing space would be determined during schematic design to best coordinate with the educational programs to minimize the impact on students and staff.

OPTION 2.4 - I. DESIGN AND CONSTRUCTION SCHEDULE

Anticipated MSBA Approval of PSR	April 10th, 2018 (MSBA Board Meeting)
Anticipated MSBA Approval of SD	August 29th, 2018 (MSBA Board Meeting)
Special Town Meeting/Ballot Vote	November 2018
Design Development Complete	November 2018 - April 2019
Construction Documents Complete	May 2019 – January 2020
Bid and Award	February 2020 - March 2020
Construction (multiple phases)	April 2020 – October 2023 (42 months)

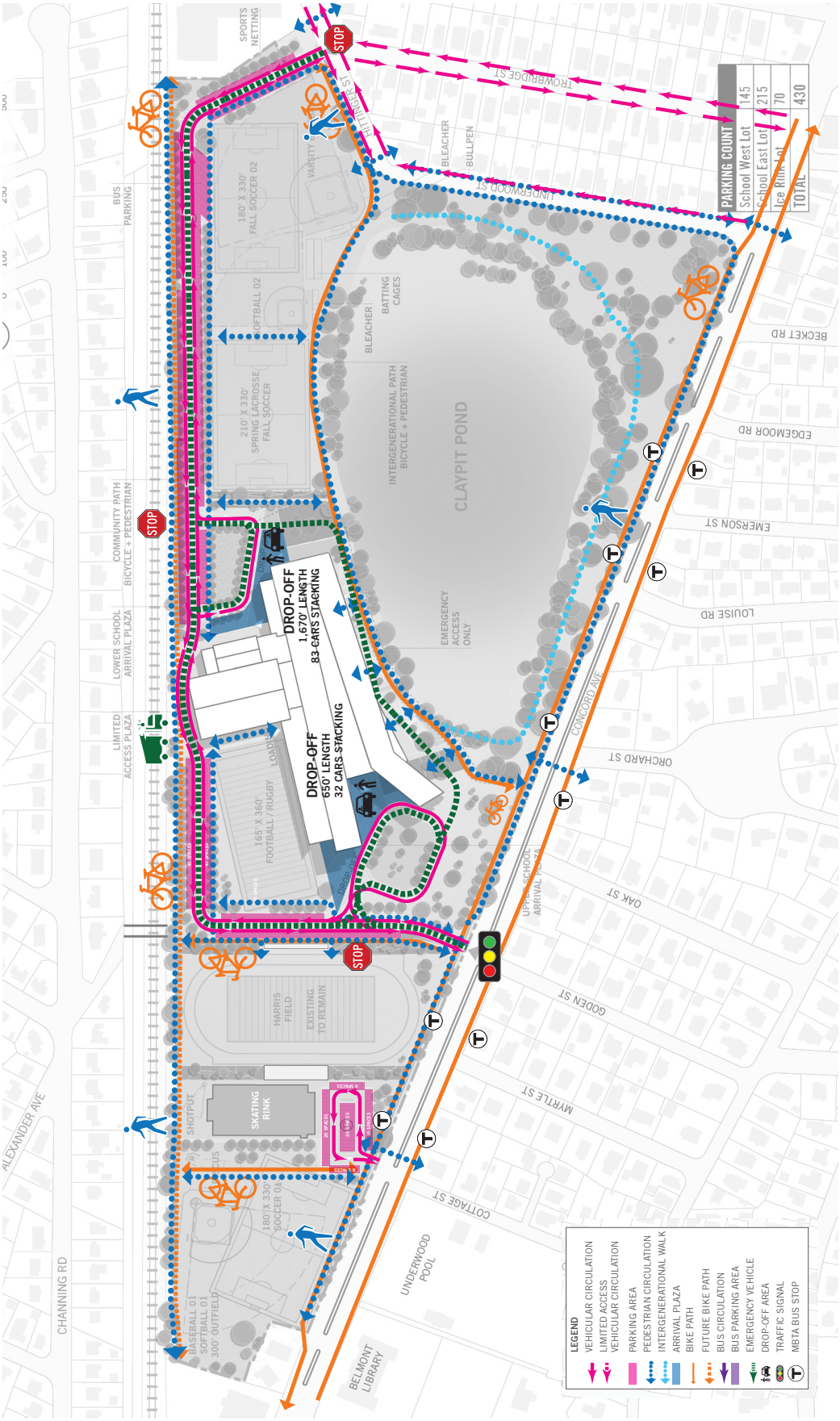
B. CONSTRUCTION IMPACT - OPTION 2.4 / Phasing Diagrams

PERKINS+WILL

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

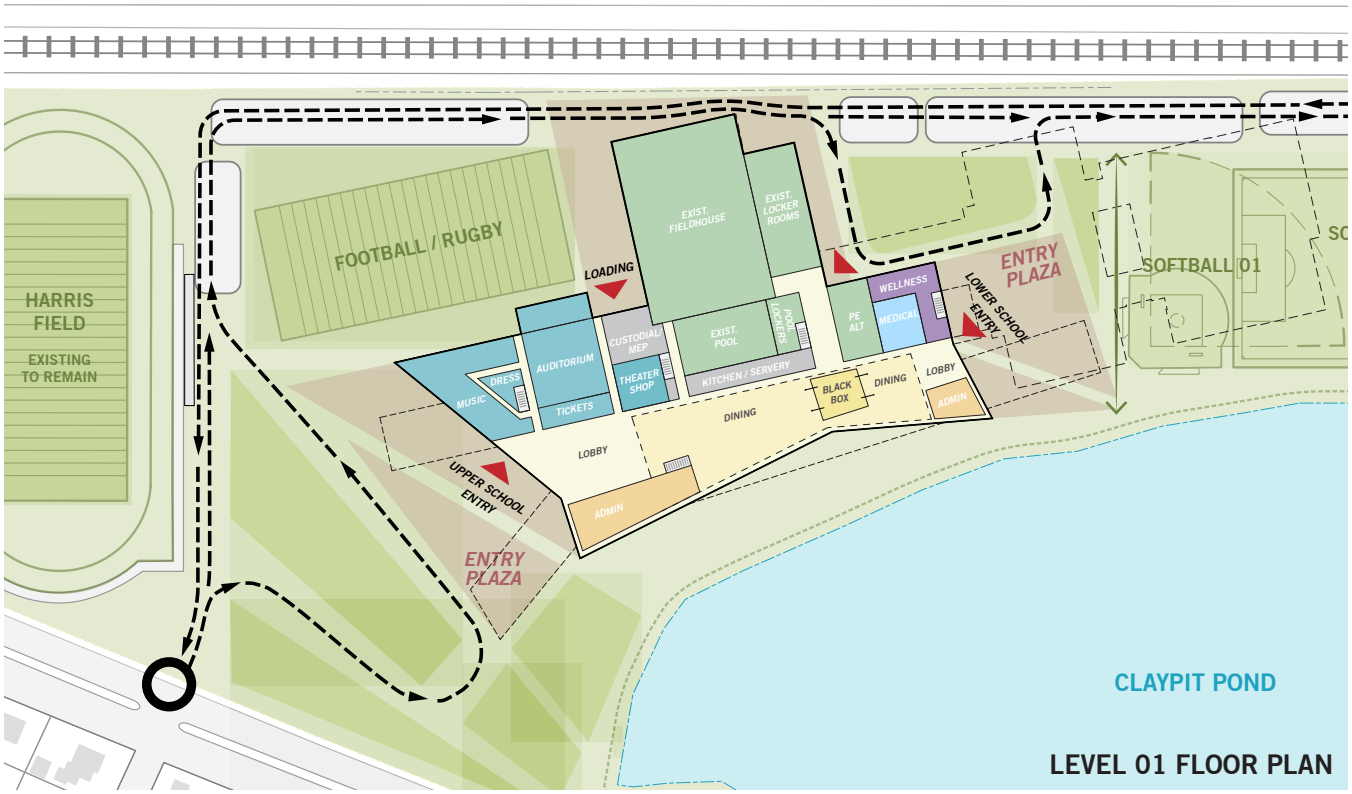
C. CONCEPT DRAWING - OPTION 2.4 / Site

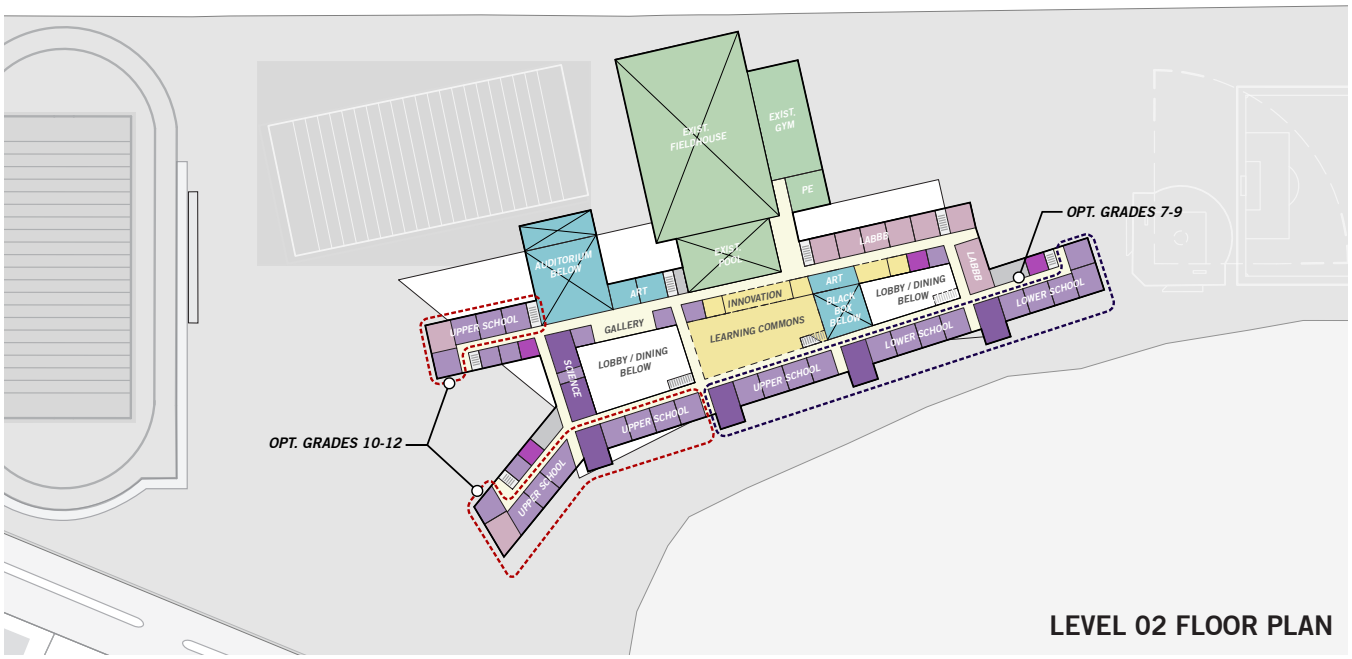
C. CONCEPT DRAWING - OPTION 2.4 / Traffic Site Plan



3.3.3 - FINAL EVALUATION OF ALTERNATIVES

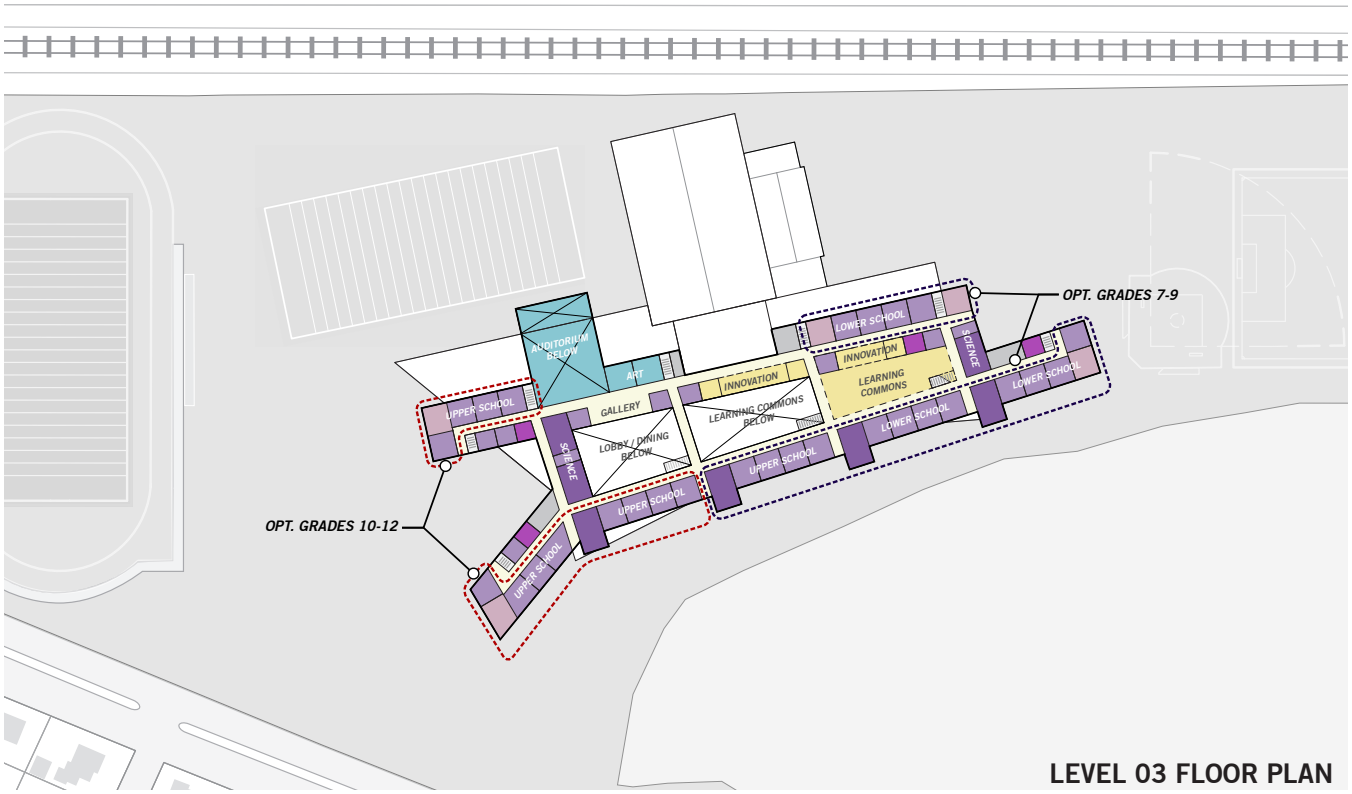
C. CONCEPT DRAWING - OPTION 2.4 / Architectural



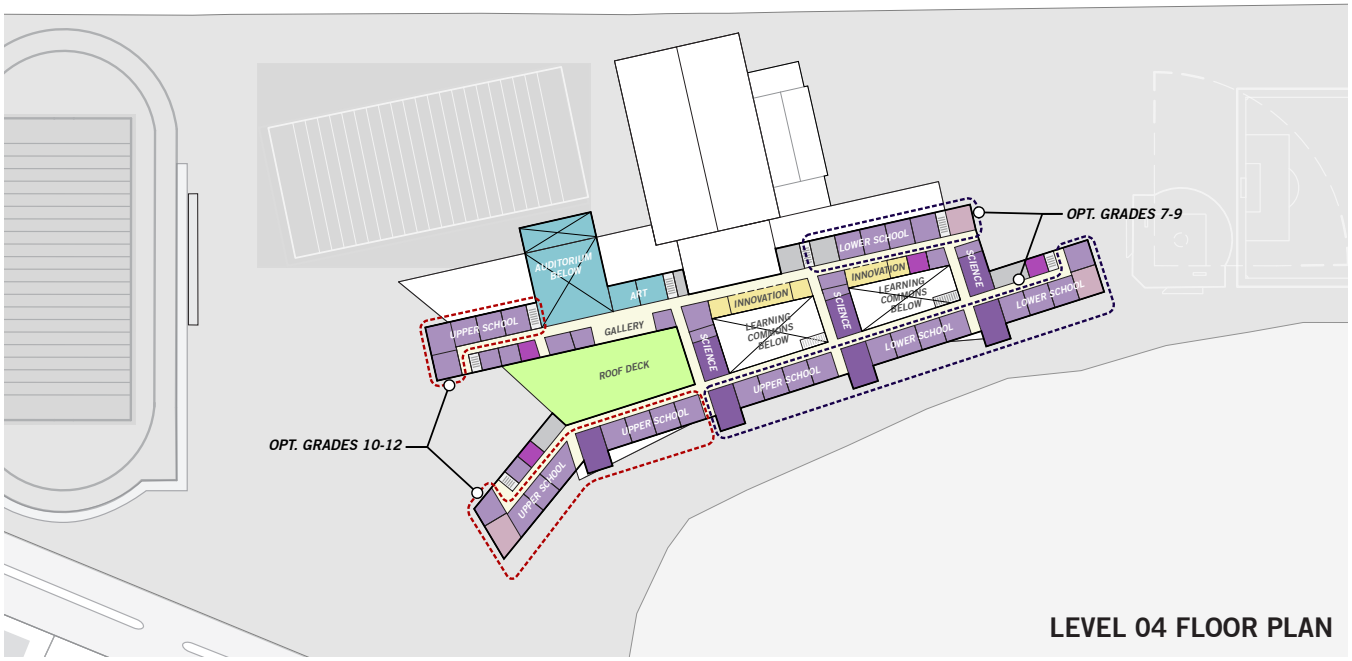


C. CONCEPT DRAWING - OPTION 2.4 / Architectural

Core Academic
Art & Music
Admin./ Guidance
Health & PE
Media Center
Auditorium & Drama
Dining/ Food Service
Medical
Circulation
Custodial/ Maint.
District Offices
Special Education



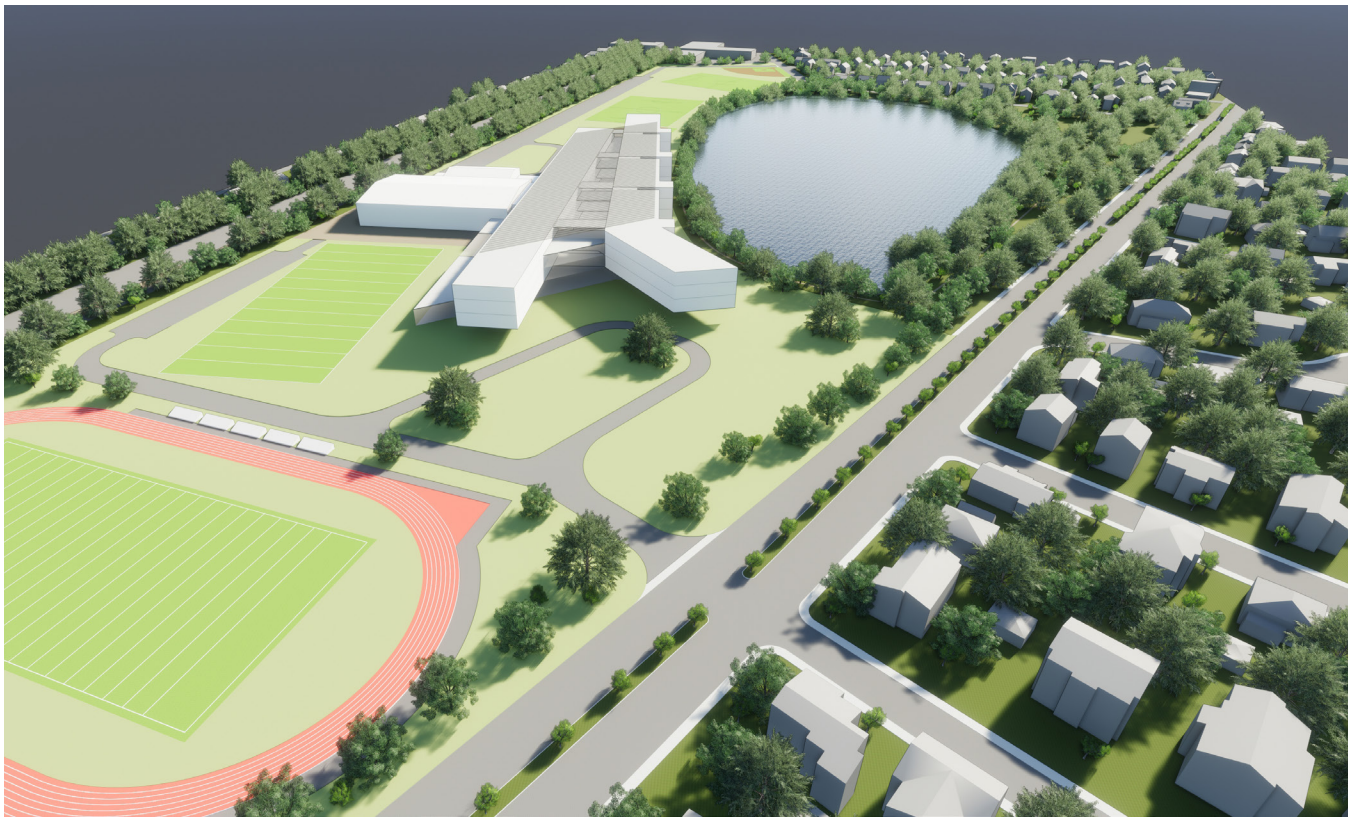
LEVEL 03 FLOOR PLAN



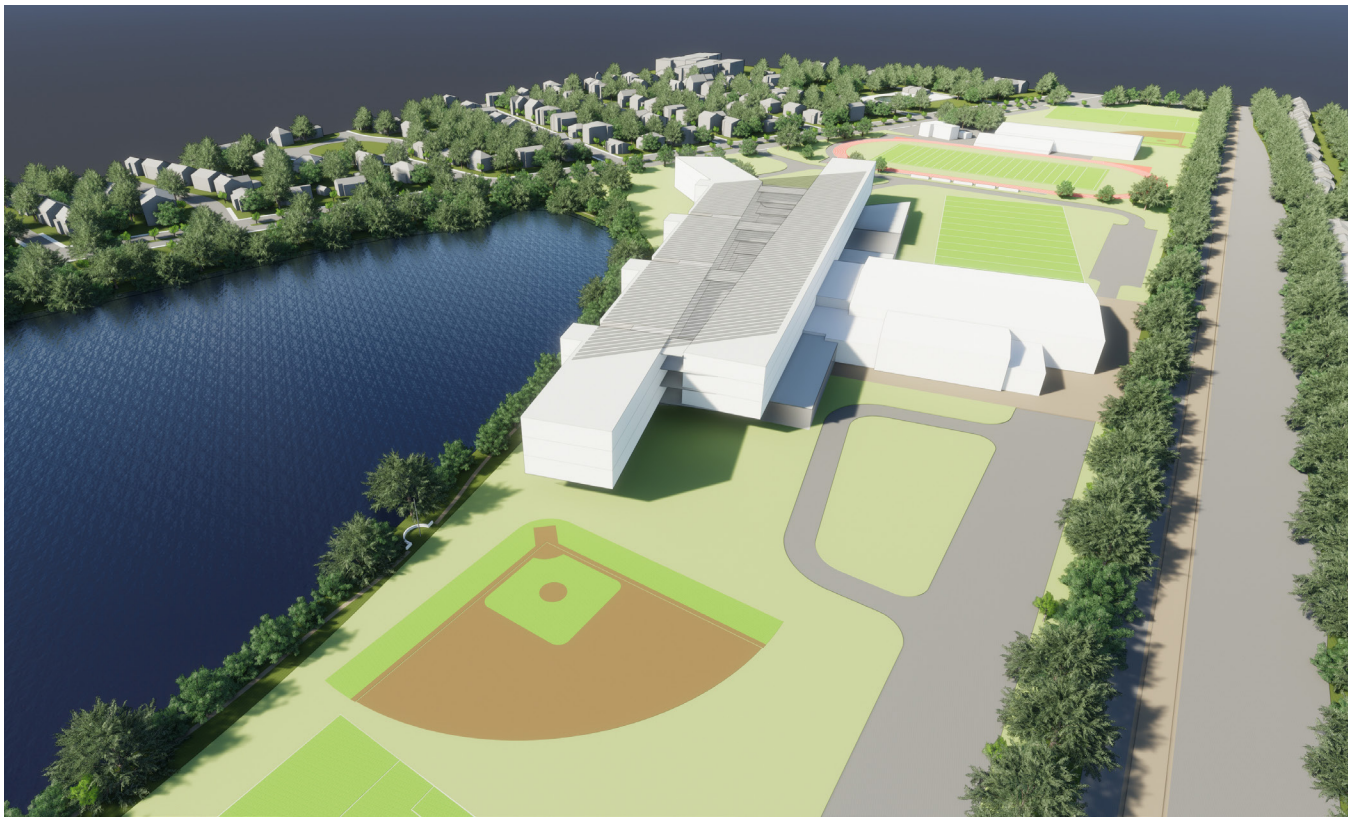
LEVEL 04 FLOOR PLAN

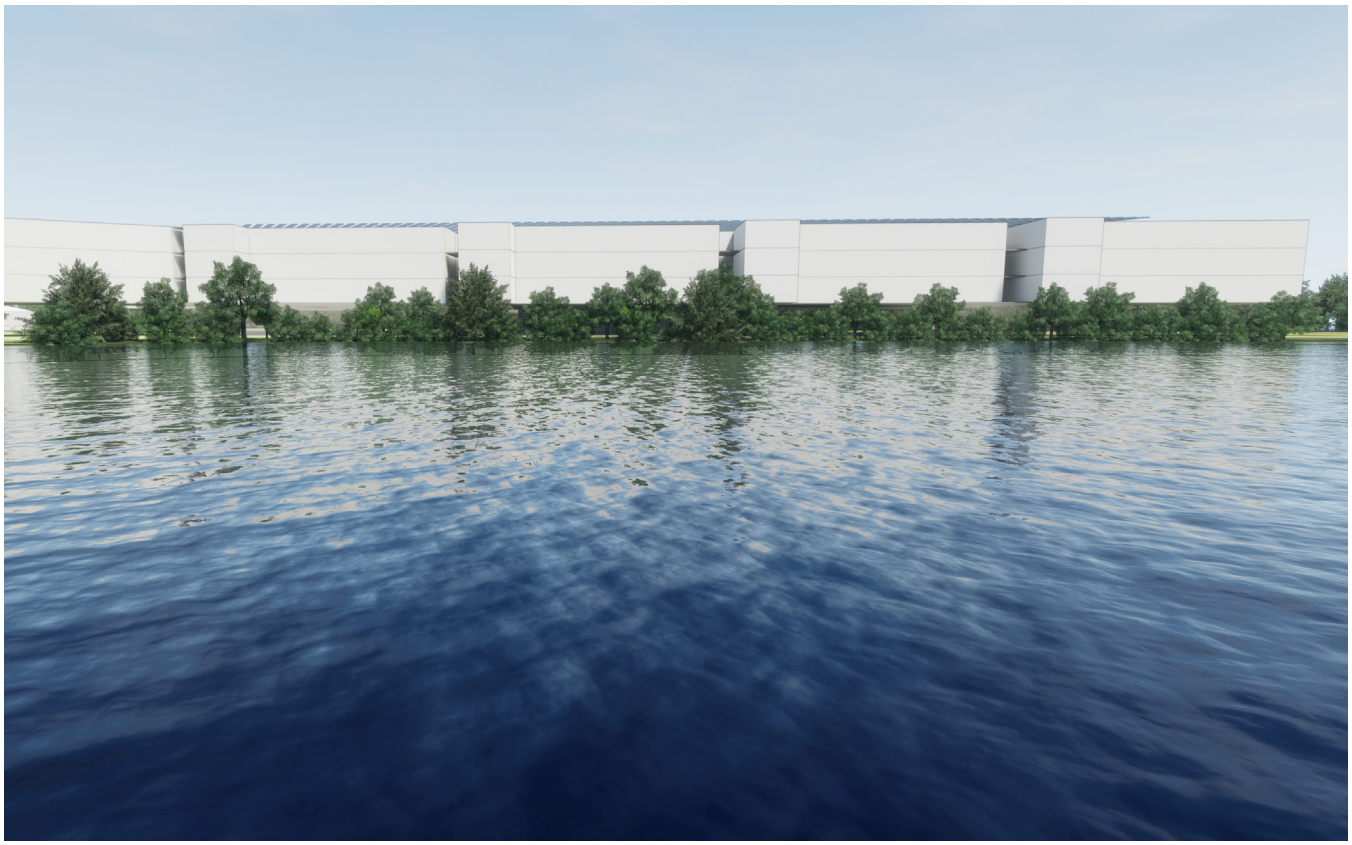
3.3.3 - FINAL EVALUATION OF ALTERNATIVES

C. CONCEPT DRAWING - OPTION 2.4



C. CONCEPT DRAWING - OPTION 2.4





BELMONT HIGH SCHOOL
Structural Narrative – Option 2.4
Minor Renovation and Major Additions to the Existing School

January 22, 2018

PROPOSED SCHEME

The proposed scheme calls for phased renovations, demolition of portions of the existing school and construction of new additions. In the first phase, a substantial new addition will be constructed at the west side of the existing school building. The addition will house the entire upper school, including a new theatre, commons space and a cafeteria. The next phase will include demolition of the eastern portion of the existing school and construction of a new addition that would house the lower school grade spaces, including a new small gymnasium. The existing field house, pool and associated spaces will be renovated in the last phase.

PRIMARY STRUCTURAL CODE ISSUES RELATED TO THE EXISTING STRUCTURE

If any repairs, renovations, additions or change of occupancy or use are made to the existing structure, a check for compliance with 780 CMR, Chapter 34 "Existing Structures" (Massachusetts Amendments to The International Existing Building Code 2015) of the Massachusetts Amendments to the International Building Code 2015 (IBC 2015) and reference code "International Existing Building Code 2015" (IEBC 2015) is required. The intent of the IEBC and the related Massachusetts Amendments to IEBC is to provide alternative approaches to alterations, repairs, additions and/or a change of occupancy or use without requiring full compliance with the code requirements for new construction.

The IEBC provides three compliance methods for the repair, alteration, change of use or additions to an existing structure. Compliance is required with only one of the three compliance alternatives. Once the compliance alternative is selected, the project will have to comply with all requirements of that particular method. The requirements from the three compliance alternatives cannot be applied in combination with each other.

The three compliance methods are as follows:

1. Prescription Compliance Method.
2. Work Area Compliance Method.
3. Performance Compliance Method.

Comment
The approach is to evaluate the compliance requirements for each of the three methods and select the method that would yield the most cost effective solution for the structural scope of the project. The selection of the compliance method may have to be re-evaluated after the impact of the selected method is understood and after analyzing the compliance requirements of the other disciplines, Architectural, Mechanical, Fire Protection, Electrical and Plumbing.
Since portions of the existing building are considered un-reinforced masonry bearing wall structures, the analysis and reinforcement of the existing structure would be governed by the requirements of Appendix A1 "Seismic Strengthening Provisions for Un-reinforced Masonry Bearing Wall Buildings" in the IEBC.

D. STRUCTURAL SYSTEMS - OPTION 2.4

1. PRESCRIPTIVE COMPLIANCE METHOD

In this method, compliance with Chapter 3 of the IEBC is required. As part of the scope of this report, the extent of the compliance requirements identified are limited to the structural requirements of this chapter.

Additions
Based on the project scope, the following structural issues have to be addressed:

- All additions should comply with the code requirements for new construction in the IBC.
- For additions that are not structurally independent of the existing structure, the existing structure and its addition, acting as a single structure, shall meet the requirements of the code for new construction for resisting lateral loads, except for the existing lateral load carrying structural elements whose demand-capacity ratio is not increased by more than 10 percent, these elements can remain unaltered.
- Any existing gravity, load-carrying structural element for which an addition or its related alterations causes an increase in the design gravity load of more than 5 percent shall be strengthened, supplemented or replaced.

Alterations

- Any existing gravity, load-carrying structural element for which an addition or its related alterations causes an increase in the design gravity load of more than 5 percent shall be strengthened, supplemented or replaced.
- For alterations that would increase the design lateral loads or cause a structural irregularity or decrease the capacity of any lateral load carrying structural element, the structure of the altered building shall meet the requirements of the code for new construction, except for the existing lateral load carrying structural elements whose demand-capacity ratio is not increased by more than 10 percent, these elements can remain unaltered.

2. WORK AREA COMPLIANCE METHOD

In this method, compliance with Chapter 5 through 13 of the IEBC is required. As part of the scope of this report, the extent of the compliance requirements identified are limited to the structural requirements of these chapters.
In this method, the extent of alterations has to be classified into LEVELS OF WORK based on the scope and extent of the alterations to the existing structure. The LEVEL OF WORK can be classified into LEVEL 1, LEVEL 2 or LEVEL 3 Alterations. In addition, there are requirements that have to be satisfied for additions to the existing structure.
The extent of the renovations (includes Architectural, FP and MEP renovations) for this project will exceed 50 percent of the aggregate area of the building, thus the LEVEL OF WORK for this project would be classified as LEVEL 3 Alterations. This would require compliance with provision of Chapter 7, 8 and 9 of the IEBC. The scope of the project includes new additions to the existing structure; this would trigger compliance with provisions in Chapter 11 of the IEBC.

Level 3 Alterations

- Any existing gravity, load-carrying structural element for which an alteration causes an increase in the design gravity load of more than 5 percent shall be strengthened, supplemented or replaced.
- For alterations where more than 30 percent of the total floor area and roof areas of the building or structure have been or proposed to be involved in structural alterations within a 12 month period, the evaluation and analysis shall demonstrate that the altered building complies with the full design wind loads as per the code requirements for new construction and with reduced IBC level seismic forces.
- For alterations where not more than 30 percent of the total floor and roof areas of the building are involved in structural alterations within a 12 month period, the evaluation and analysis shall demonstrate that the altered building or structure complies with the loads at the time of the original construction or the most recent

substantial alteration (more than 30 percent of total floor and roof area). If these alterations increase the seismic demand-capacity ratio on any structural element by more than 10 percent, that particular structural element shall comply with reduced IBC level seismic forces.

- For alterations that involve structural alterations to more than 30 percent of the total floor and roof area of the building within a 12 month period, the evaluation and analysis shall demonstrate that the altered building structure complies with IBC for wind loading and with reduced IBC level seismic forces.
- For alterations where more than 25 percent of the roof is replaced for buildings assigned to seismic design category B, C, D, E or F, all un-reinforced masonry walls shall be anchored to the roof structure and un-reinforced masonry parapets shall be braced to the roof structure.

Additions

- All additions shall comply with the requirements for the code for new construction in the IBC.
- Any existing gravity, load-carrying structural element for which an addition or its related alterations cause an increase in design gravity load of more than 5 percent shall be strengthened, supplemented or replaced.
- For additions that are not structurally independent of the existing structure, the existing structure and its addition, acting as a single structure, shall meet the requirements of the code for new construction in the IBC for resisting wind loads and IBC Level Seismic Forces (may be lower than loads from the Code for New Construction in the IBC), except for small additions that would not increase the lateral force story shear in any story by more than 10 percent cumulative. In this case, the existing lateral load resisting system can remain unaltered.

3. PERFORMANCE COMPLIANCE METHOD

Following the requirements of this method for the alterations and additions may be onerous on the project because this method requires that the altered existing structure and the additions meet the requirements for the code for new construction in the IBC.

PARTICULAR REQUIREMENTS OF COMPLIANCE METHODS

For our project, in order to meet compliance with one of the two compliance methods “Prescriptive Compliance Method” or the “Work Area Compliance Method”, we have to address the following:

1. PRESCRIPTIVE COMPLIANCE METHOD

Additions

The proposed additions will be designed structurally independent of the existing structure, thus, would not impart any additional lateral loads on the existing structure.

If the proposed alterations are such that the alterations increase the design lateral loads on the existing building or cause any structural irregularity of decrease the lateral load carrying capacity of the building, the structure of the altered building shall meet the requirements of the Code for New Construction in the IBC.

If the proposed additions increase the design gravity load on portions of the existing roof members, these members would have to be reinforced and this incidental structural alteration of the existing structure would have to be accounted for in the scope of the alterations to the existing school and would trigger requirements for alterations.

Alterations

Alterations that would increase the design gravity loads by more than 5 percent on any structural members would have to be reinforced.

If the proposed alterations of the structure increase the effective seismic weight on the existing structure due to the greater snow loads from the drifted snow against any proposed addition, or, by addition of equipment on the roof, the increase of the effective seismic weight from the drifted snow and the equipment would require that the existing lateral load resisting system comply with the requirements of the Code for New Construction in the IBC and it would increase the demand-capacity ratio on certain structural elements of the existing lateral load resisting system.

2. WORK AREA COMPLIANCE METHOD

Level 3 Alterations
If the proposed structural alterations of the existing structure are less than 30 percent of the total floor and roof areas of the existing structure, we have to demonstrate that the altered structure complies with the loads applicable at the time of the original construction and that the seismic demand-capacity ratio is not increased by more than 10 percent on any existing structural element. Those structural elements whose seismic demand-capacity ratio is increased by more than 10 percent shall comply with reduced IBC level seismic forces. The percentage increase in seismic demand-capacity ratio on any particular structural element from the added snowdrift load against the proposed addition would be fairly low, thus, this would not have any major impact on the existing lateral load resisting system, though we would have to verify that the increase in seismic demand-capacity ratio on any of those particular structural elements is not greater than 10 percent.

If the proposed structural alterations of the existing structure exceed 30 percent of the total floor and roof areas of the existing structure, we have to demonstrate that the altered structure complies with the IBC for wind loading and with reduced IBC level seismic forces.

Existing anchorage of all unreinforced masonry walls have to be evaluated. If the existing anchorage of the walls is deficient, the tops of the masonry walls will require new connections to the structure.

Additions
The proposed additions will be designed structurally independent of the existing structure; thus, it would not impart any additional lateral loads on the existing structure.

Comment
The compliance requirements of the two methods, in most respects, are very similar. The Work Area Compliance Method would trigger anchorage of un-reinforced masonry walls, if re-roofing of the existing structure is included as part of the scope for this project. The Prescriptive Compliance Method would require that the existing lateral load resisting system meet the requirements of the code for new construction of the IBC, even for small increases of design lateral loads. We are required to comply with requirements of Appendix A1 of IEBC for either method, which requires anchorage of all existing masonry walls. Based on this, we would recommend the Work Area Compliance Method for the project.

Summary of Renovations to the existing structure
Based on the scope of the proposed scheme for renovations of the existing school, we have determined that the existing structure would essentially have to comply with the Code for New Construction which would require the addition of new lateral load resisting elements such as structural steel braced beams on masonry shear walls throughout the floor plates at every level. All of the un-reinforced masonry walls are required to be anchored to the floor and roof structure and all of the roof diaphragms have to be reinforced, to resist uplift loads per the Code for New Construction. The addition of braces will require modifications to the existing column foundations at the brace locations and will require the addition of new piles. At the locations of existing slabs-on-grade, new tie beams will be required to connect the existing column foundations.

Belmont High School *Structural Narrative*
Belmont, Massachusetts Option 2.4 – Minor Renovation and Major Additions

Proposed Scheme for the Proposed Additions

SUBSTRUCTURE

FOUNDATIONS

Based on the construction of the existing school and the recommendations of the Geotechnical Engineer, the entire addition will be supported on pile foundations. The columns of the proposed structure would bear on 4 ft. – 0 in. deep reinforced concrete pile caps on structural steel piles. The exterior walls will be supported on 5 ft. – 0 in. deep grade beams spanning between pile caps with intermediate piles at 10 ft. – 0 in. on center. Based on an assumed pile capacity of 50 tons, a typical interior column in the four story classroom wings would be supported on 8 ft. – 0 in. x 8 ft. – 0 in. x 4 ft. 0 in. deep pile caps on a four pile group and a typical exterior column would be supported on 8 ft. – 0 in. x 8 ft. – 0 in. x 4 ft. 0 in. deep pile caps on a three pile group. The columns supporting the long span structure of the single story gymnasium, cafeteria, music spaces and other ancillary spaces would be supported on 8 ft. – 0 in. x 8 ft. – 0 in. x 4 ft. – 0 in. deep pile caps on three pile groups. In addition, the ground floor slab would be supported on single piles with a 2 ft. – 0 in. x 2 ft. – 0 in. x 2 ft. – 0 in. deep pile caps spaced out approximately 15 ft. – 0 in. (including interior and exterior pile caps supporting the columns.) All of the interior and exterior pile caps will be tied to the supported concrete slab.

SLAB ON GRADE

Based on the construction of the existing school and the recommendations of the Geotechnical Engineer, the lowest level of the proposed addition would be a 12 in. thick reinforced concrete slab reinforced with 6 psf reinforcing over a vapor barrier on 2 in. thick rigid insulation on compacted granular structural fill supported on piles.

SUPERSTRUCTURE

FLOOR CONSTRUCTION

Typical Floor Construction
A 5 ¼ in. light weight concrete composite metal deck slab reinforced with welded wire fabric on wide flange steel beams spanning between steel girders and columns. The weight of the structural steel is estimated to be 15 psf for the typical framing.

ROOF CONSTRUCTION

Typical Roof Construction
The roof construction would be galvanized, corrugated 1 ½ in. deep, Type 'B' metal roof deck spanning between wide flanged steel beams and girders. At locations of roof supported mechanical equipment, a concrete slab will be provided similar to the typical supported floor slab. The weight of the structural steel is estimated to be 13 psf.

Low Roof Structure above the Kitchen, Mechanical Room and the Utility Areas
The roof would be a continuation of the adjacent second floor and would be similar to the typical floor construction of 5 ¼ in. light weight concrete composite metal deck slab reinforced with welded wire fabric on wide flange steel beams spanning between steel girders and columns. This roof will be supporting the mechanical units. The units would be screened by a screen comprised of structural steel posts and beams. The weight of the structural steel is estimated to be 15 psf.

Alt. PE and Media Center Roof Framing
The roof construction would be acoustic, galvanized corrugated 3 in. deep, Type 'NA' metal roof deck spanning between long span metal joists and hollow structural steel columns. The weight of the structural steel is estimated to be 13 psf.

D. STRUCTURAL SYSTEMS - OPTION 2.4

VERTICAL FRAMING ELEMENTS

Columns

Columns would be hollow structural steel columns. Typical columns would be HSS 8 x 8 columns and the columns at the double story spaces at the Gymnasium and Lobby would be HSS 12 x 12.

Lateral Load-Resisting System

The proposed addition would be separated from the existing building by way of an expansion joint. The typical lateral load resisting system for the other parts of the school would be concentric steel braced frames comprised of hollow structural steel sections.

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

E. SITE UTILITIES - OPTION 2.4

SITE UTILITIES

Storm Drainage

Stormwater from the site will continue to be directed to Clay Pit Pond. Outside of the existing stormwater outfalls into Clay Pit Pond it is expected that the entire stormwater system will have to be reconstructed so that the new stormwater system can effectively mitigate stormwater quality, rate and volumes from the project site. Runoff generated by the new parking and driveway areas would be collected in a catch-basin to manhole closed drainage system. Water quality from these areas would be addressed by directing those flows through Stormceptor water quality units (or similar). Volume and rates of stormwater from the site would then be addressed by directing these flows to subsurface infiltration systems located beneath the parking areas. The infiltration systems would consist of galleys of 36-inch perforated pipe in crushed stone bedding. Overflows from these infiltration systems would then be directed through the new closed drainage system to the existing outfalls to Clay Pit Pond.

Roof drainage from the building is not required to be treated for water quality, therefore it can be tied directly into the new closed drainage system prior to discharge from the existing outfalls. A portion of the roof drainage could be daylighted to a raingarden or stormwater demonstration area that is incorporated into the landscape design. This landscaped area would consist of an area with variable topography to direct the stormwater through it, plantings to provide treatment and nutrient uptake, walkways or boardwalks that allow students to observe the processes and possibly even hardscape stormwater features such as runnels or small falls to provide aeration.

The new and reconstructed athletic fields would have sub-drainage located below the topsoil layer, as is typical of turf field construction. The sub-drains can be connected directly into the new closed drainage system.

Sewer

Building placement in this scheme appears to conflict with a portion of the existing sewer main which bisects the site, running west to east approximately under the sidewalk, adjacent to the existing access drive in front of the school. Approximately 500 linear feet of 24-inch sewer main would need to be relocated to accommodate the new building location. Portions of the existing 24-inch sewer not in conflict with the new building would be maintained. Sanitary sewer service connections from the new school would be connected to the new/maintained 24-inch main. Lab waste flows would be directed through a pH neutralization system prior to connection to the sanitary sewer system. Flows from the cafeteria would be directed through a new, 10,000-gallon, external grease trap.

Water

It appears that portions of the new construction would conflict with the existing water main that is routed around the rear of the existing building. A new 8-inch water main, approximately 2,500 feet long, would be installed in the first phase of the construction, along the rear property line, out of the way of any future phases. New 4-inch domestic water and 6-inch fire services would be provided to the building from the new 8-inch main. Six new fire hydrants, located along the main, would also be provided as directed by the Belmont Fire Department

Natural Gas

The existing gas service conflicts with the proposed construction. A new gas service, located to the west of the proposed building would be provided from the existing gas main in Concord Avenue to the mechanical area located at the rear of the proposed building.

Electrical

A new ductbanck consisting of four 4-inch, concrete encased conduits would be installed from the existing substation located just east of the site on Hittinger Street to the new electric room located to the rear of the proposed building.

PRELIMINARY PERMITTING CONSIDERATIONS

Wetlands Protection Act (310 CMR 10.00)

A Notice of Intent would need to be filed with the Town of Belmont Conservation Commission for any work within 100-feet of Clay Pit Pond. In addition, a Stormwater Pollution Prevention Plan (SWPPP) would need to be prepared and an application filed with the Environmental Protection Agency under the National Pollutions Discharge Elimination System (NPDES) program for the construction related activities. Erosion control measures will need to be installed and maintained in good working order around the perimeter of the site. Due to the phase nature of the construction, the perimeter controls will have to be re-installed several times over the duration of the project.

E. SITE UTILITIES - OPTION 2.4

Flood Plain

Based on the Flood Insurance Rate Map (FIRM), Community Panel Number 25017C0418E dated June 4, 2010, the portions of the existing High School site are located within Zone X (Areas determined to be outside the 0.2% annual chance floodplain). There is no regulatory requirement for working within a Zone X. The Zone AE, which is associated with the 100-year flood area, is located in close proximity to the banks of Clay Pit Pond. None of the proposed building or any critical infrastructure is being proposed within the Zone AE.

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

F. BUILDING SYSTEMS / PFP - OPTION 2.4

FIRE PROTECTION

A. General

1) A minor renovation and major addition to the building will require a new sprinkler system to be installed.

B. To comply with current codes, this existing building and addition will require a complete sprinkler system installation per the Massachusetts State Building Code, Chapter 34. The Fire Protection system would be designed to meet the requirements of NFPA 13 "Installation of Sprinkler Systems" and Chapter 9 of the Massachusetts State Building Code, 780 CMR, "Fire Protection Systems".

C. A new dedicated 8" sprinkler service, connected to the town water system in the street, should be brought into the building. The exact entrance location will need to be coordinated with the Architect. As the sprinkler service enters the building a Massachusetts approved double check valve backflow preventer assembly, complete with OS&Y valves on the inlet and outlet, will be required.

D. The building will be protected by three types of sprinkler systems and each will protect the following areas:

- Wet sprinkler system – base building system
- Dry sprinkler system – to protect areas subject to freezing; i.e. loading docks and outdoor walkways covered by building overhangs, etc.
- Pre-action sprinkler system – to protect the MDF room

E. The alarm check valves for the wet and dry sprinkler systems will be installed on separate risers after the double check valve assembly in the water service entrance room. The alarm check valves will be complete with standard trim packages including pressure gauges, retard chamber, 2" main drain, water flow indicator and supervisory switches. The dry alarm valve will be supplied with an air compressor and associated appurtenances.

F. Fire protection piping main feeds to the fire protection systems from the alarm check valves will extend out to the building through the first-floor ceiling space. The piping will then extend to all areas of the building to provide complete sprinkler cover age throughout. Potential sprinkler zoning will be coordinated with any new fire wall layouts.

G. The fire protection design will include a combination standpipe system located in all egress stairways. These standpipes will feed the sprinkler system as well as provide a fire department hose connection at each level of the building.

H. The sprinkler system standpipes will feed the sprinkler system at each floor level. Each floor will be a separate zone. The floor control valve assembly at the riser that feeds each floor will contain a flow switch and tamper switch. An inspector's test connection will be installed on the floor control valve station. If the auditorium stage is greater than 1,000 square feet, fire department valves will be required on each side of the stage.

I. Sprinkler heads installed in gypsum or suspended ceilings will be glass bulb, quick response, chrome plated semi-recessed type. In areas without ceilings, brass upright sprinklers will be installed. Where upright sprinklers are subject to potential damage, such as in storage rooms, protective cages will be installed. In areas where it is not possible to run piping above the ceiling the use of sidewall sprinkler heads would be recommended.

J. The MDF room will be protected by a pre-action sprinkler system. A pre-action alarm valve with all required appurtenances will need to be located next to or near the MDF. Piping from this valve will extend into the room and connect to sprinkler heads. The piping system will be filled with compressed air. Once a sprinkler head activates, the air will discharge and open the pre-action alarm valve to allow water into the system and through the open sprinkler head.

K. Sprinkler piping for the system will be as follows:

- Piping 2" and smaller shall be schedule 40 black steel with cast iron fittings with threaded joints.
- Piping 2 ½" and larger shall be Schedule 10 black steel with malleable iron fittings with rolled grooved joints.
- Dry sprinkler systems will be supplied with Schedule 10 galvanized piping throughout.

F. BUILDING SYSTEMS / PFP - OPTION 2.4

L. All tamper and flow switches installed on the sprinkler system will be connected to the buildings fire alarm system. Each tamper and flow switch will be a dedicated point on the fire alarm system.

M. The exterior fire department connection for the sprinkler system will be a flush type mounted on the exterior of the building within 100' of a fire hydrant. The exact type of connection (storz or siamese) will be coordinated with the Belmont Fire Department. Final location and number of fire department connections will also be coordinated with the Belmont Fire Department.

N. The hydraulic requirements for the building will be as follows:

- Light Hazard - All offices, corridors and the auditorium hydraulically calculated to deliver 0.1 gpm per square foot over the most remote 1,500 square feet.
- Ordinary Hazard - All storage rooms and mechanical rooms hydraulically calculated to deliver 0.15 gpm per square foot over the most remote 1,500 square feet.
- Ordinary Hazard Group II - The stage area hydraulically calculated to deliver 0.2 gpm per square foot over the most remote 1,500 square feet.

PLUMBING

A. General

1) A minor renovation and major addition to the building would require that all existing systems be modified to comply with current codes. The following recommendations to the plumbing systems should also be considered.

2) All existing plumbing systems, or portions thereof, that were capable of remaining and being maintained should also be removed or modified to meet the requirements of any planned renovations.

3) All existing plumbing systems to be removed as part of the select building demolition should be removed back to the nearest point of connection of their respective system.

4) New above ground sanitary waste piping should be installed throughout remaining portions of the existing building to replace the existing older system that is currently in place.

5) New above ground domestic hot and cold water piping should be installed throughout remaining portions of the existing building to replace the existing older systems that are currently in place.

6) Install new waste outlets as required to accept HVAC condensate and sprinkler waste discharge.

B. Plumbing Fixtures

1) All water closets, urinals and lavatories in the existing building are old and not current water conserving type. Removal of all fixtures is required as the existing fixtures have reached the end of their serviceable life. Water closets should be replaced with new dual flush valve fixtures. A full flush will discharge at a rate of 1.6 gallons per flush (gpf). When only flushing liquid waste and paper, the reduced flush rate will be 1.1 gpf. Urinals should be replaced with 0.25 gpf fixtures. Lavatories should be replaced and new low-flow type faucets (0.5 gpm or less) added with temperature limit stops which will deliver water with a maximum temperature of 110°F. ADA requirements for fixture spacing, mounting heights and protection of any exposed piping will also need to be met during a renovation to the bathrooms.

2) The state plumbing code dictates the number of plumbing fixtures required in a building. Minimum plumbing fixture requirements will be determined once the total occupancy numbers for the building have been established based on the final plan layout.

C. Domestic Cold-Water System

1) The existing 6" domestic water line that enters the building is the original service to the building. Although the existing 6" domestic water service appears to be adequate to meet the current building water requirements, consideration should be given to replacing it with a new 6" dedicated domestic water service since a new 8" water service would also be brought in at this time to feed the new sprinkler system. The installation of a water meter on the new service will be provided to allow the town to be able to monitor water usage as may be required.

D. Domestic Hot Water System

1) The existing steam water heaters serving the larger portions of the building are original to the building and have passed their useful life expectancy. Also with the use of these steam water heaters, the boilers are required to operate during the summer months to allow hot water to be created for the building. It is recommended to install new gas-fired storage type water heaters in the same locations as the existing. It is also recommended that redundant water heaters be included in the new system design. This would allow the system to continue to deliver hot water if one of the water heaters were to need service. The water heaters would be sized to provide hot water to all fixtures within the building.

2) The existing electric water heaters serving the various wings of the building are older and have passed their useful life expectancy. These should be removed. The new gas-fired water heaters should provide hot water to all fixtures that these units currently serve.

E. Sanitary Waste and Vent System

1) The sanitary system in the existing building appears to be in fair condition but replacement may be required because of a possible fixture count change and probable relocation of fixtures in the renovation plan. Any new piping would connect to the existing waste and vent piping at a convenient point to be determined by further investigation.

F. Storm Drainage

1) The existing building roof drainage appears to be in good condition and no replacement is required. The roof itself appears to be in good condition and leaks around the roof drains themselves have not been reported.

2) New roof drains and storm water piping system will need to be added to the new addition. Discharge of the storm water will be coordinated with the civil engineer.

3) Backwater valves should be installed on all interior storm system piping originating from roof drains on lower roof sections as per the state plumbing code.

G. Natural Gas System

1) Currently the existing gas service is more than adequate to meet the school's demand requirements and should remain. Gas piping should be reconfigured to serve all mechanical equipment that will require gas. Any new gas-fired kitchen equipment should also be connected to this service. It is recommended that gas sub-metering be used to separately meter gas consumption for the mechanical equipment and kitchen uses.

H. Insulation

1) The pipe insulation that currently exists should be tested to determine the extent of any hazardous materials. The insulation should be removed and replaced with new fiberglass insulation with an all service jacket. Domestic water and horizontal storm drainage piping that is not currently insulated should have new insulation installed. New domestic water piping and horizontal storm drainage piping installed throughout the new building addition will be insulated.

2) Insulation will also need to be provided on waste piping and water piping below handicapped lavatories and sinks.

I. Hose Bibbs and Wall Hydrants

1) During any renovation done to the building, the existing hose bibbs in the toilet rooms should be removed and new wall mounted hose bibbs with an integral vacuum breaker and removable tee handle installed. In the new addition, hose bibbs will be provided in all bathrooms and mechanical spaces. New wall hydrants will be provided on the exterior of the building and their locations coordinated with the architect.

J. Cross Connection Control

1) The existing hose bibbs and wall hydrants do not have backflow prevention devices. Backflow devices should be integral to all new hose bibbs and wall hydrants installed during the renovation.

2) All service sink faucets installed during a renovation and in the new addition, will also be supplied with integral vacuum breakers.

3) A new reduced pressure backflow preventer assembly should also be installed on the existing 6" domestic water service (or on a new service if this is the preferred option) to further protect the town's domestic water system.

K. Boys, Girls and Pool Locker Room/Shower Areas

F. BUILDING SYSTEMS / PFP - OPTION 2.4

1) All locker room/shower areas should be completely renovated. Floor drains within any new shower stalls should be arranged so that the water from one shower does not enter the adjacent shower area. New shower valves should be installed with code compliant shower heads. Master mixing valves should be installed at each shower location. Valves shall be provided with limiting stops set to a maximum water temperature delivery of 112°F.

2) All plumbing fixtures will be replaced as discussed in the "Plumbing Fixture" section of this report.

L. Kitchen

1) The new cafeteria kitchen will include the addition of new gas-fired equipment. This equipment can be connected to the new gas service located outside the building as noted above.

2) Any new gas equipment would be fed by gas piping connecting to a master shut-off valve that would be interconnected with the kitchen hood and exhaust system. Gas would only operate when the kitchen hood exhaust system is operating.

3) Additional floor sinks and/or floor drains would be added to any new equipment design to ensure proper drainage throughout the kitchen.

4) A new three-compartment sink with new grease trap should be included per state code requirements.

5) A new dishwasher with accompanying grease trap may also be provided per state code requirements.

6) A new exterior grease trap, located underground, outside of the kitchen portion of the building will also need to be considered as part of any new kitchen design. Venting of this exterior grease trap should enter back into the school building and exit to the atmosphere above the roof.

M. Science Wing

1) New science classrooms will include new sinks and faucets. Faucets should be low-flow type fixtures with a maximum delivery rate of 0.5 gpm.

2) All new science classroom sinks will connect to a new polypropylene acid resistant piping system that empties into a central acid neutralization tank and system. This system would balance the pH of the lab waste and then safely discharge it into the regular sanitary waste system before it connects back to the town's sanitary waste system.

3) New protected hot and cold-water systems should be created to serve the new science classrooms by installing reduced pressure backflow preventers on the hot and cold-water piping designated to serve this area.

4) Gas piping to each science classroom should first feed an emergency shut-off valve located in a valve box on the wall near the classroom exit door. Piping from this valve would then feed any gas turrets within that classroom only.

5) New emergency showers and eyewashes will be installed in each science classroom. A new tempered water system should be created to serve these fixtures. A new gas-fired water heater should be installed somewhere within the science wing and be dedicated to the new tempered water system. Water should be stored at 140°F and a master mixing valve should be mounted nearby and set to deliver tempered water to this wing at approximately 70°F-90°F per state plumbing code requirements. A tempered water return system will also be required to keep this system from becoming stagnant per state plumbing code requirements as well.

N. Pipe Materials

1) Below grade sanitary and storm drainage piping will be service weight bell and spigot cast iron with neoprene gasketed joints. Above grade sanitary and storm piping will be service weight hubless cast iron with Massachusetts approved stainless steel and neoprene no-hub connector assemblies.

2) All water supply and return piping shall be Type "L" copper.

3) All water supply and return piping insulation shall be in accordance with the Energy Code.

4) All gas piping will be threaded black steel piping up to 2 ½" size. Piping 3" and larger shall be welded.

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

F. BUILDING SYSTEMS / HVAC - OPTION 2.4

BELMONT HIGH SCHOOL

HEATING, VENTILATING, AND AIR CONDITIONING

MINOR RENOVATION / MAJOR ADDITION / C.2.4

A. General:

1. This description applies to the Minor Renovation / Major Addition option (C.2.4) where the existing fieldhouse and associated locker rooms and the swimming pool and associated locker rooms remain. The existing boiler and main electrical room also remains. New construction is built in two phases from west to east with the existing building largely remaining in operation initially and then being phased out after the initial phase is complete.

2. Heating, air conditioning and ventilation systems shall be high-efficiency systems that allow for the ability towards achieving a Net Zero Energy facility.

B. Ground Loop Geo-Exchange System:

1. A vertical borehole well field area consisting of (400) 6-inch diameter boreholes spaced 20 feet apart shall be provided. Each borehole shall be 375 to 450 feet deep. Actual depth to be determined based on thermal conductivity testing performed on a test well. The number of boreholes may be increased or decreased based on thermal testing results and/or determination of the final heating and cooling loads.

3. Provide a 1-1/4 inch supply and return pipe within each borehole with a U-bend at the bottom. Piping shall be high density polyethylene (HDPE) with DR9 wall thickness. Polyethylene pipe and fittings shall be heat fused by butt, socket, sidewall, or electrofusion in accordance with pipe manufacturer's procedures. Underground supply and return piping from boreholes shall collect to four buried circuit vaults constructed of HDPE or concrete. Supply and return circuit piping in each vault shall combine to 8 inch main header piping which shall be routed into the building.

4. Steel sleeve casings shall be provided for the upper section of each borehole down to bedrock. Each borehole shall be filled with a bentonite based thermally enhanced grout mixture.

C. Central Heating and Cooling System:

1. Central geothermal heating and cooling shall be provided by four high efficiency 300 ton (approx. nominal capacity) heat recovery chiller-heaters or (40) 30 ton modular chiller-heaters connected to the ground loop system.

2. The ground loop circulation system shall be filled with 25% propylene glycol solution and shall be served by three 1000 GPM pumps with variable frequency drives.

3. Chiller-heater condenser water shall be constant flow primary with zero pressure bypass connections to the ground loop distribution and the building heating distribution. There shall be three primary condenser water pumps at 1,000 GPM each.

4. Secondary condenser/heating pumps shall be variable flow with variable frequency drives. There shall be three secondary heating pumps at 1,000 GPM each.

5. Chilled water distribution from chiller evaporators to building distribution shall be variable primary flow with three 750 GPM pumps.

6. The building circulation loop shall consist of a four-pipe distribution. The main distribution to heating/cooling terminal units in the building shall be four-pipe. Rooftop air handling units, heat recovery air handling units, and central air handling units shall be two-pipe configuration.

7. The building loop piping system shall contain a 25% propylene glycol solution for freeze protection and corrosion protection.

8. The building terminal heating units will be designed to utilize low temperature heating supply water (130°F maximum). Heating terminal units such as fin tube radiation and heating coils may require larger surface areas due to the low water temperature. In areas with high heating loads, two-row fin-tube and heating coils may be required.

D. Exterior Classrooms - Induction Units with Displacement:

1. The system serving heating, cooling and ventilation for typical exterior classrooms shall utilize four-pipe floor mounted chilled beam induction units with displacement supply air. Four 5 ft. long units shall be provided for each typical classroom mounted along the exterior wall. Units shall be served by two 7-inch diameter primary ventilation supply air ducts.

2. The primary supply air serving each classroom shall be provided with a modulating supply air volume control terminal to control supply air when the room is occupied.

3. Systems will be interfaced to the local space vacancy sensor to reduce ventilation air and reset the space cooling and heating set point temperatures when the room is unoccupied.

4. A carbon dioxide sampling sensing system will be provided in classrooms to provide monitoring and occupied control of ventilation air.

E. Interior Classrooms and Other Spaces – Ceiling Induction Units:

1. Interior classrooms and other interior occupied spaces will be served with ventilation supply air from a rooftop heat recovery ventilation unit connected to ceiling mounted chilled beam induction terminals. Induction terminals shall be provided with four-pipe supply and return water connections.

2. Individual classrooms shall be provided with a supply air volume control terminal to control ventilation air when the room is occupied. A carbon dioxide sampling sensing system shall be provided for classrooms to monitor and control ventilation air.

F. Classroom and Interior Ventilation Systems:

1. Outside ventilation air for classrooms and interior spaces will be provided by roof mounted dedicated outside air heat recovery units (HRU).

2. The HRU's will be variable air volume and will include supply and exhaust fans with variable frequency drives, total energy recovery wheels and secondary sensible reheat wheels to allow for a low level of dehumidification control. The units will be provided with two-pipe dual temperature water connections to a single combination pre-heat and cooling coil. Changeover between hot water and chilled water supply shall be provided with the use of changeover valves connected to the hot water and chilled water systems. Each unit shall include 100% recirculation dampers for morning warm-up mode and after-hours night setback heating.

3. All unit energy recovery wheels and coils shall be sized for low face velocity to increase unit and system efficiency.

4. Variable supply air will be based on demand from classrooms and interior spaces. Return/exhaust air shall be controlled by air flow measurement and tracking of the supply and exhaust air with limited volume control terminals in the exhaust air system.

5. Corridors will be provided with ventilation air from the HRU system. Air quantities in excess of basic ventilation requirements will be provided for building exhaust makeup air as required. Corridors will not be fully air conditioned with the exception of areas that have direct solar loads.

G. Existing Gymnasium:

1. The existing heating and ventilating units in the gym shall be replaced with new HVAC units in Phase 02. The units shall include a hydronic coil for heating and cooling using hot water and chilled water. Units shall also include a heat recovery section with an enthalpy wheel for outdoor air heat recovery meeting the requirements of the MA energy code due to the level of outdoor air required.

2. Two units shall be provided, which shall be located indoors or outdoors depending on structural and architectural requirements. Units be provided with a round ductwork distribution exposed within the space.

3. The units shall be provided with variable frequency drives for the supply and return fans to reduce the fan speed during times of low demand. Supply, return, and outside air flow measurement and control shall be provided.

4. Provide a new H&V unit with plate heat exchanger to serve the existing locker rooms.

H. Existing Swimming Pool:

1. The existing heating and ventilating unit serving the pool shall be replaced with a new H&V unit in Phase 02. The unit shall include a hydronic coil for heating using hot water. The unit shall also include an air-to-air flat plate heat exchanger for exhaust air sensible heat recovery.

2. The pool deck exhaust system shall remain, but the existing exterior mounted exhaust fan shall be relocated to the roof due to the Phase 02 construction. Exhaust duct shall be extended up through the building in a ne duct shaft.

3. Provide a new H&V unit with flat plate heat exchanger to serve the existing locker rooms.

I. Miscellaneous Areas:

1. All normally occupied areas will be air conditioned except for corridors, the kitchen, and culinary classrooms with kitchen hoods (if applicable). The kitchen and culinary areas are partially tempered by using transfer air from the commons for make-up air.

2. The Auditorium, Stage, Media Center, Cafeteria, and Administration areas, will be served by rooftop air conditioning units (RTU). Separate occupancy scheduling for each unit will provide operational flexibility.

3. Rooftop air conditioning units (RTU) will include supply fan, return fan, hot water heating coil, chilled water cooling coil, filters, and variable frequency drives. Units serving Administration, Media Center, Band/Chorus, and the Cafeteria will be variable air volume (VAV) with local variable air volume boxes for zone temperature control.

4. The Auditorium and Gymnasium units will be single zone with a variable frequency drive to modulate the supply air during periods of low demand and occupancy.

5. The Auditorium, Gymnasium, Cafeteria, and Media Center systems will be provided with space carbon dioxide (CO_2) sensors to provide modulation of outside air based on occupancy demand.

6. Areas such as the Cafeteria, Black Box, parts of the Media Center, main lobby and open group learning spaces may alternatively be provided with a radiant floor cooling and heating system. System shall include connections to the hot water and chilled water piping, circulation pumps, circuit headers, controls, and under-slab PEX piping distribution.

J. Building Management System (BMS):

1. Provide direct digital control (DDC) BMS with local and unitary controls and web interface for remote access, alarms, and monitoring of all HVAC equipment in the building including; chillers, pumps, heat recovery units, rooftop units, fans and terminal units shall be controlled and mapped to a central monitoring station. System shall be based on the Niagara Framework open protocol for interoperability between manufacturers.

2. BMS system shall be interfaced to the building electrical and gas sub-meters. Daily, weekly, and annual energy use shall be reported for each meter.

K. Carbon Dioxide Sensing System:

1. Provide an Aircuity, or equal, carbon dioxide air sampling and sensing system consisting of room sensors, cabling, tubing, room probes, air routers, and vacuum pumps.

2. Air tubing from room sensors shall be collected through air routers to sensing stations.

3. The system shall include an information management system and shall be integration with the building management system.

4. Building management system input shall provide control input for modulating supply air terminal units or automatic dampers.

L. Electrical and BTU Metering:

1. Electrical metering shall be provided for collection of historical and real-time performance data. Separate meter groups shall be provided for the upper school areas and lower school areas consisting of meters for the measurement of lighting and plug loads for each classroom group by wing, floor or classroom type.

2. Individual metering of lighting and plug loads shall be provided for the Kitchen, Media Center, Auditorium/Stage, Gymnasium, and Administration areas.

3. Electrical metering shall be provided for each air handling system, central system pumps (by each group type), and each chiller-heater.

4. Provide BTU metering of chilled water, hot water, ground loop circulation systems and domestic hot water system.

M. Phasing Considerations:

1. Construction of the new facility is in two phases (Phase 02 and Phase 04). Phase 02 of construction allows for the existing building to remain occupied, while a large part of the new construction is completed. Therefore, the existing boiler room must remain active during Phase 02 and the new chiller-heater plant must be constructed to support the new construction. Approximately 900 SF of new mechanical space will need to be constructed next to the boiler

room in the first phase to provide space for the new equipment. One of the steam boilers may also be phased out and demolished in this first phase.

2. Construction phasing will require that the geothermal borehole field be installed in two phases. The first phase may be constructed in the area of the new football field, parking and drive lanes to the west of the fieldhouse. The second phase may be constructed in the area of the Lacrosse 02 field, and parking and drive lanes to the east.

3. The existing gym and pool areas will be renovated in Phase 02, including replacement of the existing HVAC equipment.

4. Completion of the new central chiller-heater plant construction may begin in Phase 03 with the removal of the remainder of the existing boiler plant.

F. BUILDING SYSTEMS / Electrical - OPTION 2.4

Belmont High School

ELECTRICAL

2.4 Minor Renovation / Major Addition

A. Existing Electric Services:

1. Based on the proposed renovation/addition scope to maintain the Field House and Pool, existing services will be required to be maintained to deal with construction phasing and maintaining existing systems while renovations and new additions are completed.

2. The intent is that upon completion, there will be new services throughout the entire renovated facility and new additions.

3. The Main Electric Room housing the main electric switchboard is located adjacent the Boiler Room, these rooms are located at the northwest corner of the facility adjacent the Fieldhouse.

4. Scope will include maintaining and/or providing new feeders to existing panelboards and mechanical equipment to be kept operational during renovation and new construction.

5. Coordinate with Utility Company for the relocation of any utility poles and overhead pole lines associated with new construction and scheduled demolition of the existing school building.

6. All existing services shall be maintained for the complete operation of existing school building until the scheduled date of demolition of the existing building. Upon substantial completion, coordinate with the respective utility company and include all work required for the removal of all existing utility services that become abandoned including power, telephone, cable TV, and fire alarm services.

7. Include the removal of all existing roadway, parking, and walkway lighting structures. At the scheduled time of demolition of the existing buildings include disconnecting all services and making safe the existing structure for complete demolition.

8. Include maintaining the operation of existing site equipment such as irrigation pumps. Provide new services to all equipment affected by new construction.

B. New Main Electric Service:

1. A new primary service will be provided from utility company primary services via an underground ductbank and manhole system to a new utility company pad mounted transformer.

2. Secondary service from the new pad mounted transformer will be underground to a new main switchboard at 480/277V, 3-phase, 4-wire. Switchboard will be located in a new main electric room.

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

F. BUILDING SYSTEMS / Electrical - OPTION 2.4

C. New Normal Distribution System:

1. Main switchboard will be provided with surge protection (SPD) and ground fault protection on main and feeder devices.

2. Surge protection will be provided in all 120/208V panelboards.

D. New Emergency Distribution System:

1. Natural gas/diesel (fuel source to be determined) emergency generator will power emergency egress lighting and exit lighting in corridors, assembly areas, and stairwells. Miscellaneous systems to include the following:

   a. Kitchen walk-in coolers and freezers.

   b. Telephone system.

   c. Security system.

   d. District and school IT head-end equipment (located in the MDF Room).

   e. Cooling equipment for school and district IT equipment.

   f. Fire alarm system.

   g. Circulator pumps and controls.

2. Separate automatic transfer switches shall be provided for emergency and non-emergency loads.

3. In addition to the equipment and systems listed above, the following equipment and systems will be fed from the generator.

   a. Additional lighting in Gymnasium, Cafeteria, Kitchen, and associated toilets and corridors.

   b. HVAC ventilation equipment (no air-conditioning) associated with the Gymnasium, Cafeteria, Kitchen, and associated toilets and corridors.

   c. Receptacles in Gymnasium and Cafeteria.

4. Generator will be ground mounted at the exterior of the building in a self-contained sound attenuated enclosure with an integral base mounted fuel tank (if diesel). Generator will be mounted on an elevated concrete platform for survivability.

5. Emergency panels will be located in new two-hour rated electric closets.

6. Non-emergency (standby) loads will be located in separate closets via separate automatic transfer switch and panelboards.

7. Emergency feeders run outside two-hour electric rooms and shafts and not in or under floor slab will utilize MI Cables.

8. A portable generator connection will be provided to meet National Electric Code Article 700 requirements to have a portable generator available while servicing the building generator.

E. Sustainable Design Intent LEED 4.0:

1. Sustainable Design Intent compliance will include:

a. Advanced measurement and verification of air conditioning, fans, lighting, and receptacle power via electronic sub-meters equal to E-Mon, D-Mon Class 2000 3-phase kWh and demand meters. Measurement and verification metering will be monitored by the Building Management System (BMS).

b. Plug and process load reductions through the use of vacancy/occupancy sensor controls for local convenience outlets in classrooms, offices, library and resource rooms. Open areas such as Media Center, Auditorium and Kitchen will be equipped with relay panels controlled via the lighting control system, to reduce loads on a time schedule basis.

c. Advanced lighting controls include a low voltage lighting control system with time schedule control for common areas, vacancy/occupancy sensors, and photocells for daylight harvesting.

d. Empty conduit provisions will be provided for future green vehicles charger stations based on two percent of the available parking.

e. Empty conduits and space provisions will be provided for photovoltaic (PV) installations. Include conduits and space provisions for inverters at a minimum of three locations on Level 3 and/or Level 4 electric closets.

F. Lighting:

1. New luminaires will be provided throughout all renovated areas as well as new construction. Luminaires will be dimmable LED. All luminaires will be suitable for respective utility rebate incentives.

2. Exterior building mounted around the entire building including all canopies, all entry drives, parking areas, and all walkways will be full cutoff LED type. All exterior lighting will be controlled via the building low voltage lighting control system.

3. Athletic field lighting will be provided at the Softball and Baseball fields.

G. Lighting Controls:

1. A low voltage lighting control system will be provided for common areas such as corridors and other areas not controlled by occupancy sensors.

2. Manual low voltage override switches to override the time of day lighting control schedules shall be provided. Override switches will permit extension of lighting control program as well as ON-OFF override for exiting the facility.

3. Lighting program for time of day schedules shall permit all lighting, including exterior to be turned off during non-occupied hours, reducing sky glow and light trespass. Activation of either fire alarm or intrusion detection system shall override the lighting program.

4. Vacancy and occupancy sensors will control lighting in most spaces including classrooms, offices, and utility type spaces. In addition, all spaces will be provided with local low voltage dimmable switching.

5. Daylight harvesting will be employed in all perimeter classrooms, offices, and other spaces with substantial daylight utilizing daylight sensors in each space.

H. Auditorium:

1. A professional theatrical lighting system will be provided.

I. Convenience Power:

1. Safety type duplex receptacles will be provided throughout the building in quantities to suit space programming.

2. Plug load reduction will be achieved by vacancy/occupancy sensors in classrooms, offices, and staff spaces, and circuits routed via relay panels, controlled via lighting control system time schedule for open areas such as Commons/Café, Kitchen and culinary areas.

J. Fire Alarm:

1. Existing automatic, fully supervised, analog addressable, voice evacuation system will be maintained and utilized where applicable.

   a. Manual pull stations (with tamperproof covers if applicable), at points of egress, and other locations as required to meet code.

   b. Audible/visual units in corridors, classrooms, and throughout the building to meet code.

   c. Visual only units in conference rooms, meeting rooms and small toilets.

   d. Smoke detectors in corridors, stairwells, electric, and telecommunications rooms, elevator lobbies, and elevator machine rooms.

   e. Smoke duct detectors in HVAC units over 2,000 CFM, and within five feet of smoke dampers including connections to all smoke/fire dampers.

   f. Connections to all Fire Protection devices and Kitchen hood.

   g. Connections to audio/visual systems, sound systems, and dimmed lighting controls.

   h. Remote annunciator at main entrance and secondary entrances as directed by Belmont Fire Department.

   i. 24 VDC magnetic hold open devices at smoke doors.

   j. Master box and exterior beacon (quantity of beacons per Belmont Fire Department.

   k. Wiring will be fire alarm MC cable.

K. Technology per Technology Section.

F. BUILDING SYSTEMS / Electrical - OPTION 2.4

L. Integrated Intrusion, Access Control, CCTV, and Alarm System:

1. Intrusion alarm system will provide magnetic switches on perimeter doors, motion sensors in all perimeter rooms on first floor with susceptible access from grade. Motion sensors will be provided in first, second, and third floor corridors. System will have secure-access zoning. Zoning will be provided to suit all proposed off hours usage including community programs.

2. CCTV coverage will be provided at main and secondary entries as well as all other perimeter entries to be used by students and staff on a daily basis and for off hours community programs, including Gymnasium and Cafeteria entries.

3. Exterior CCTV coverage will be provided to cover the entire perimeter of the building.

4. Access control via card access system will be provided at all exterior doors.

5. CCTV system will be IP based with minimal 30 day recording capacity. System will be web based to allow viewing by Belmont Police Department.

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

F. BUILDING SYSTEMS / Information Technology - OPTION 2.4

Structured Cabling System:

The School Department is responsible for the fiber network for both the schools and the Town (including the light department and TV Studio). The fiber network handles general data as well as Phone (VoIP) and security for the school district and the Town. There are three centralization points for the fiber – the high school, Chenery Middle School, and the Town Library. Internet services and wireless controllers in the existing high school MDF provide connectivity at all the school facilities and the Town. These systems must remain operational during construction. Therefore, the MDF and the existing district fiber must be protected during construction.

A new MDF will be created. The MDF will be the central location of all head end equipment including but not limited to servers, storage, switch electronics, security equipment, video equipment, telephone system, public address system and security system. It will be a dedicated space with proper ventilation, environmental treatment and emergency power. The new MDF will be built-out and cutover during an early phase of construction. The district fiber will be re-routed or extended to the new MDF location. Existing Telco lines, which terminate in the Main Office area will need to be protected and re-routed or extended. Temporary cabling and services may be necessary to maintain functionality of existing systems during demo work.

New IDFs will be created. The IDF locations will serve as intermediate closets for local cabling and equipment. The IDFs will be dedicated spaces with proper ventilation, environmental treatment and emergency power. Each closet will connect to the MDF with backbone cabling. IDFs will be built-out and come on line in conjunction with construction phasing. Existing IDFs will be brought offline in conjunction with construction phasing. Temporary cabling and services may be necessary to maintain functionality of existing systems during demo work.

Equipment racks will be installed in the MDF and IDFs for patch panels and network hardware. Two-post and four-post racks will be provided. Racks will be 19" EIA floor mount racks with wide floor mounting flanges, vertical cables guides and horizontal cable managers. Power for rack equipment will be installed in cable tray above the racks. Power will consist of both 20A and 30A twist-lock receptacles.

The existing Category 5 horizontal cabling will be replaced. The new data cabling infrastructure will be based on a Category 6A, or most up to date standard at the time of bid. The data channel will be comprised of the passive components including cabling, connectors, patch panel port, and patch cords capable of supporting 10 Gigabit per second networking. Category 6A data cabling will be provided to all equipment requiring data and voice connectivity, including but not limited to data outlets, voice outlets, video surveillance cameras, access control network connections, and other related equipment. This cabling will support computer network requirements, wireless connectivity, telephone system (VoIP) and IP-based security needs. Cabling will terminate in the MDF or one of the IDFs. Temporary cabling may be necessary to maintain functionality of existing systems during demo work.

The existing fiber backbone within the school will be replaced. The new fiber backbone will connect the MDF and all IDFs. It will consist of twelve strands of multi-mode and six strands of single-mode fiber optic cables. All multimode fiber optic cables will use multimode, graded-index fibers with 50-micron cores only. Fiber will be laser-enhanced and guaranteed for transmission distances in 10 Gigabit Ethernet of up to 500 Meters. All single-mode fiber optic cables will be OS2, tight buffered, high flexibility. Temporary cabling and services may be necessary to maintain functionality of existing systems during demo work.

Data and Voice Communication Systems:

Updated networking hardware will be provided for the MDF and IDFs consisting of network switch electronics for the data and voice communication systems, distributed communication system, audio-video communication system, security system, wireless LAN and other Owner equipment. Components will consist of PoE+ chassis and power supplies, 10/100/1000 PoE+ modules, fiber transceivers, patch cables and UPS equipment. The switches will be fully configured according to network requirements and VLANs will be created according to best practice and equipment requirements. Backbone will be 10Gb minimum.

Updated VoIP server and hardware will be provided. The existing NEC 8300 will be upgraded to the 9300 platform, or current standard at the time of bid. Several elementary schools in the district depend on the existing VoIP system for connectivity, so it must remain operational during

F. BUILDING SYSTEMS / Information Technology - OPTION 2.4

construction. The new system must be compatible with existing VoIP equipment in the district.

Audio/Visual Communication System

Digital signage will be provided in gathering areas and large group instruction spaces. The system will consist of LED displays, media players, and a server or cloud based digital signage solution.

Classrooms and general instruction spaces will be equipped with a local audio system consisting of ceiling speaker, amplification, wireless microphones and auxiliary inputs. There will be an input available for FM assistive listening systems.

Distributed Communication System

The existing Simplex Building Communication System will be replaced with a new system. The new system should be built-out with the new MDF during an early phase of construction so that newly renovated or constructed areas can come online. The new distributed communication system will consist of a fully operational IP platform public address system for district and school internal communications system incorporating school safety notifications and general communications. It will provide complete internal communications using state of the art IP technology with two-way loud speaker internal communication, bell event notification, emergency announcements that will override any pre-programmed zones assuring that all emergency/lockdown announcements are heard at all locations, and atomic time synchronization. The system will connect directly to the high school's LAN and have the future capability of expanding to connect to other intercom systems in the school district over the WAN for district-wide, emergency, and live voice announcements in the future (additional hardware will be required at the other school facilities for this feature). Configuration of zoning, bell schedules, calendars, and emergency sequences will be accomplished using a browser-based interface.

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BELMONT HIGH SCHOOL FEASIBILITY STUDY
AUDIOVISUAL SYSTEMS, OPTION C.2.4

SUBMITTED TO: PERKINS + WILL

CONSULTANT: ACENTECH

JANUARY 23, 2018

ACENTECH PROJECT NO. 629341

We visited Belmont High School on August 28, 2017 with the school and the entire design team to assess the existing conditions at the school. The following are our comments related to the audiovisual systems for the school.

BACKGROUND

Acentech is an independent consulting firm specializing in architectural acoustics, noise and vibration control, and the design of advanced sound, audiovisual, multimedia, and videoconferencing systems. In order to provide unbiased consulting and design services, Acentech does not sell or install equipment and does not represent any dealer, distributor, or manufacturer.

ROOM SCHEDULE

Unless otherwise noted, the focus of this project is limited to the following spaces and/or systems.

- Auditorium
- Music Classrooms
- Cafeteria
- Entry Hall
- Classrooms (including Art Classrooms)
- Lecture Hall (aka Little Theater)
- Book Rooms
- Field House

EXISTING CONDITION EVALUATION

During our site visit, the existing audiovisual systems were reviewed. In general, the technology being used in the school is outdated and does not support current standards. Additionally, there did not appear to be consistency in the system components from room to room. Standardization is generally desirable so that technical staff can more easily troubleshoot and correct any problems with the systems, and also so that they can stock common replacement parts (such as projector lenses and filters).

Consistency from system to system also allows them to be easier for the end users. If an end user needs to use the audiovisual system in a space that they do not typically use, the user can feel comfortable and confident that they will understand how to use the system in that room since it will be exactly the same as the one they typically use.

In all of the classrooms that we observed, the video projection systems included analog video (VGA) connections, but not digital video (HDMI). Analog video systems are rapidly being phased out. Fewer source devices support this connectivity, and the cost to support the older technology is increasing due to low supply of the components needed to support this. While some adapters allow users to connect digital video sources

to analog displays (projectors and video display panels), the adapters are not reliable and do not always work.

Portable assistive listening systems were observed in some classrooms. These portable systems ("Redcat Lightspeed") are generally used for speech amplification. They do not typically connect to the audiovisual systems. In spaces with installed amplified sound systems, assistive listening systems are required in order to comply with the ADA (Americans with Disabilities Act). Further information about this requirement is listed later in this report.

It did not appear that audiovisual control system interfaces were used in most of the systems we observed. A control system interface (either as a touch screen control panel, or a button panel) will make the audiovisual system easier to use for the end user. The controls will always be available and in the same location (will not need to look for remote controls that can easily be lost).

The existing audiovisual equipment rack for the Auditorium is located on the downstage left corner. It is located next to electrical equipment and lighting dimmer racks. Unless the dimmer racks are using newer technologies, locating these racks in close proximity to one another should be avoided. Electrical "noise" (RF) from the lighting dimmers can create interference and create audible hum or buzz in the sound system.

Finally, current audiovisual system technologies allow the systems to connect to the data network. This allows the systems to automatically alert technicians about problems. For example, a system can alert a technician when a video projector's lamp has been used for a set number of hours. This allows the technician to know ahead of time that the lamp will need to be replaced soon, and give them time to order replacement parts before the lamp no longer works.

BUDGET SUMMARY

This report describes the functionality of the proposed audiovisual systems and does not include cost estimates. A programming meeting with key users is recommended to confirm the features described in this report, and a more accurate narrative and budget can be developed to cover this. Please note that audiovisual technology cost estimates do not cover construction items traditionally carried in the mechanical and electrical engineers' budgets. These items include, but are not limited to, conduit, junction boxes, structural supports, electrical power, and data network cabling.

TOTAL COST OF OWNERSHIP

The total cost of ownership of the audiovisual systems, in addition to the installation costs of the systems, includes several on-going costs:

Support Staff Costs:
The increase in the use of audiovisual systems carries with it the need to provide additional support for the users of the systems. This is balanced by network tools that allow support staff to work more efficiently. Specifically, the network-based management software will allow the staff to turn systems on and off, verify the operation of the equipment, schedule events for automatic operation, and receive automatic notification of system failures, projector lamp replacement, etc., without visiting the room. Without a detailed study of the current and anticipated support staff requirements, it is not possible to predict the staffing costs following the completion of the project; however, AV system management software is key to minimizing the support staff costs.

AV System Service:
The installation contract should require the installing contractor to provide a service contract for all systems for an additional three years beyond the initial one-year P&L warranty. The cost of a service contract for the period following the expiration of the initial contract is likely to be approximately 10% of the cost of the initial installation per year. In addition, there will be charges associated with the actual repair of equipment that may fail during the life of the service contract.

Equipment Replacement:

The useful life of audiovisual system equipment varies with the type of equipment. In general, the useful life of most AV equipment is 5 - 10 years. Replacing individual items of equipment will be necessary during the life of the systems. Complete upgrades of the systems may be appropriate after ten years, as much because of the progress of technology and because of equipment usable life.

INFRASTRUCTURE VS. EQUIPMENT

The distinction between infrastructure and equipment must be emphasized: Infrastructure is part of the building construction including, but not limited to, conduit, raceways, junction and device boxes, and is not outlined in this program. Other infrastructure provisions, such as electrical power and grounding specified exclusively for audiovisual systems cabling and equipment may be required and should be carried in the electrical budget. Properly designed AV infrastructure allows for not only the installation of the initially specified equipment, but for the evolution of the systems over many years. If proper infrastructure is provided, additional capabilities and equipment can be added later as technology progresses.

Equipment refers to the devices that can be connected through the infrastructure. Equipment includes microphones, loudspeakers, mixers, signal processing gear, video projectors, flat panel displays, cameras, AV control systems, equipment racks, and many other devices that comprise an AV system. One thing is certain – equipment will change over the life of the room as user needs and technology change. For this reason, infrastructure is the key to the long-term success of a thoughtfully conceived AV design project because it governs what can and cannot be easily installed in the future.

EQUIPMENT NOTES AND DEFINITIONS

This program is not a technical specification and is insufficient to bid or build an AV system. Except where useful to illustrate a standard of performance or a specific user requirement, equipment manufacturers and model numbers are not used.

- Permanently installed refers to equipment that is part of the room systems and cannot easily be removed for use elsewhere.
- Portable refers to equipment that is available for connection at one or more locations, but is not hard-wired to the system. Portable equipment can be disconnected by the user or technical personnel and stored or used with systems elsewhere in the facility.
- Future Provisions refers to equipment that may be purchased and used or installed at a future date.
- Options refer to equipment or systems that are not at this point considered to be central to the needs of the Owner but may be chosen if desired. Optional equipment is not included in the budget estimate totals.
- OFE (Owner Furnished Equipment) refers to equipment that is either already owned by the Owner, or may be purchased in the future as needs arise. FBO (Furnished by Others), or “by others” refers to any service or equipment (e.g. lighting) required but not a part of the AV system design or installation.

SYSTEM CLASSIFICATIONS:

Presentation Systems

Presentation systems are the source, routing, and display devices that provide highly intelligible communication of speech, music, information, and graphics to groups of people. This includes equipment such as microphones, loudspeakers, video projectors, plasma displays, computers, and the interfacing, mixing, routing, and control equipment that connects these devices together and allows the user to select the appropriate sources and operate the system.

Assistive Listening Systems

Permanently installed Assistive Listening Systems (ALS) are required by the ADA (Americans with Disabilities Act), a 1990 federal law that forbids discrimination against persons who are handicapped. A 2010 revision states, “In each assembly area where audible communication is integral to the use of the space, an assistive listening system shall be provided” in the following quantities and versions:

Receivers for Assistive Listening Systems		
Capacity of Seating in Assembly Area	**Minimum Number of Required Receivers**	**Minimum Number of Required Receivers Required to be Hearing-aid Compatible**
50 or less	2	2
51 to 200	2, plus 1 per 25 seats over 50 seats[1]	2
201 to 500	2, plus 1 per 25 seats over 50 seats[1]	1 per 4 receivers*
501 to 1000	20, plus 1 per 33 seats over 500 seats[1]	1 per 4 receivers*
1001 to 2000	35, plus 1 per 50 seats over 1000 seats[1]	1 per 4 receivers*
2001 and over1	55 plus 1 per 100 seats over 2000 seats[1]	1 per 4 receivers*
		1 "Or Fraction thereof"

The term "assembly area" includes facilities used for entertainment, educational, or civic gatherings. Additionally, courtrooms are required to support Assistive Listening systems regardless of whether or not an installed sound system exists.

Audiovisual Control System

Audiovisual (AV) control systems are required to centralize the operation of the various functions of the AV system. This includes environmental controls such as lighting presets and shade and drape controls, as well as audiovisual functions such as system and projector power, source device selection and media transport controls, audio volume controls, and many other operational functions identified by the design team before the equipment is installed.

Advanced functions of the AV control system may include multi-level password protection for system operation to prevent unauthorized use, control of automatic system shut-down sequences (to reduce unnecessary wear and tear), and a help system interface for user experiencing technical problems (see below).

Remote Management

Permanently-installed AV control systems can be connected to the Owner LAN to enable remote control and diagnostics of the AV systems. An asset management hardware / software suite allows monitoring and operation of AV systems via the Owner's LAN. These products allow technical personnel to operate audiovisual systems in remote locations from any computer with a web browser. The features of remote management systems include:

- Real-time monitoring of system status, including notification of imminent problems in certain devices before they fail.
- Mobile management.
- A method of asset management by tracking equipment usage in real time.
- Will integrate with other control system hardware/software.

Video Conferencing/Distance Learning

Videoconferencing equipment (HD CODECs, software codecs, cameras, echo cancellers, telephone interfaces and related devices) is equipment specifically designed to transmit and receive audio and video signals over local and wide area networks. This capability is not currently planned for this project.

Broadcast Systems
Broadcast quality equipment and systems generally refer to audio and video devices (cameras, recorders, and editing equipment) of the highest quality, specifically designed for the recording, editing, and production at the commercial level, such as in network television studios. Broadcast equipment is an order of magnitude more expensive than “professional” quality equipment, and is not planned for this project.

PROPOSED AUDIOVISUAL SYSTEM DESCRIPTIONS

AUDITORIUM
The auditorium will be used for live music and theater performances, multimedia presentations with audio and video, lectures, and panel discussion. It is anticipated that the following will be required:

Sound System
- Microphones:
    - Wired Microphones: The system will include a stereo microphone that is hung in the room and used for audio recordings. Another microphone will be permanently installed over the stage/performance area and used for backstage monitoring. A gooseneck microphone will be provided for connection to a lectern (lectern, by others). Connections for wired microphones will be available at the sides of the stage, above the stage performance area, and along the side walls of the seating area.
    - Wireless Microphones: The system will include 4 wireless microphone systems. Each will include an interchangeable handheld and lavalier (clip-on) microphone transmitter.
- Audio Mixers: The system will operate in one of two microphone mixing modes; automatic or manual. These modes will be selectable from a control panel.
    - Automatic Microphone Mixing Mode: This mode will allow an end-user to simply connect a microphone to the system at one of multiple designated microphone receptacle locations. Master volume control will be accessible from the control panels. This will be the system's default setting and will be used for presentations, movies, and lectures.
    - Manual Microphone Mixing Mode: For events when more complex operation of the sound system is required, the automatic microphone-mixing can be bypassed and the system can be run by a trained operator. Volume levels of microphones and other audio playback sources will be controlled from a 32-channel digital mixing console; providing a flexible variety of audio outputs that can be used for special effects, recording, and speech reinforcement. The mixing console will be permanently located at a "tech position" within the house. The mixing location will require ample space for operation of the console and other items such as scripts required for rehearsals or performances. The mixing console will connect to the IT network and will have the capability of being controlled from an Owner-furnished tablet computer (such as an Apple iPad) that is connected via Wi-Fi to the same IT network.
- Audio Recorder: An audio recorder will used for recording events from the stereo microphone. The recorder will be capable of connecting to the IT network and can upload recorded audio tracks to another computer or server. The USB connection will allow recordings to be transferred to a thumb drive.
- Audio Signal Processing: A digital audio signal processor will be used for automatic microphone mixing, and equalizing the loudspeakers. The signal processor will be expandable so that, if required, additional input and output capacity can be added to the system in the future.
- Production Communications: A two-channel intercom system will be used for communication between production crew members at control locations, and the backstage spaces. AV connection panels within the performance space will include receptacles for the connection of intercom belt-packs. Wall-mounted speaker stations will be located in the music classrooms and other backstage spaces. The system will be provided with eight dual-channel belt-packs, headsets, and cables.
- Loudspeakers:

  - Installed Auditorium System: The loudspeaker system will provide uniform audio coverage through the audience area allowing the system to provide high levels of speech intelligibility and musical clarity.
  - The loudspeaker configuration will consist of a central loudspeaker cluster above and in-line with the primary stage area. It will be used for speech reinforcement and playback of audio. Supplementary "delay" loudspeakers will be provided to cover the rear seating areas. Front-fill loudspeakers will be used in the stage apron. Subwoofers will also be provided. Left and right loudspeakers will be used for stereo audio playback, and for sound effects; which can be panned across the left, center, and right loudspeakers. Amplifiers will be provided to power the loudspeakers.
  - Control Room: A pair of wall-mounted loudspeakers will be installed in the Control Booth and will be used by technicians in the booth to monitoring audio from the stage performance/event. Amplifiers will be provided to power the loudspeakers.
  - Portable: Four portable self-powered loudspeakers will be provided for use on stage as "wedge" monitor loudspeakers. These loudspeakers can also be used in the house or on stage as sound effects speakers. Additionally, the loudspeakers will slant for use as a "wedge" or fold back monitor loudspeaker for use on stage.
  - Backstage and Front of House: In addition to the Auditorium's loudspeakers, ceiling-mounted loudspeakers will be provided in backstage areas, dressing rooms, etc. for audio monitoring (for cues, etc.). Amplifiers will be provided to power the loudspeakers.
- Assistive Listening System: An FM-based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers (i.e., headphones) will be stored centrally and issued to participants as required. These receivers are intended to be used by patrons with hearing impairments.

Display System

- Video Projector: The system will display computer and motion video using a high brightness video projector with appropriate lens. The projector will be installed at the rear of the Auditorium in the control booth.
- Projection Screen: A motorized video projection screen with a high-contrast screen material will hang from above the stage.
- AV Sources: AV sources will include an Owner-furnished computer. Inputs for portable AV devices, such as a laptop computer or portable audio player, will be available at three locations (one on one side of the stage, one at the in-house audio mix location, and one in the Control Booth).
- Video Cameras: A high-definition video camera with integral pan/tilt head will be installed in the Theater. In addition, a night vision camera will also be provided for viewing of dark scenes. The cameras will be used to feed images of events in the space to backstage and front-of-house areas with video displays. Control of the cameras will be via presets on the touchscreen control panel.
- Video Routing and Processing: A matrix type switcher will be used to route video and audio sources to the displays and sound system. This will include video signal transmitters and receivers that are needed to send digital video signals longer distances. It will support playback and distribution of digital and analog video formats and the transport system will be compatible with newer generation 4K sources. Fiber optic transmitter outputs will be provided to send signals to the backstage areas with video displays, such as the Music Classrooms.

System Control

The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of three 10" LCD touch screens (one at the side of the stage, one at the in-house audio mix location, and one in the Control Booth). The control panels will be able to control all functions of the audiovisual system; including source selection and media transport controls, volume control, and can interface with other operational functions including lighting and HVAC.

Miscellaneous

Miscellaneous equipment will include a floor-standing and lockable equipment rack(s), AC power distribution, and sequencers in the racks, custom connection panels at the stage/performance area and

house mix position, audio press feed connections to locations within the room, and all cable, connectors, and additional hardware and labeling required to install the system.

MUSIC CLASSROOMS

The Music Classrooms will include the Band Room and Chorus Room. These spaces will be used for musical instruction and rehearsal for choir, jazz band, orchestra, and band groups. Each audiovisual system will comprise the following sub-systems:

Sound System

- Microphones: A stereo microphone will be provided and will hang from the ceiling. This microphone will tie into the AV system and can be used for recording performances.
- Audio Signal Processing: A digital audio signal processor will be used for signal routing and equalizing the loudspeakers.
- Audio Recording: A network USB/SD audio recorder will be provided.
- Loudspeakers: Wall-mounted loudspeakers will be wall-mounted at the front of the room for program audio playback. Amplifiers will be provided to power the loudspeakers.
- Assistive Listening System: An FM-based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers (i.e., headphones) will be stored centrally and issued to participants as required. These receivers are intended to be used by patrons with hearing impairments.

Display System

- Video Projector: The system will display computer and motion video using short-throw, 3,300 ANSI lumen video projectors (1280 x 800 WXGA resolution). The projectors will be installed on the wall above the whiteboard/projection screens in each room (whiteboard material to be provided by Others). Note that the whiteboard material should be of a projection quality and should not create reflections or hot spots from the projector.
- AV Sources: AV sources will include connectivity for an Owner-furnished computer. Inputs for portable AV devices, such as a laptop computer or portable audio player, will be available at locations at the front of the room. An overflow audio and video feed from the Auditorium will also be provided.
- Video Routing and Processing: A matrix type switcher will be used to route video and audio sources to the display and sound system. This will include video signal transmitters and receivers that are needed to send digital video signals longer distances. It will support playback and distribution of digital and analog video formats and the transport system will be compatible with newer generation 4K sources.

System Control

The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of a 7”LCD touch screen at the presentation area. The control panel will be able to control all functions of the audiovisual system; including source selection and media transport controls, and volume control. Control system processing will be embedded in the video matrix switch.

Miscellaneous

Miscellaneous equipment will include a floor-standing and lockable equipment rack, AC power distribution and sequencers in the racks, custom connection panels, and all cable, connectors, and additional hardware and labeling required to install the system.

CAFETERIA

The Cafeteria will include seating for a large number of students. An audiovisual system will be provided for lectures and will serve as an area to view and hear overflow AV feeds from the Auditorium. The audiovisual system will comprise the following sub-systems:

Sound System

- Microphones:

  - Wired Microphones: Connections for wired microphones will be available.
  - Wireless Microphones: The system will include a wireless microphone system. This will include lavalier (clip-on) microphone transmitter.
- Audio Signal Processing: A digital audio signal processor will be used for automatic microphone mixing and equalizing the loudspeakers.
- Loudspeakers: The loudspeaker configuration will consist of distributed ceiling-mounted loudspeakers and will be used for program audio and speech reinforcement. Amplifiers will be provided to power the loudspeakers.
- Assistive Listening System: An FM-based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers (i.e., headphones) will be stored centrally and issued to participants as required. These receivers are intended to be used by patrons with hearing impairments.

Video System

- Video Displays: Two wall-mounted video display panels will be provided to display computer and motion video. These can be used for digital signage with owner provided PC, local AV presentations, or overflow video feeds from the auditorium.
- AV Sources: Inputs for portable AV devices, such as a laptop computer or portable audio player, will be available at one location in the Cafeteria area.
- Video Routing and Processing: A matrix type switcher will be used to route video and audio sources to the display and sound system. This will include video signal transmitters and receivers that are needed to send digital video signals longer distances. It will support playback and distribution of digital and analog video formats and the transport system will be compatible with newer generation 4K sources.

System Control

The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of a 7” LCD touch screen. The control panel will be able to control all functions of the audiovisual system; including source selection and media transport controls, and volume control.

Miscellaneous

Miscellaneous equipment will include a floor-standing and lockable equipment rack, AC power distribution and sequencers in the racks, custom connection panels, and all cable, connectors, and additional hardware and labeling required to install the system.

ENTRY HALL

The Entry Hall is a public area where large murals are hung. A digital video wall will be used to display electronic artwork, and can also be used to display other images and announcements. The audiovisual system will comprise of the following sub-systems:

Display System:

- Video Display: The system will display computer and motion video using a wall-mounted video wall consisting of nine (9) x 55" video display panels arranged in a 3 x 3 grid. The overall image size will be approximately 81" high x 143.5" wide.
- AV Sources: Inputs for portable AV devices, such as a laptop computer, will be available at a wall-mounted receptacle panel in the main office area of the school. An Owner-furnished computer will connect to the system.
- Video Routing: A switcher will be used to route video and audio sources to the display and sound system. This will include video signal transmitters and receivers that are needed to send digital video signals longer distances. The video routing equipment will be compliant with newer generation digital video sources (4K).

System Control:

The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of a wall-mounted 7” LCD

touch screen. It will be able to control all functions of the audiovisual system; including source selection and media transport controls.

Miscellaneous:
Miscellaneous equipment will include an equipment rack, AC power distribution and sequencing, custom connection panels, and all cable, connectors, and additional hardware and labeling that are required to install the system.

CLASSROOMS
The classrooms (including the art classrooms) will be used for lectures and presentations. The audiovisual systems will each comprise of the following sub-systems:

Sound System
- Loudspeakers: A pair of wall-mounted loudspeakers will be used for program audio playback. Amplifiers will be provided to power the loudspeakers.
- Assistive Listening System: An infrared-based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers (i.e., headphones) will be stored centrally and issued to participants as required. These receivers are intended to be used by patrons with hearing impairments.

Display System
- Video Projector: The system will display computer and motion video using a wall-mounted short-throw video projector (1920 x 1200 WUXGA minimum resolution). The projector will display content on a wall-mounted white board suitable for projection (white board, by Others).
- AV Sources: AV sources will include inputs for portable AV devices, such as a laptop computer or portable audio player. It will be available at the front of the room on a wall-mounted receptacle panel.

System Control
The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of a wall-mounted button panel. It will be able to control all functions of the audiovisual system; including source selection, volume control, and power.

Miscellaneous
Miscellaneous equipment will include custom connection panels, and all cable, connectors, and additional hardware and labeling required to install the system.

LECTURE HALL (AKA LITTLE THEATER)
The Lecture Hall will be used for multimedia presentations with audio and video, lectures, panel discussions, and community events.

Sound System
- Microphones:
  - Wired Microphones: A gooseneck and handheld microphone will be provided for connection to a lectern (lectern, by others). Connections for additional wired microphones will be available.
  - Wireless Microphones: The system will include a wireless microphone system. The system will include handheld and lavalier (clip-on) microphone transmitters.
- Audio Signal Processing: A digital audio signal processor will be used for automatic microphone mixing and equalizing the loudspeakers.
- Loudspeakers: Loudspeakers will be provided for speech reinforcement and audio playback. Amplifiers will be provided to power the loudspeakers.
- Assistive Listening System: An FM-based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers (i.e., headphones) will be

stored centrally and issued to participants as required. These receivers are intended to be used by patrons with hearing impairments.

Display System:

- Video Projector: The system will display computer and motion video using a high-brightness video projector (1920 x 1200 WUXGA minimum resolution).
- Projection Screen: A motorized video projection screen with a high-contrast screen material will hang from the presentation wall.
- AV Sources: AV sources will an Owner-furnished computer. Inputs for portable AV devices, such as a laptop computer or portable audio player, will be available at two locations at the front of the room.
- Video Cameras: One high-definition video camera with integral pan/tilt head will be installed in the Lecture Hall on the rear wall. Control of the camera will be via presets on the touchscreen control panel.
- Video Routing and Processing: A matrix type switcher will be used to route video and audio sources to the display and sound system. This will include video signal transmitters and receivers that are needed to send digital video signals longer distances. It will support playback and distribution of digital and analog video formats and the transport system will be compatible with newer generation 4K sources.

System Control

The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of a 10" LCD touch screen at the presentation area. The control panel will be able to control all functions of the audiovisual system; including source selection and media transport controls, volume control, and can interface with other operational functions including lighting and HVAC. Control system processing will be embedded in the video matrix switch.

Miscellaneous

Miscellaneous equipment will include a floor-standing and lockable equipment rack, AC power distribution and sequencers in the racks, custom connection panels, and all cable, connectors, and additional hardware and labeling required to install the system.

Book Rooms

The Book Rooms will be used for workgroups and tutorial sessions. The audiovisual systems will each comprise of the following sub-systems:

Sound System

- Loudspeakers: A pair of wall-mounted loudspeakers will be used for program audio playback. Amplifiers will be provided to power the loudspeakers.
- Assistive Listening System: An infrared-based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers (i.e., headphones) will be stored centrally and issued to participants as required. These receivers are intended to be used by patrons with hearing impairments.

Display System

- Video Display Panel: The system will display computer and motion video using a wall-mounted video display panel.
- AV Sources: AV sources will include inputs for portable AV devices, such as a laptop computer or portable audio player. It will be available at the front of the room on a wall-mounted receptacle panel.

System Control

The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of a wall-mounted button panel. It will be able to control all functions of the audiovisual system; including source selection, volume control, and power.

Miscellaneous
Miscellaneous equipment will include custom connection panels, and all cable, connectors, and additional hardware and labeling required to install the system.

FIELD HOUSE
The Field House will be used for practice, large games, presentations, and events. The audiovisual system will comprise of a number of sub-systems that include the following:

Sound System
- Microphones: The system will include one wireless handheld microphone transmitter. Connections for wired microphones will be available at wall-mounted receptacle panels and on a portable equipment rack.
- Audio Processing and Mixing: A digital audio signal processor will be used for automatic microphone mixing, and equalizing the loudspeakers. An 8-channel audio mixer in the portable equipment rack will be used to mix microphones and other audio sources.
- Loudspeakers: Distributed ceiling-mounted loudspeakers will be provided for speech reinforcement and program audio playback. Loudspeakers will be zoned so that they can be used over the entire Field House floor, or only over the smaller sections. For larger events and games, additional loudspeakers will be used to provide coverage to the bleacher seating area. Amplifiers will be used to power the loudspeakers.
- Assistive Listening System: An FM or infrared based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers, intended for use by patrons with hearing impairments, will be stored centrally and issued to participants as required. Inductive neck loop adapters will be provided along with the receivers for compatibility with telecoil-enabled hearing aids.

System Control
The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of one wall-mounted 5” LCD touch screen, and an additional 5” LCD touch screen in the portable equipment rack. The control panel will be able to control all functions of the audiovisual system; including source selection and media transport controls, and volume control.

Miscellaneous:
Miscellaneous equipment will include a floor-standing and lockable equipment rack, a portable equipment rack for use during events and games, AC power distribution and sequencers in the rack(s), custom connection panels, and all cable, connectors, and additional hardware and labeling required to install the system.

ARCHITECTURAL, MECHANICAL, AND ELECTRICAL CONSIDERATIONS

1. Architectural: The following items should be considered for proper coordination between audiovisual system components and other trades:
    a. Loudspeaker coverage must not be obstructed.
    b. Structure will be necessary to ensure that loudspeakers and the projection screen can be ceiling-mounted at recommended locations.
    c. Antennas for the assistive listening system and wireless microphones will be mounted on the wall.
    d. Wall-mounted connection panel locations will require coordination.
    e. Ceiling-mounted video projectors must be free from vibration.
2. AV Equipment Racks:
    a. Equipment racks will require coordination for space and cooling/airflow requirements. This will include floor-standing equipment racks, and any small equipment racks that may be installed within millwork.
        i. Floor-standing AV equipment racks shall be fixed in position and will require front access for day-to-day operational needs. They will also require rear access for

service. Clearances must be maintained around the AV equipment racks (36") to comply with the requirements of the Americans with Disabilities Act.

ii. AV equipment rack rooms may require oversized doors.

3. Auditorium Mixing Console:
   a. The Control Booth's mixing position will require ample space for operation of the console and other items such as scripts required for rehearsals or performances. The audio console is 48" wide by 36" deep.
   b. Control Booth:
      i. Please note the following guidelines:
         1. Coordination will be required with the acoustical consultant to maintain proper acoustical isolation between the Auditorium and the Control Booth.
         2. The glass in front of the video projector should be low iron. It should also be tilted between 2 and 5 degrees. Coordinate direction of tilt with the acoustical consultant.
4. Video Projection:
   a. In order to optimize the viewing experience and achieve the minimum recommended video display contrast ratio, ambient lighting within the spaces with projection will need to be reviewed. Additionally, overhead lighting should be zoned so that lighting areas directly above the projection screen surfaces can be switched off during presentations.
   b. Whiteboards & marker boards that are used as a projection surfaces shall be of projection quality so that they minimize reflections and projection hotspots.
5. Blocking will be required at all wall-mounted video display panel and loudspeaker locations.
6. Mechanical/Electrical: The following items should be considered for proper coordination between the audiovisual system components and other trades:
   a. The AC power system will be designed and specified by the electrical engineer and will include a dedicated power panel, transient voltage surge suppression, and AC outlets.
   b. Electrical outlets will be required at the equipment racks, mix location floor-box, and wall-mounted receptacle panels.
   c. IT data drops are strongly recommended at the equipment racks and all AV receptacle panels.
   d. If lighting control is desired from the audiovisual system control touch panel, the lighting system will require an interface for communication with the control system.
   e. Equipment Rack Locations:
      i. AC power requirements and heat loads will need to be considered at each equipment rack and video projector location.

* * * * * *

End of Feasibility Study

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

OPTION 3.1 - NEW CONSTRUCTION

SUMMARY

Option 3.1 proposes a newly constructed 7-12 high school. The scheme creates a series of east-west bars organizing the program around view corridors that look toward the existing pond and athletic fields. In the first phase, a completely new facility would be constructed off the southwest edge of the existing high school building that stretches along Clay Pit Pond. Program for all grade configurations could occupy the new building upon completion, allowing for a complete demolition of the existing building structure including caissons, foundations, concrete floor and roof slabs. The existing fieldhouse and associated pool would be demolished in this option as well. The building's academic life is organized around a central commons. This common space is organized at the base of the building with a focus on orientation toward the pond's natural edge. This allows for a visible public expression of spaces used frequently by the community. The science labs are integrated on opposite sides of centrally-located common spaces, with classroom spaces on the building's perimeter with optimal solar orientation.

SITE STRATEGY

Separate entrances and drop-offs are possible for lower school and upper school students on opposite sides of the building's centrally-located common amenity spaces. The new structure is placed equally between the existing rail line to the north and the smaller scale neighborhood to the south. After demolition of the existing school, the athletic fields could be organized to form a highly efficient and flexible green space stretching the entire east-west length of the site.

SUSTAINABILITY AND BUILDING PERFORMANCE

The following sustainability and resiliency attributes have been considered in evaluating this option:

ENVELOPE– Aggressive performance will be pursued in the new wall make-up including a goal of R-28 and minimized thermal bridging with the intent of minimizing air and vapor movement

ORIENTATION- This scheme orients the majority of teaching spaces to the south and north with the intent of eliminating glare and the majority of public and common spaces to the south.

SKIN TO VOLUME RATIO- The skin to volume ratio of the new construction scheme is the most efficient but will rely on daylighting internal spaces from above which may conflict with PV placement.

WINDOW TO WALL RATIO- The window to wall ratio of the new construction scheme will attempt to achieve 30-40 glazing balancing heat gain with effective daylighting.

PV POTENTIAL- - This scheme creates a simple continuous roof surface that does not shade its selves and optimizes roof top yield by orienting itself in the east-west direction.

SITE ENVIRONMENTAL PERFORMANCE- This scheme also allows for one contiguous large geo-exchange field and allows for more performative landscape adjacent to the pond allowing outdoor teaching space to overlap with site sustainable strategies at the water edge. It also places the building mass close to the existing ice rink allowing for potential future synergies in energy and waste heat use. Phasing of the geo-exchange loop may be challenging given the schedule for demolition and logical location for the well field.

PROSPECTIVE SITE ANALYSIS - OPTION 3.1

SITE

This narrative provide an analysis of the option including natural site limitations, building footprint(s), athletic fields, parking areas and drives, bus and parent drop-off areas, site access, and surrounding site features. This narrative excludes temporary site facilities, phasing implications, site drainage, utilities and permitting requirements addressed separately. All addition renovation and new building options include complete reconstruction of the site east of Harris Field to accommodate the site program requirements except tennis which will be accommodated at other existing courts in Town.

A. PROSPECTIVE SITE ANALYSIS - OPTION 3.1

Harris Field including the track and supporting facilities are existing to remain. Spatial accommodations have been made in the site planning for the school project to accommodate a multi-modal community path along the north property line abutting the MBTA right-of-way and a multigenerational path around Clay Pit Pond – both with separate funding and implementation timelines. The school building project site design is anticipated to incorporate the portion of the multigenerational path that connects across the north side of Clay Pit Pond, as that will serve as a vital link between the school's site program elements and circulation through the campus.

The existing school building is located on higher ground north of Claypit Pond towards the rear (north) of the site. The primary vehicular (car and bus) circulation and drop-off is a one-way loop from east (Hittinger Street) to west (Concord Avenue). The main pedestrian entrances are the south sides of the building. Buses drop off and pick up students along the south side of the building. The site has three primary parking areas. The largest parking lot (292 spaces) is located to the east of the school building. Small lots are located to the south (36 spaces) and north (21 spaces) of the building. Nine buses currently park along the far east side of the east parking lot. All parking areas contain accessible parking.

Most of the school's athletic facilities are located west of the school building including two baseball fields (varsity is played on Grant Memorial Field which includes bleacher seating, dugout shelters and a prominent gateway) with rectangular field layouts (for soccer and field hockey) overlapping their outfields, a rugby/football practice field and Harris Field which includes a running track and synthetic turf field, home and away bleachers and sports lighting. An indoor skating rink in poor condition and a football field house separate these fields from the varsity softball field further west with lighting and a soccer/lacrosse field overlapping the outfield. Ten tennis courts are located adjacent to the east parking area and the junior varsity softball field is located further east of the primary east parking area.

BUILDING FOOTPRINT

In Option C3.1, the existing school building would be completely removed after the new building is constructed on the adjacent athletic fields to the west. The new building footprint is positioned in the middle of the site set back from both Concord Avenue and the railroad right-of-way.

ATHLETIC FIELDS

The athletic fields except Harris Field are reconfigured as follows:

- One baseball field and overlapping softball field with a soccer/field hockey field overlapping the outfield is located west of the rink.
- A football/rugby field is located north of the new building inside one of the drop off driveway loops.
- The varsity baseball field (to replace the Brendan Grant Memorial Field) is located at the east end of the site.
- The varsity softball field is adjacent to the varsity baseball field.
- A soccer field overlaps the varsity softball outfield.
- A lacrosse/soccer field is located between the varsity softball field and the school building.

TRAFFIC CIRCULATION

The driveway between the building and Clay Pit Pond is eliminated, and a new 2-way driveway is located around the rear of the building with new access points across from Trowbridge and Goden Streets. Building entrances to the upper and lower school program have separate entrances and drop off loops along the north and south sides of the building. The multigenerational path connecting along the north side of the pond links the site and building program elements and provides pedestrian, bicycle and emergency vehicle access through the site.

PARKING

This site plan meets the school's parking need for 430 spaces. Parking is redistributed along the entire length of the campus driveway providing access to the school building and fields. This parking configuration also serves as a buffer between the school campus and MBTA rail line as well as the future multi-modal Community Path planned along the north border of the site.

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

B. CONSTRUCTION IMPACT - OPTION 3.1

Option 3.1 would require little or no renovations within the existing occupied school. New construction would be would be undertaken in 1 phase. Modular classrooms would not be required on site during renovations. Scheduling work over summer or holiday breaks may alleviate some of the disruption but would need to be carefully managed. The anticipated construction schedule is 36 months.

Work under this option would be the least disruptive to students and staff. Students would not be forced to move until construction of the new building is complete. Disruption from noise, dust, odors and construction traffic could be anticipated.

The detailed plan for phasing and swing space would be determined during schematic design to best coordinate with the educational programs to minimize the impact on students and staff.

OPTION 3.1 - I. DESIGN AND CONSTRUCTION SCHEDULE

Anticipated MSBA Approval of PSR	April 10th, 2018 (MSBA Board Meeting)
Anticipated MSBA Approval of SD	August 29th, 2018 (MSBA Board Meeting)
Special Town Meeting/Ballot Vote	November 2018
Design Development Complete	November 2018 - April 2019
Construction Documents Complete	May 2019 – January 2020
Bid and Award	February 2020 - March 2020
Construction (multiple phases)	April 2020 – March 2023 (36 months)

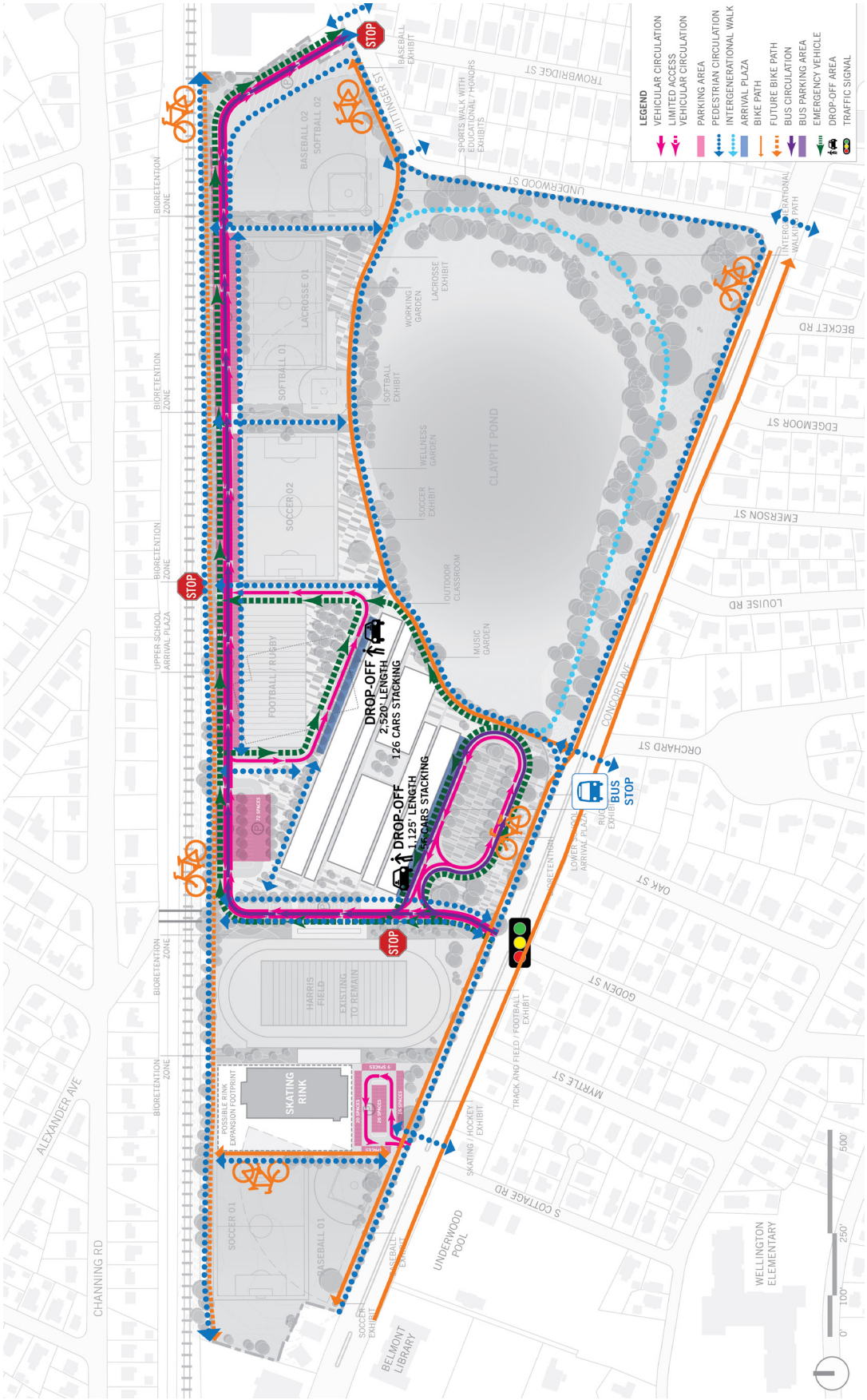
B. CONSTRUCTION IMPACT - OPTION 3.1 / Phasing Diagrams

PERKINS+WILL

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

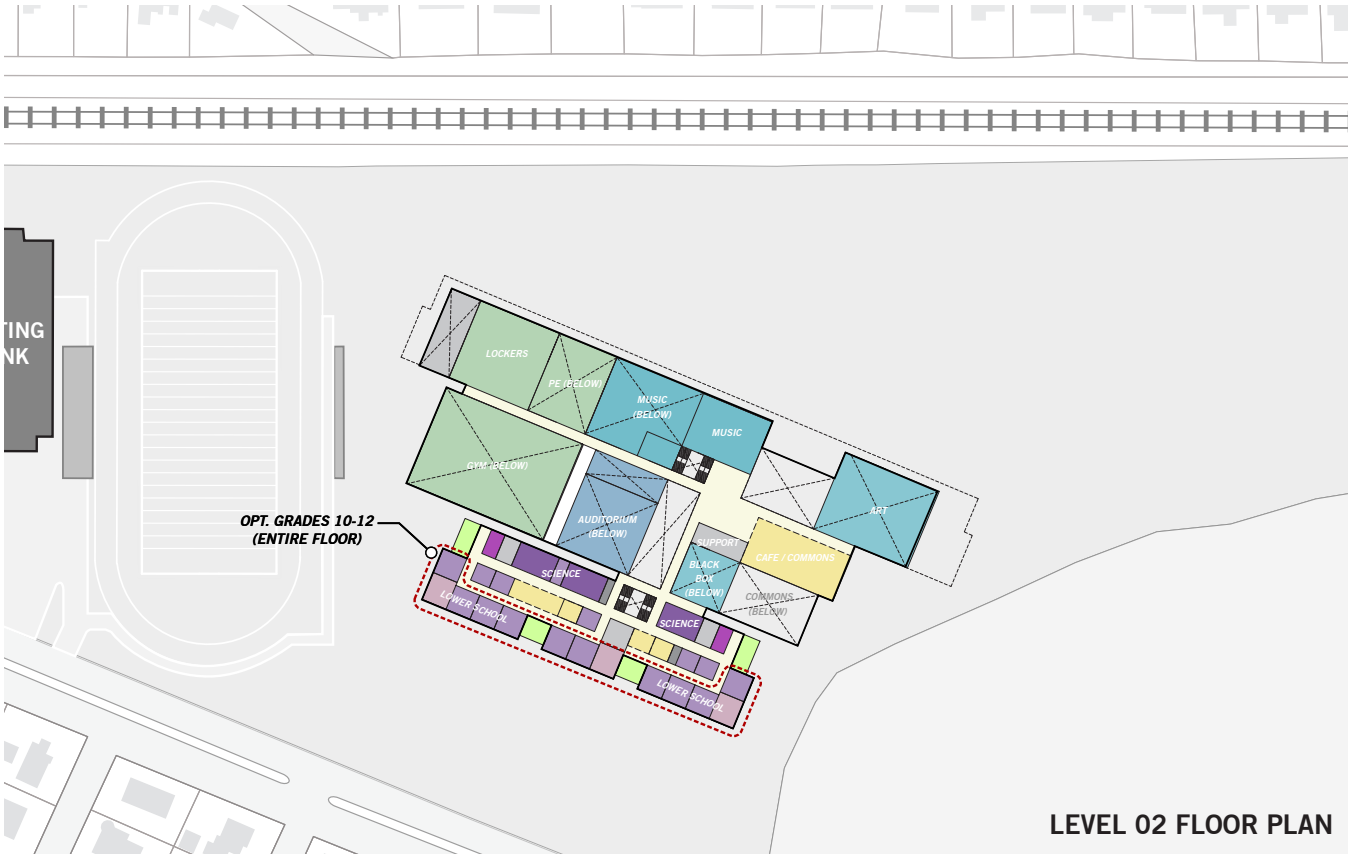
C. CONCEPT DRAWING - OPTION 3.1 / Site

C. CONCEPT DRAWING - OPTION 3.1 / Traffic Site Plan



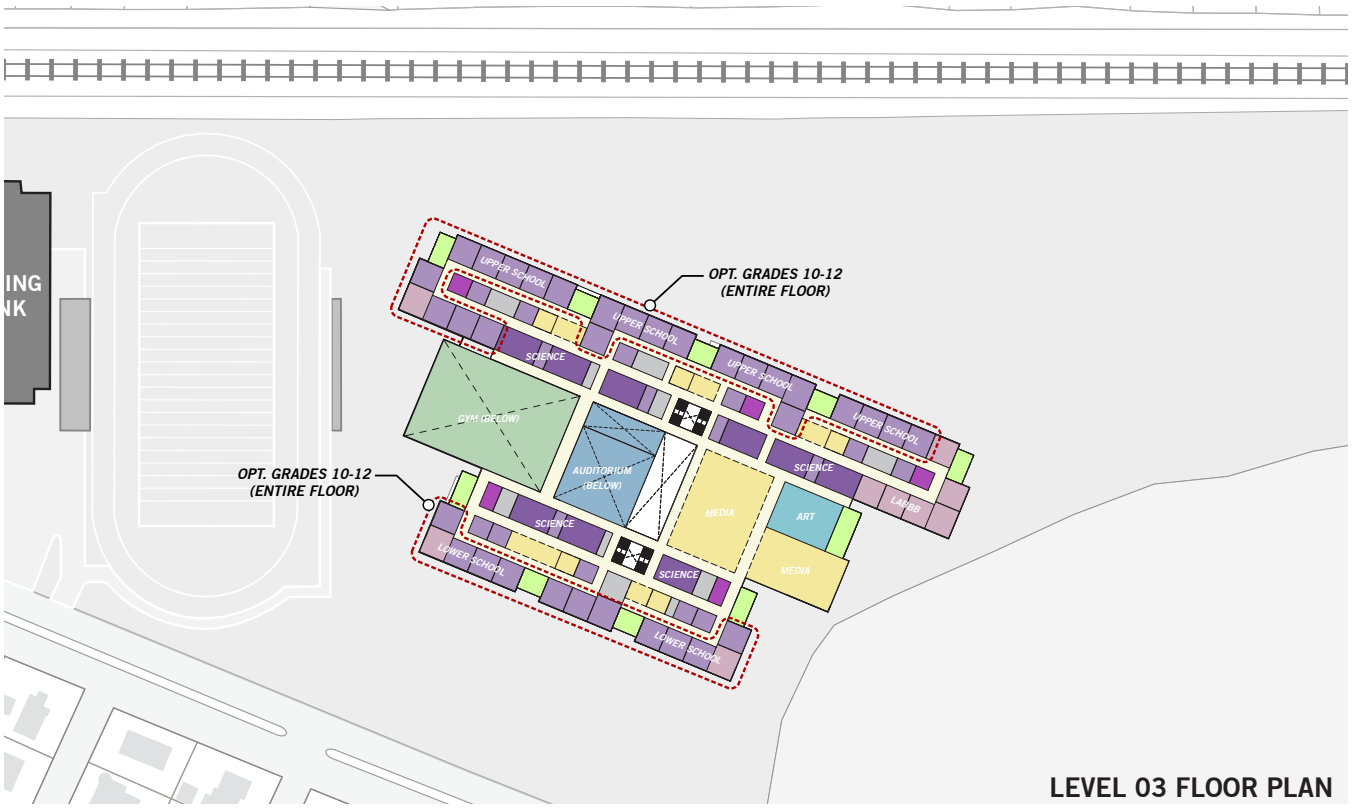
3.3.3 - FINAL EVALUATION OF ALTERNATIVES

C. CONCEPT DRAWING - OPTION 2.4 / Architectural

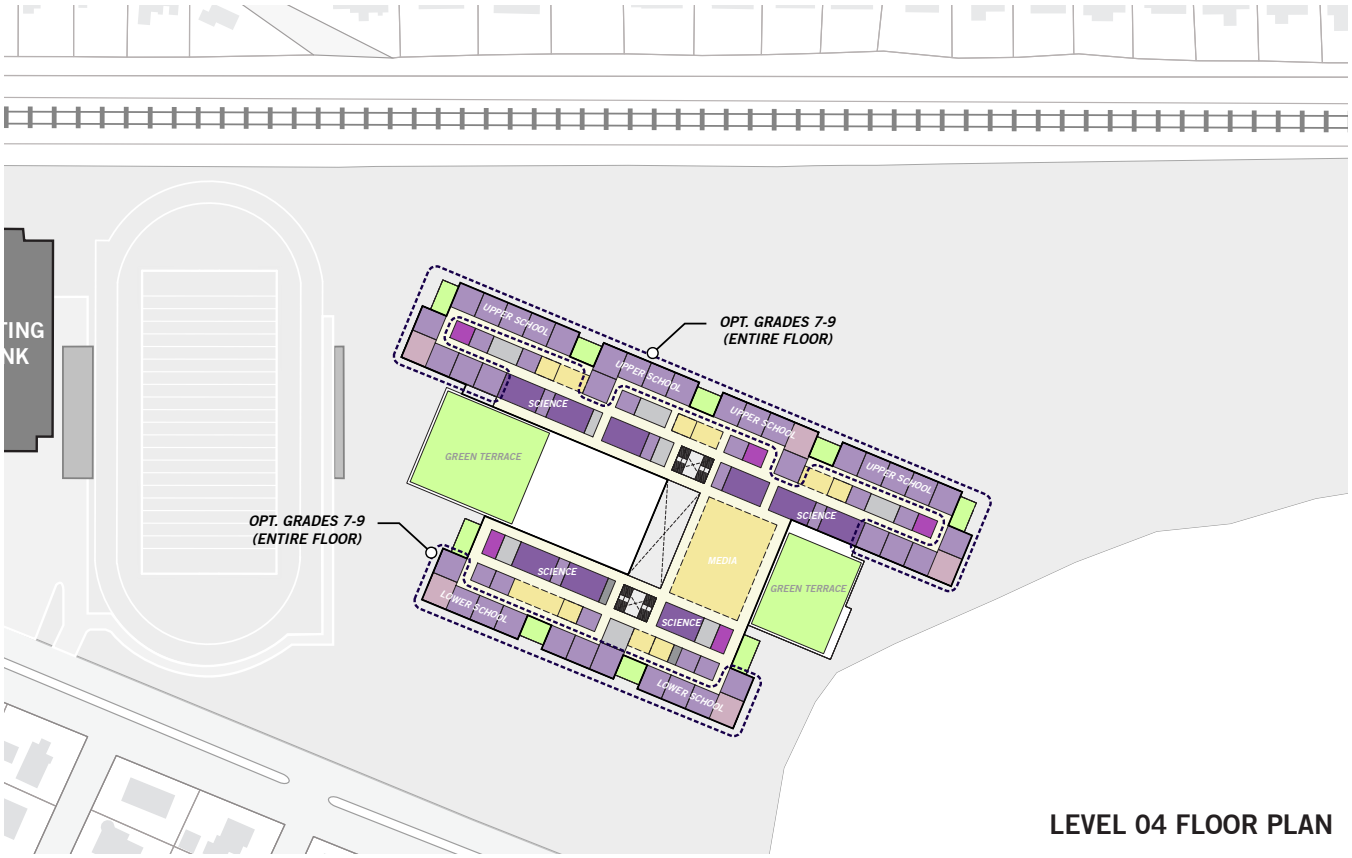


C. CONCEPT DRAWING - OPTION 2.4 / Architectural

Core Academic
Art & Music
Admin./ Guidance
Health & PE
Media Center
Auditorium & Drama
Dining/ Food Service
Medical
Circulation
Custodial/ Maint.
District Offices
Special Education



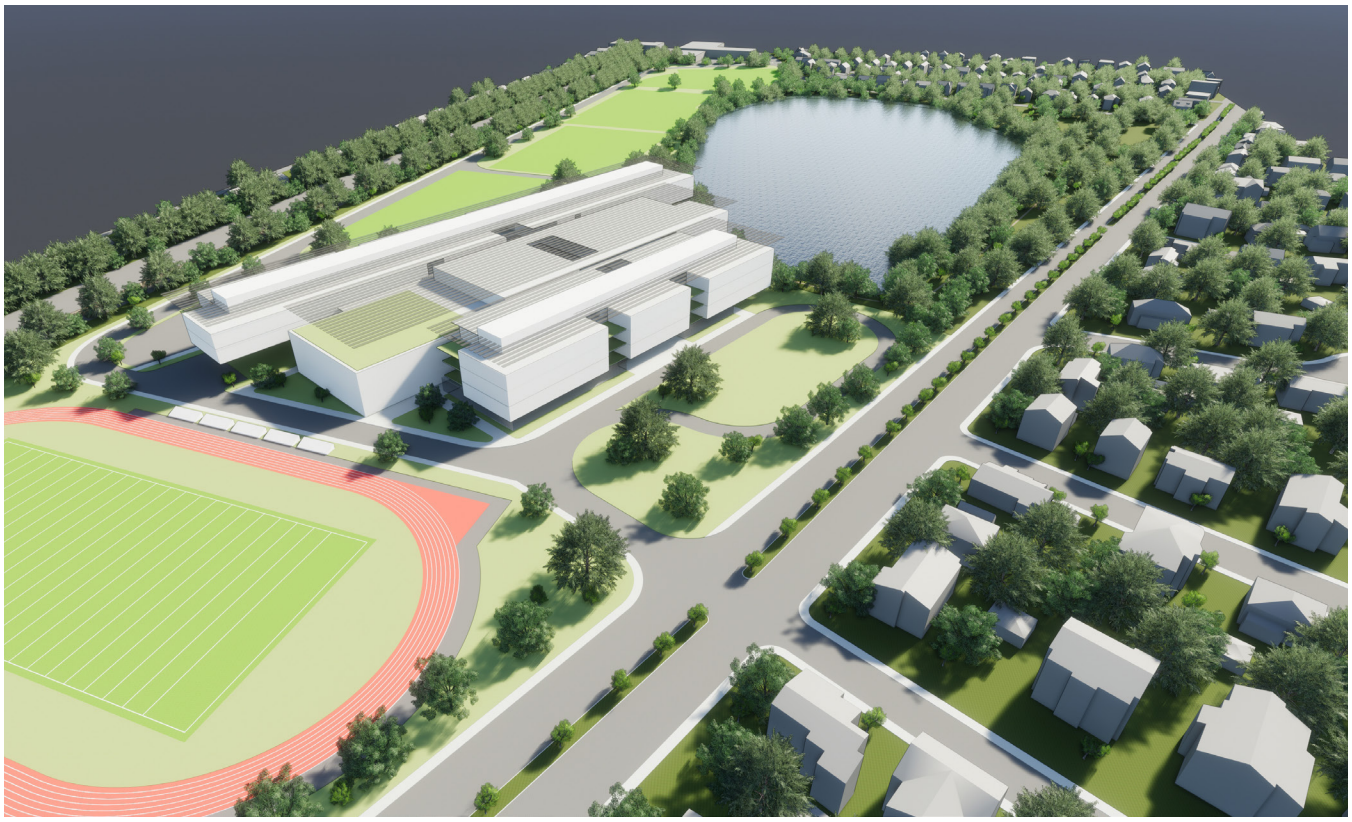
LEVEL 03 FLOOR PLAN



LEVEL 04 FLOOR PLAN

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

C. CONCEPT DRAWING - OPTION 3.1



C. CONCEPT DRAWING - OPTION 3.1

Belmont High School
Structural Narrative
New Construction – Option 3.1

January 22, 2018

SUBSTRUCTURE

FOUNDATIONS

Based on the construction of the existing school and recommendations of the Geotechnical Engineer, the entire structure of the school will be supported on pile foundations. The columns of the proposed structure would bear on 4 ft. - 0 in. deep reinforced concrete pile caps on structural steel piles. The exterior walls will be supported on 5 ft. – 0 in. deep grade beams spanning between pile caps with intermediate piles at 10 ft. - 0 in. on center. Based on the assumed pile capacity of 50 tons, a typical interior column in the four story classroom wings would be supported on 8 ft. 0 in. x 8 ft. 0 in. x 4 ft. 0 in. deep pile caps on a four pile group and a typical exterior column would be supported on 8 ft. 0 in. x 8 ft. 0 in. x 4 ft. 0 in. deep pile caps on a three pile group. The columns supporting the long span structure of the single story gymnasium, cafeteria, music spaces and other ancillary spaces would be supported on 8 ft. - 0 in. x 8 ft. - 0 in. x 4 ft. - 0 in. deep pile caps on three pile groups. In addition, the ground floor slab would be supported on single piles with a 2 ft. - 0 in. x 2 ft. - 0 in. x 2 ft. - 0 in. deep pile caps spaced out approximately 15 ft. - 0 in. (including interior and exterior pile caps supporting the columns.) All of the interior and exterior pile caps will be tied to the supported concrete slab.

SLAB ON GRADE

Based on the construction of the existing school and recommendations of the Geotechnical Engineer, the lowest level slab of the proposed structure would be a 12 in. thick reinforced concrete slab reinforced with 6 psf reinforcing over a vapor barrier on 2 in. thick rigid insulation on compacted granular structural fill supported on piles.

SUPERSTRUCTURE

FLOOR CONSTRUCTION

Typical Floor Construction
A 5 ¼ in. light weight concrete composite metal deck slab reinforced with welded wire fabric on wide flange steel beams spanning between steel girders and columns. The weight of the structural steel is estimated to be 13 psf for the typical framing. The weight of the structural steel for the long-span structure above the multi-purpose rooms and PE space is estimated to be 18 psf.

ROOF CONSTRUCTION

Typical Roof Construction
The roof construction would be galvanized, corrugated 1 ½ in. deep, Type 'B' metal roof deck spanning between wide flanged steel beams and girders. At locations of roof supported mechanical equipment, a concrete slab will be provided similar to the typical supported floor slab. The weight of the structural steel is estimated to be 13 psf.

Low Roof Structures
The roof would be a continuation of the adjacent second floor and would be similar to the typical floor construction of 5 ¼ in. light weight concrete composite metal deck slab reinforced with welded wire fabric on wide flange steel beams

spanning between steel girders and columns. This roof will be supporting the mechanical units. The units would be screened by a screen comprised of structural steel posts and beams. The weight of the structural steel is estimated to be 15 psf.

Gymnasium Roof Framing
The roof construction would be acoustic, galvanized, corrugated 3 in. deep, Type 'NA' metal roof deck spanning between long span steel joists. The weight of the structural steel framing is estimated to be 15 psf.

Auditorium Roof Framing
The roof construction would be galvanized, corrugated 3 in. deep, Type 'N' metal roof deck spanning between long span steel joists. The weight of the structural steel framing is estimated to be 15 psf. The weight of the structural steel framing supporting the roof and the rigging above the stage is estimated to be 18 psf.

VERTICAL FRAMING ELEMENTS

Columns
Columns would be hollow structural steel columns. Typical columns would be HSS 8 x 8 columns and the columns at the double story spaces at the Gymnasium, Auditorium and Lobby would be HSS 12 x 12.

Lateral Load-Resisting System
The proposed school structure would be divided into three or four parts separated by way of expansion joints.

The typical lateral load resisting system for the other parts of the school would be concentric steel braced frames comprised of hollow structural steel sections.

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

E. SITE UTILITIES - OPTION 3.1

SITE UTILITIES

Storm Drainage

Stormwater from the site will continue to be directed to Clay Pit Pond. Outside of the existing stormwater outfalls into Clay Pit Pond it is expected that the entire stormwater system will have to be reconstructed so that the new stormwater system can effectively mitigate stormwater quality, rate and volumes from the project site. Runoff generated by the new parking and driveway areas would be collected in a catch-basin to manhole closed drainage system. Water quality from these areas would be addressed by directing those flows through Stormceptor water quality units (or similar). Volume and rates of stormwater from the site would then be addressed by directing these flows to subsurface infiltration systems located beneath the parking areas. The infiltration systems would consist of galleys of 36-inch perforated pipe in crushed stone bedding. Overflows from these infiltration systems would then be directed through the new closed drainage system to the existing outfalls to Clay Pit Pond.

Roof drainage from the building is not required to be treated for water quality, therefore it can be tied directly into the new closed drainage system prior to discharge from the existing outfalls. A portion of the roof drainage could be daylighted to a raingarden or stormwater demonstration area that is incorporated into the landscape design. This landscaped area would consist of an area with variable topography to direct the stormwater through it, plantings to provide treatment and nutrient uptake, walkways or boardwalks that allow students to observe the processes and possibly even hardscape stormwater features such as runnels or small falls to provide aeration.

The new and reconstructed athletic fields would have sub-drainage located below the topsoil layer, as is typical of turf field construction. The sub-drains can be connected directly into the new closed drainage system.

Sewer

Building placement in this scheme appears to conflict with a portion of the existing sewer main which bisects the site, running west to east approximately under the sidewalk, adjacent to the existing access drive in front of the school. Approximately 400 linear feet of 24-inch sewer main would need to be relocated to accommodate the new building location. Portions of the existing 24-inch sewer not in conflict with the new building would be maintained. Sanitary sewer service connections from the new school would be connected to the new/maintained 24-inch main. Lab waste flows would be directed through a pH neutralization system prior to connection to the sanitary sewer system. Flows from the cafeteria would be directed through a new, 10,000-gallon, external grease trap.

Water

It appears that portions of the new construction would conflict with the existing water main that is routed around the rear of the existing building. A new 8-inch water main, approximately 1,600 feet long, would be installed in the first phase of the construction, along the rear property line, out of the way of any future phases. New 4-inch domestic water and 6-inch fire services would be provided to the building from the new 8-inch main. Six new fire hydrants, located along the main, would also be provided as directed by the Belmont Fire Department

Natural Gas

The existing gas service conflicts with the proposed construction. A new gas service, located to the west of the proposed building would be provided from the existing gas main in Concord Avenue to the mechanical area located at the rear of the proposed building.

Electrical

A new ductbanck consisting of four 4-inch, concrete encased conduits would be installed from the existing substation located just east of the site on Hittinger Street to the new electric room located to the rear of the proposed building.

PRELIMINARY PERMITTING CONSIDERATIONS

Wetlands Protection Act (310 CMR 10.00)

A Notice of Intent would need to be filed with the Town of Belmont Conservation Commission for any work within 100-feet of Clay Pit Pond. In addition, a Stormwater Pollution Prevention Plan (SWPPP) would need to be prepared and an application filed with the Environmental Protection Agency under the National Pollutions Discharge Elimination System (NPDES) program for the construction related activities. Erosion control measures will need to be installed and maintained in good working order around the perimeter of the site. Due to the phase nature of the construction, the perimeter controls will have to be re-installed several times over the duration of the project.

E. SITE UTILITIES - OPTION 3.1

Flood Plain

Based on the Flood Insurance Rate Map (FIRM), Community Panel Number 25017C0418E dated June 4, 2010, the portions of the existing High School site are located within Zone X (Areas determined to be outside the 0.2% annual chance floodplain). There is no regulatory requirement for working within a Zone X. The Zone AE, which is associated with the 100-year flood area, is located in close proximity to the banks of Clay Pit Pond. None of the proposed building or any critical infrastructure is being proposed within the Zone AE.

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

F. BUILDING SYSTEMS / PFP - OPTION 3.1

FIRE PROTECTION

A. General

1) Construction of a new school will require a new sprinkler system will be installed. The sprinkler system will include the following features.

B. A new building will require a complete sprinkler system installation per the Massachusetts State Building Code, Chapter 34. The Fire Protection system would be designed to meet the requirements of NFPA 13 "Installation of Sprinkler Systems" and Chapter 9 of the Massachusetts State Building Code, 780 CMR, "Fire Protection Systems".

C. A new dedicated 8" sprinkler service, connected to the town water system in the street, should be brought into the building. The exact entrance location will need to be coordinated with the Architect. As the sprinkler service enters the building a Massachusetts approved double check valve backflow preventer assembly, complete with OS&Y valves on the inlet and outlet, will be required.

D. The building will be protected by three types of sprinkler systems and each will protect the following areas:

- Wet sprinkler system – base building system
- Dry sprinkler system – to protect areas subject to freezing; i.e. loading docks and outdoor walkways covered by building overhangs, etc.
- Pre-action sprinkler system – to protect the MDF room

E. The alarm check valves for the wet and dry sprinkler systems will be installed on separate risers after the double check valve assembly in the water service entrance room. The alarm check valves will be complete with standard trim packages including pressure gauges, retard chamber, 2" main drain, water flow indicator and supervisory switches. The dry alarm valve will be supplied with an air compressor and associated appurtenances.

F. Fire protection piping main feeds to the fire protection systems from the alarm check valves will extend out to the building through the first-floor ceiling space. The piping will then extend to all areas of the building to provide complete sprinkler cover age throughout. Potential sprinkler zoning will be coordinated with any new fire wall layouts.

G. The fire protection design will include a combination standpipe system located in all egress stairways. These standpipes will feed the sprinkler system as well as provide a fire department hose connection at each level of the building.

H. The sprinkler system standpipes will feed the sprinkler system at each floor level. Each floor will be a separate zone. The floor control valve assembly at the riser that feeds each floor will contain a flow switch and tamper switch. An inspector's test connection will be installed on the floor control valve station. If the auditorium stage is greater than 1,000 square feet, fire department valves will be required on each side of the stage.

I. Sprinkler heads installed in gypsum or suspended ceilings will be glass bulb, quick response, chrome plated semi-recessed type. In areas without ceilings, brass upright sprinklers will be installed. Where upright sprinklers are subject to potential damage, such as in storage rooms, protective cages will be installed. In areas where it is not possible to run piping above the ceiling the use of sidewall sprinkler heads would be recommended.

J. The MDF room will be protected by a pre-action sprinkler system. A pre-action alarm valve with all required appurtenances will need to be located next to or near the MDF. Piping from this valve will extend into the room and connect to sprinkler heads. The piping system will be filled with compressed air. Once a sprinkler head activates, the air will discharge and open the pre-action alarm valve to allow water into the system and through the open sprinkler head.

K. Sprinkler piping for the system will be as follows:

- Piping 2" and smaller shall be schedule 40 black steel with cast iron fittings with threaded joints.
- Piping 2 ½" and larger shall be Schedule 10 black steel with malleable iron fittings with rolled grooved joints.
- Dry sprinkler systems will be supplied with Schedule 10 galvanized piping throughout.

F. BUILDING SYSTEMS / PFP - OPTION 3.1

L. All tamper and flow switches installed on the sprinkler system will be connected to the buildings fire alarm system. Each tamper and flow switch will be a dedicated point on the fire alarm system.

M. The exterior fire department connection for the sprinkler system will be a flush type mounted on the exterior of the building within 100' of a fire hydrant. The exact type of connection (storz or siamese) will be coordinated with the Belmont Fire Department. Final location and number of fire department connections will also be coordinated with the Belmont Fire Department.

N. The hydraulic requirements for the building will be as follows:

- Light Hazard - All offices, corridors and the auditorium hydraulically calculated to deliver 0.1 gpm per square foot over the most remote 1,500 square feet.
- Ordinary Hazard - All storage rooms and mechanical rooms hydraulically calculated to deliver 0.15 gpm per square foot over the most remote 1,500 square feet.
- Ordinary Hazard Group II - The stage area hydraulically calculated to deliver 0.2 gpm per square foot over the most remote 1,500 square feet.

PLUMBING

A. General

1) The new high school building will be provided with the following plumbing systems.

B. Plumbing Fixtures

1) Plumbing fixtures will be new high efficiency, water conserving type, and wall-hung for optimum sanitary purposes. Automatic hard-wired flushometer valves and lavatory faucets are to be provided.

2) Fixture flow rates should be provided as follows:

- Water closets (dual flush type) at 1.6 gpf or 1.1 gpf
- Urinals - 0.25 gpf
- Lavatories - 0.5 gpm or less
- Showers – 1.5 gpm

3) The state plumbing code dictates the number of plumbing fixtures required in a building. Minimum plumbing fixture requirements will be determined once the total occupancy numbers for the building have been established based on the final plan layout.

C. Domestic Cold Water

1) Domestic cold water connecting to all fixtures as required. Domestic cold-water service piping shall extend 10'-0" beyond the building exterior for connection to the site water distribution piping system.

D. Domestic Hot Water

1) Domestic hot water will be produced and stored in two high-efficiency condensing type gas-fired domestic water storage heaters with a single code-compliant insulated tank sized to meet the highest hourly demand. There will be two insulated distribution and recirculation loops for domestic hot water; one for the kitchen (140°F) and a main building loop (125°F). All lavatories qualifying as "public" lavatories will be provided with individual mixing valves below the fixture to reduce hot water discharge temperatures to 110°F maximum per code. Mixing valves for hand sinks in the kitchen shall reduce discharge temperature to 120°F maximum.

E. Sanitary Waste & Vent System

1) Sanitary waste and vent connecting to all fixtures as required. Sanitary waste service piping shall extend 10'-0" beyond the building exterior for connection to the site sanitary piping system.

F. Storm Drainage

1) Roof drainage will be a combination of roof drains with internal roof drain piping serving flat roofs, and gutters and downspouts serving sloped roof portions of the building. Internal roof drain piping will convey storm water to underground piping and exit the building through foundation walls to connection with site storm drainage piping. The Plumbing sub-contractor will be responsible for underground service piping to a point 10'-0" beyond the building exterior. Horizontal roof leaders above grade within the building shall be insulated.

2) Waste outlets to accept HVAC condensate and sprinkler discharge shall be provided as needed and connect to the

storm water piping system.

G. Natural Gas System

1) Natural gas service provided by the local gas company serving the town. The gas company shall provide the underground service, gas meter and gas regulator. Contractor's work will begin on the discharge side of the gas meter and extend to all equipment requiring natural gas.

H. Hose Bibbs and Wall Hydrants

1) Freeze proof wall hydrants shall be provided around the perimeter of the building.

2) Hose bibbs will be provided in all bathrooms with more than one flushing fixture and all mechanical spaces and will be provided with cross connection protection.

I. Kitchen

1) The cafeteria kitchen is to be provided with all plumbing connections noted on the food service drawings. Piping from the local grease interceptors and from kitchen floor drains subject to the introduction of fats, oil or grease will be by a dedicated grease waste piping system leading to the exterior grease trap. There will be three local grease interceptors; one for the three-compartment pot sink, one for the ware-washing/garbage disposer and one dedicated to automatic dishwasher drainage. The grease waste discharge from these interceptors will be piped to an exterior grease trap.

2) Grease waste piping system from the new kitchen to an exterior grease trap located outside of the building. Grease trap vent piping shall enter the new building underground and exit through the roof of the building per state code requirements.

J. Science Labs

1) Lab waste and vent connecting to all fixtures as required. Lab waste piping shall discharge into a central acid neutralization system located on the lowest level of the building. System shall monitor and adjust the pH level of the waste and then discharge this waste to the sanitary waste piping system outside the building, as part of the underground system.

2) Non-potable (protected) hot and cold water systems shall be created to serve the new science labs by installing reduced pressure backflow preventers on the hot and cold water piping designated to serve this area.

3) New emergency showers and eyewashes should be installed in each science classroom. A new tempered water system should be created to serve these fixtures. A new gas-fired water heater should be installed somewhere within the science wing and be dedicated to the new tempered water system. Water should be stored at 140°F and a master mixing valve should be mounted nearby and set to deliver tempered water to this wing at approximately 70°F-90°F per state plumbing code requirements. A tempered water return system will also be required to keep this system from becoming stagnant per state plumbing code requirements as well.

4) A dedicated gas piping main will serve the new science labs of the building. Gas will be supplied to each classroom. Each classroom with be equipped with an emergency gas shut-off valve located in a valve box near the exit door of the classroom. Gas will distribute from this location to bench or countertop gas turrets as required. Each science classroom will also be supplied with one emergency shower/eyewash unit as required by code. These units will be supplied with tempered water as required by code. Floor drains with trap primer connections will be provided under each shower/eyewash unit to protect against water damage when in use or due to accidental discharge.

K. Pipe Materials

1) Below grade sanitary and storm drainage piping will be service weight bell and spigot cast iron with neoprene gasketed joints. Above grade sanitary and storm piping will be service weight hubless cast iron with Massachusetts approved stainless steel and neoprene no-hub connector assemblies.

2) All water supply and return piping shall be Type "L" copper.

3) All water supply and return piping insulation shall be in accordance with the Energy Code.

4) All gas piping will be threaded black steel piping up to 2 ½" size. Piping 3" and larger shall be welded.

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

F. BUILDING SYSTEMS / HVAC - OPTION 3.1

BELMONT HIGH SCHOOL

HEATING, VENTILATING, AND AIR CONDITIONING

NEW CONSTRUCTION / C.3.1

A. General:

1. This description applies to the new construction option (C.3.1) where the new building is constructed while the existing building remains in operation.

2. Heating, air conditioning and ventilation systems shall be high-efficiency systems that allow for the ability towards achieving a Net Zero Energy facility.

B. Ground Loop Geo-Exchange System:

1. A vertical borehole well field consisting of (400) 6-inch diameter boreholes spaced 20 feet apart shall be provided. Each borehole shall be 375 to 450 feet deep. Actual depth to be determined based on thermal conductivity testing performed on a test well. The number of boreholes may be increased or decreased based on thermal testing results and/or determination of the final heating and cooling loads.

3. Provide a 1-1/4 inch supply and return pipe within each borehole with a U-bend at the bottom. Piping shall be high density polyethylene (HDPE) with DR9 wall thickness. Polyethylene pipe and fittings shall be heat fused by butt, socket, sidewall, or electrofusion in accordance with pipe manufacturer's procedures. Underground supply and return piping from boreholes shall collect to four buried circuit vaults constructed of HDPE or concrete. Supply and return circuit piping in each vault shall combine to 8 inch main header piping which shall be routed into the building.

4. Steel sleeve casings shall be provided for the upper section of each borehole down to bedrock. Each borehole shall be filled with a bentonite based thermally enhanced grout mixture.

C. Central Heating and Cooling System:

1. Central geothermal heating and cooling shall be provided by four high efficiency 300 ton (approx. nominal capacity) heat recovery chiller-heaters or (40) 30 ton modular chiller-heaters connected to the ground loop system.

2. The ground loop circulation system shall be filled with 25% propylene glycol solution and shall be served by three 1000 GPM pumps with variable frequency drives.

3. Chiller-heater condenser water shall be constant flow primary with zero pressure bypass connections to the ground loop distribution and the building heating distribution. There shall be three primary condenser water pumps at 1,000 GPM each.

4. Secondary condenser/heating pumps shall be variable flow with variable frequency drives. There shall be three secondary heating pumps at 1,000 GPM each.

5. Chilled water distribution from chiller evaporators to building distribution shall be variable primary flow with three 750 GPM pumps.

6. The building circulation loop shall consist of a four-pipe distribution. The main distribution to heating/cooling terminal units in the building shall be four-pipe. Rooftop air handling units, heat recovery air handling units, and central air handling units shall be two-pipe configuration.

7. The building loop piping system shall contain a 25% propylene glycol solution for freeze protection and corrosion protection.

8. The building terminal heating units will be designed to utilize low temperature heating supply water (130°F maximum). Heating terminal units such as fin tube radiation and heating coils may require larger surface areas due to the low water temperature. In areas with high heating loads, two-row fin-tube and heating coils may be required.

D. Exterior Classrooms - Induction Units with Displacement:

1. The system serving heating, cooling and ventilation for typical exterior classrooms shall utilize four-pipe floor mounted chilled beam induction units with displacement supply air. Four 5 ft. long units shall be provided for each typical classroom mounted along the exterior wall. Units shall be served by two 7-inch diameter primary ventilation supply air ducts.

2. The primary supply air serving each classroom shall be provided with a modulating supply air volume control terminal to control supply air when the room is occupied.

3. Systems will be interfaced to the local space vacancy sensor to reduce ventilation air and reset the space cooling and heating set point temperatures when the room is unoccupied.

4. A carbon dioxide sampling sensing system will be provided in classrooms to provide monitoring and occupied control of ventilation air.

E. Interior Classrooms and Other Spaces – Ceiling Induction Units:

1. Interior classrooms and other interior occupied spaces will be served with ventilation supply air from a rooftop heat recovery ventilation unit connected to ceiling mounted chilled beam induction terminals. Induction terminals shall be provided with four-pipe supply and return water connections.

2. Individual classrooms shall be provided with a supply air volume control terminal to control ventilation air when the room is occupied. A carbon dioxide sampling sensing system shall be provided for classrooms to monitor and control ventilation air.

F. Classroom and Interior Ventilation Systems:

1. Outside ventilation air for classrooms and interior spaces will be provided by roof mounted dedicated outside air heat recovery units (HRU).

2. The HRU's will be variable air volume and will include supply and exhaust fans with variable frequency drives, total energy recovery wheels and secondary sensible reheat wheels to allow for a low level of dehumidification control. The units will be provided with two-pipe dual temperature water connections to a single combination pre-heat and cooling coil. Changeover between hot water and chilled water supply shall be provided with the use of changeover valves connected to the hot water and chilled water systems. Each unit shall include 100% recirculation dampers for morning warm-up mode and after-hours night setback heating.

3. All unit energy recovery wheels and coils shall be sized for low face velocity to increase unit and system efficiency.

4. Variable supply air will be based on demand from classrooms and interior spaces. Return/exhaust air shall be controlled by air flow measurement and tracking of the supply and exhaust air with limited volume control terminals in the exhaust air system.

5. Corridors will be provided with ventilation air from the HRU system. Air quantities in excess of basic ventilation requirements will be provided for building exhaust makeup air as required. Corridors will not be fully air conditioned with the exception of areas that have direct solar loads.

G. Miscellaneous Areas:

1. All normally occupied areas will be air conditioned except for corridors, the kitchen, and culinary classrooms with kitchen hoods (if applicable). The kitchen and culinary areas are partially tempered by using transfer air from the commons for make-up air.

2. The Auditorium, Stage, Media Center, Gymnasium, Cafeteria, and Administration areas, will be served by rooftop air conditioning units (RTU). Separate occupancy scheduling for each unit will provide operational flexibility.

3. Rooftop air conditioning units (RTU) will include supply fan, return fan, hot water heating coil, chilled water cooling coil, filters, and variable frequency drives. Units serving Administration, Media Center, Band/Chorus, and the Cafeteria will be variable air volume (VAV) with local variable air volume boxes for zone temperature control.

4. The Auditorium and Gymnasium units will be single zone with a variable frequency drive to modulate the supply air during periods of low demand and occupancy.

5. The Auditorium, Gymnasium, Cafeteria, and Media Center systems will be provided with space carbon dioxide (CO_2) sensors to provide modulation of outside air based on occupancy demand.

6. Areas such as the Cafeteria, Black Box, parts of the Media Center, main lobby and open group learning spaces may alternatively be provided with a radiant floor cooling and heating system. System shall include connections to the hot water and chilled water piping, circulation pumps, circuit headers, controls, and under-slab PEX piping distribution.

H. Building Management System (BMS):

1. Provide direct digital control (DDC) BMS with local and unitary controls and web interface for remote access, alarms, and monitoring of all HVAC equipment in the building including; chillers, pumps, heat recovery units, rooftop units, fans and terminal units shall be controlled and mapped to a central monitoring station. System shall be based on the Niagara Framework open protocol for interoperability between manufacturers.

2. BMS system shall be interfaced to the building electrical and gas sub-meters. Daily, weekly, and annual energy use shall be reported for each meter.

I. Carbon Dioxide Sensing System:

1. Provide an Aircuity, or equal, carbon dioxide air sampling and sensing system consisting of room sensors, cabling, tubing, room probes, air routers, and vacuum pumps.

2. Air tubing from room sensors shall be collected through air routers to sensing stations.

3. The system shall include an information management system and shall be integration with the building management system.

4. Building management system input shall provide control input for modulating supply air terminal units or automatic dampers.

J. Electrical and BTU Metering:

1. Electrical metering shall be provided for collection of historical and real-time performance data. Separate meter groups shall be provided for the upper school areas and lower school areas consisting of meters for the measurement of lighting and plug loads for each classroom group by wing, floor or classroom type.

2. Individual metering of lighting and plug loads shall be provided for the Kitchen, Media Center, Auditorium/Stage, Gymnasium, and Administration areas.

3. Electrical metering shall be provided for each air handling system, central system pumps (by each group type), and each chiller-heater.

4. Provide BTU metering of chilled water, hot water, ground loop circulation systems and domestic hot water system.

K. Phasing Considerations:

1. Construction of the new facility is independent from the existing building, which is to remain in operation throughout the new construction phase.

2. After the completion of the new construction, the existing systems in the existing building shall be demolished.

3. Since the athletic fields will not be constructed until after the new building is occupied and the existing building is demolished, the outdoor space for the installation of a new geothermal distribution is limited to parking and drive lane areas behind the building. This is not sufficient to support the full heating and cooling load for the building. Therefore, it will be necessary to install a temporary boiler outdoors to supplement the heating demand through the winter months. It may also be necessary to install a temporary chiller system if it is not possible to install the complete geothermal well field prior to the following summer.

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

F. BUILDING SYSTEMS / Electrical - OPTION 3.1

Belmont High School

ELECTRICAL

3.1 New Construction

A. Existing Electric Services:

1. All existing services shall be disconnected and removed from the building. Coordinate with the respective utility company and include all work required for the removal of all existing utility services that become abandoned including power, telephone, cable TV, and fire alarm services.

2. Include the removal of all existing roadway, parking, and walkway lighting structures. At the scheduled time of demolition of the existing buildings include disconnecting all services and making safe the existing structure for complete demolition.

3. Include maintaining the operation of existing site equipment such as irrigation pumps. Provide new services to all equipment affected by new construction.

B. New Main Electric Service:

1. A new primary service will be provided from utility company primary services via an underground ductbank and manhole system to a new utility company pad mounted transformer.

2. Secondary service from the new pad mounted transformer will be underground to a new main switchboard at 480/277V, 3-phase, 4-wire. Switchboard will be located in a new main electric room.

C. New Normal Distribution System:

1. Main switchboard will be provided with surge protection (SPD) and ground fault protection on main and feeder devices.

2. Surge protection will be provided in all 120/208V panelboards.

D. New Emergency Distribution System:

1. Natural gas/diesel (fuel source to be determined) emergency generator will power emergency egress lighting and exit lighting in corridors, assembly areas, and stairwells. Miscellaneous systems to include the following:

   a. Kitchen walk-in coolers and freezers.

   b. Telephone system.

   c. Security system.

   d. District and school IT head-end equipment (located in the MDF Room).

e. Cooling equipment for school and district IT equipment.

f. Fire alarm system.

g. Circulator pumps and controls.

2. Separate automatic transfer switches shall be provided for emergency and non-emergency loads.

3. In addition to the equipment and systems listed above, the following equipment and systems will be fed from the generator.

a. Additional lighting in Gymnasium, Cafeteria, Kitchen, and associated toilets and corridors.

b. HVAC ventilation equipment (no air-conditioning) associated with the Gymnasium, Cafeteria, Kitchen, and associated toilets and corridors.

c. Receptacles in Gymnasium and Cafeteria.

4. Generator will be ground mounted at the exterior of the building in a self-contained sound attenuated enclosure with an integral base mounted fuel tank (if diesel). Generator will be mounted on an elevated concrete platform for survivability.

5. Emergency panels will be located in new two-hour rated electric closets.

6. Non-emergency (standby) loads will be located in separate closets via separate automatic transfer switch and panelboards.

7. Emergency feeders run outside two-hour electric rooms and shafts and not in or under floor slab will utilize MI Cables.

8. A portable generator connection will be provided to meet National Electric Code Article 700 requirements to have a portable generator available while servicing the building generator.

E. Sustainable Design Intent LEED 4.0:

1. Sustainable Design Intent compliance will include:

a. Advanced measurement and verification of air conditioning, fans, lighting, and receptacle power via electronic sub-meters equal to E-Mon, D-Mon Class 2000 3-phase kWh and demand meters. Measurement and verification metering will be monitored by the Building Management System (BMS).

b. Plug and process load reductions through the use of vacancy/occupancy sensor controls for local convenience outlets in classrooms, offices, library and resource rooms. Open areas such as Media Center, Auditorium and Kitchen will be equipped with relay panels controlled via the lighting control system, to reduce loads on a time schedule basis.

c. Advanced lighting controls include a low voltage lighting control system with time schedule control for common areas, vacancy/occupancy sensors, and photocells for daylight harvesting.

d. Empty conduit provisions will be provided for future green vehicles charger stations based on two percent of the available parking.

e. Empty conduits and space provisions will be provided for photovoltaic (PV) installations. Include conduits and space provisions for inverters at a minimum of three locations on Level 3 and/or Level 4 electric closets.

F. Lighting:

1. New luminaires will be provided throughout all renovated areas as well as new construction. Luminaires will be dimmable LED. All luminaires will be suitable for respective utility rebate incentives.

2. Exterior building mounted around the entire building including all canopies, all entry drives, parking areas, and all walkways will be full cutoff LED type. All exterior lighting will be controlled via the building low voltage lighting control system.

3. Athletic field lighting will be provided at the Softball and Baseball fields.

G. Lighting Controls:

1. A low voltage lighting control system will be provided for common areas such as corridors and other areas not controlled by occupancy sensors.

2. Manual low voltage override switches to override the time of day lighting control schedules shall be provided. Override switches will permit extension of lighting control program as well as ON-OFF override for exiting the facility.

3. Lighting program for time of day schedules shall permit all lighting, including exterior to be turned off during non-occupied hours, reducing sky glow and light trespass. Activation of either fire alarm or intrusion detection system shall override the lighting program.

4. Vacancy and occupancy sensors will control lighting in most spaces including classrooms, offices, and utility type spaces. In addition, all spaces will be provided with local low voltage dimmable switching.

5. Daylight harvesting will be employed in all perimeter classrooms, offices, and other spaces with substantial daylight utilizing daylight sensors in each space.

H. Auditorium:

1. A professional theatrical lighting system will be provided.

I. Convenience Power:

1. Safety type duplex receptacles will be provided throughout the building in quantities to suit space programming.

2. Plug load reduction will be achieved by vacancy/occupancy sensors in classrooms, offices, and staff spaces, and circuits routed via relay panels, controlled via lighting control system time schedule for open areas such as Commons/Café, Kitchen and culinary areas.

F. BUILDING SYSTEMS / Electrical - OPTION 3.1

J. Fire Alarm:

1. Existing automatic, fully supervised, analog addressable, voice evacuation system will be retained and utilized where applicable.

   a. Manual pull stations (with tamperproof covers if applicable), at points of egress, and other locations as required to meet code.

   b. Audible/visual units in corridors, classrooms, and throughout the building to meet code.

   c. Visual only units in conference rooms, meeting rooms and small toilets.

   d. Smoke detectors in corridors, stairwells, electric, and telecommunications rooms, elevator lobbies, and elevator machine rooms.

   e. Smoke duct detectors in HVAC units over 2,000 CFM, and within five feet of smoke dampers including connections to all smoke/fire dampers.

   f. Connections to all Fire Protection devices and Kitchen hood.

   g. Connections to audio/visual systems, sound systems, and dimmed lighting controls.

   h. Remote annunciator at main entrance and secondary entrances as directed by Belmont Fire Department.

   i. 24 VDC magnetic hold open devices at smoke doors.

   j. Master box and exterior beacon (quantity of beacons per Belmont Fire Department.

   k. Wiring will be fire alarm MC cable.

K. Technology per Technology Section.

L. Integrated Intrusion, Access Control, CCTV, and Alarm System:

1. Intrusion alarm system will provide magnetic switches on perimeter doors, motion sensors in all perimeter rooms on first floor with susceptible access from grade. Motion sensors will be provided in first, second, and third floor corridors. System will have secure-access zoning. Zoning will be provided to suit all proposed off hours usage including community programs.

2. CCTV coverage will be provided at main and secondary entries as well as all other perimeter entries to be used by students and staff on a daily basis and for off hours community programs, including Gymnasium and Cafeteria entries.

3. Exterior CCTV coverage will be provided to cover the entire perimeter of the building.

4. Access control via card access system will be provided at all exterior doors.

5. CCTV system will be IP based with minimal 30 day recording capacity. System will be web based to allow viewing by Belmont Police Department.

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

F. BUILDING SYSTEMS / Information Technology - OPTION 3.1

Structured Cabling System:

The School Department is responsible for the fiber network for both the schools and the Town (including the light department and TV Studio). The fiber network handles general data as well as Phone (VoIP) and security for the school district and the Town. There are three centralization points for the fiber – the high school, Chenery Middle School, and the Town Library. Internet services and wireless controllers in the existing high school MDF provide connectivity at all the school facilities and the Town. These systems must remain operational during construction. The district fiber must be extended to the new school. The existing MDF and the existing district fiber must remain functional until cutover. The district fiber must be protected during site work.

The MDF will be the central location of all head end equipment including but not limited to servers, storage, switch electronics, security equipment, video equipment, telephone system, public address system and security system. It will be a dedicated space with proper ventilation, environmental treatment and emergency power. The district fiber will be re-routed the new MDF.

The IDF locations will serve as intermediate closets for local cabling and equipment. The IDFs will be dedicated spaces with proper ventilation, environmental treatment and emergency power. Each closet will connect to the MDF with backbone cabling.

Equipment racks will be installed in the MDF and IDFs for patch panels and network hardware. Two-post and four-post racks will be provided. Racks will be 19" EIA floor mount racks with wide floor mounting flanges, vertical cables guides and horizontal cable managers. Power for rack equipment will be installed in cable tray above the racks. Power will consist of both 20A and 30A twist-lock receptacles.

The new data cabling infrastructure will be based on a Category 6A, or most up to date standard at the time of bid. The data channel will be comprised of the passive components including cabling, connectors, patch panel port, and patch cords capable of supporting 10 Gigabit per second networking. Category 6A data cabling will be provided to all equipment requiring data and voice connectivity, including but not limited to data outlets, voice outlets, video surveillance cameras, access control network connections, and other related equipment. This cabling will support computer network requirements, wireless connectivity, telephone system (VoIP) and IP-based security needs. Cabling will terminate in the MDF or one of the IDFs.

Fiber backbone will connect the MDF and all IDFs. It will consist of twelve strands of multi-mode and six strands of single-mode fiber optic cables. All multimode fiber optic cables will use multimode, graded-index fibers with 50-micron cores only. Fiber will be laser-enhanced and guaranteed for transmission distances in 10 Gigabit Ethernet of up to 500 Meters. All single-mode fiber optic cables will be OS2, tight buffered, high flexibility.

Data and Voice Communication Systems:

Networking hardware will be provided for the MDF and IDFs consisting of network switch electronics for the data and voice communication systems, distributed communication system, audio-video communication system, security system, wireless LAN and other Owner equipment. Components will consist of PoE+ chassis and power supplies, 10/100/1000 PoE+ modules, fiber transceivers, patch cables and UPS equipment. The switches will be fully configured according to network requirements and VLANs will be created according to best practice and equipment requirements. Backbone will be 10Gb minimum.

VoIP server and hardware will be provided. The existing NEC 8300 will be upgraded to the 9300 platform, or current standard at the time of bid. Several elementary schools in the district depend on the existing VoIP system for connectivity, so it must remain operational during construction. The new system must be compatible with existing VoIP equipment in the district.

Audio/Visual Communication System

Digital signage will be provided in gathering areas and large group instruction spaces. The system will consist of LED displays, media players, and a server or cloud based digital signage, solution.

Classrooms and general instruction spaces will be equipped with a local audio system consisting of ceiling speaker, amplification, wireless microphones and auxiliary inputs. There will be an input available for FM assistive listening systems the Owner may have.

Distributed Communication System

The distributed communication system will consist of a fully

F. BUILDING SYSTEMS / Information Technology - OPTION 3.1

operational IP platform public address system for district and school internal communications system incorporating school safety notifications and general communications. It will provide complete internal communications using state of the art IP technology with two-way loud speaker internal communication, bell event notification, emergency announcements that will override any pre-programmed zones assuring that all emergency/lockdown announcements are heard at all locations, and atomic time synchronization. The system will connect directly to the high school's LAN and have the future capability of expanding to connect to other intercom systems in the school district over the WAN for district-wide, emergency, and live voice announcements in the future (additional hardware will be required at the other school facilities for this feature). Configuration of zoning, bell schedules, calendars, and emergency sequences will be accomplished using a browser-based interface.

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BELMONT HIGH SCHOOL FEASIBILITY STUDY – AUDIOVISUAL SYSTEMS, OPTION C.3.1

SUBMITTED TO: PERKINS + WILL

CONSULTANT: ACENTECH

JANUARY 23, 2018

ACENTECH PROJECT NO. 629341

We visited Belmont High School on August 28, 2017 with the school and the entire design team to assess the existing conditions at the school. The following are our comments related to the audiovisual systems for the school.

BACKGROUND

Acentech is an independent consulting firm specializing in architectural acoustics, noise and vibration control, and the design of advanced sound, audiovisual, multimedia, and videoconferencing systems. In order to provide unbiased consulting and design services, Acentech does not sell or install equipment and does not represent any dealer, distributor, or manufacturer.

ROOM SCHEDULE

Unless otherwise noted, the focus of this project is limited to the following spaces and/or systems.

- Auditorium
- Music Classrooms
- Cafeteria
- Entry Hall
- Classrooms (including Art Classrooms)
- Lecture Hall (aka Little Theater)
- Book Rooms
- Gymnasium

EXISTING CONDITION EVALUATION

During our site visit, the existing audiovisual systems were reviewed. In general, the technology being used in the school is outdated and does not support current standards. Additionally, there did not appear to be consistency in the system components from room to room. Standardization is generally desirable so that technical staff can more easily troubleshoot and correct any problems with the systems, and also so that they can stock common replacement parts (such as projector lenses and filters).

Consistency from system to system also allows them to be easier for the end users. If an end user needs to use the audiovisual system in a space that they do not typically use, the user can feel comfortable and confident that they will understand how to use the system in that room since it will be exactly the same as the one they typically use.

In all of the classrooms that we observed, the video projection systems included analog video (VGA) connections, but not digital video (HDMI). Analog video systems are rapidly being phased out. Fewer source devices support this connectivity, and the cost to support the older technology is increasing due to low supply of the components needed to support this. While some adapters allow users to connect digital video sources

to analog displays (projectors and video display panels), the adapters are not reliable and do not always work.

Portable assistive listening systems were observed in some classrooms. These portable systems ("Redcat Lightspeed") are generally used for speech amplification. They do not typically connect to the audiovisual systems. In spaces with installed amplified sound systems, assistive listening systems are required in order to comply with the ADA (Americans with Disabilities Act). Further information about this requirement is listed later in this report.

It did not appear that audiovisual control system interfaces were used in most of the systems we observed. A control system interface (either as a touch screen control panel, or a button panel) will make the audiovisual system easier to use for the end user. The controls will always be available and in the same location (will not need to look for remote controls that can easily be lost).

The existing audiovisual equipment rack for the Auditorium is located on the downstage left corner. It is located next to electrical equipment and lighting dimmer racks. Unless the dimmer racks are using newer technologies, locating these racks in close proximity to one another should be avoided. Electrical "noise" (RF) from the lighting dimmers can create interference and create audible hum or buzz in the sound system.

Finally, current audiovisual system technologies allow the systems to connect to the data network. This allows the systems to automatically alert technicians about problems. For example, a system can alert a technician when a video projector's lamp has been used for a set number of hours. This allows the technician to know ahead of time that the lamp will need to be replaced soon, and give them time to order replacement parts before the lamp no longer works.

BUDGET SUMMARY

This report describes the functionality of the proposed audiovisual systems and does not include cost estimates. A programming meeting with key users is recommended to confirm the features described in this report, and a more accurate narrative and budget can be developed to cover this. Please note that audiovisual technology cost estimates do not cover construction items traditionally carried in the mechanical and electrical engineers' budgets. These items include, but are not limited to, conduit, junction boxes, structural supports, electrical power, and data network cabling.

TOTAL COST OF OWNERSHIP

The total cost of ownership of the audiovisual systems, in addition to the installation costs of the systems, includes several on-going costs:

Support Staff Costs:
The increase in the use of audiovisual systems carries with it the need to provide additional support for the users of the systems. This is balanced by network tools that allow support staff to work more efficiently. Specifically, the network-based management software will allow the staff to turn systems on and off, verify the operation of the equipment, schedule events for automatic operation, and receive automatic notification of system failures, projector lamp replacement, etc., without visiting the room. Without a detailed study of the current and anticipated support staff requirements, it is not possible to predict the staffing costs following the completion of the project; however, AV system management software is key to minimizing the support staff costs.

AV System Service:
The installation contract should require the installing contractor to provide a service contract for all systems for an additional three years beyond the initial one-year P&L warranty. The cost of a service contract for the period following the expiration of the initial contract is likely to be approximately 10% of the cost of the initial installation per year. In addition, there will be charges associated with the actual repair of equipment that may fail during the life of the service contract.

Equipment Replacement:

The useful life of audiovisual system equipment varies with the type of equipment. In general, the useful life of most AV equipment is 5 - 10 years. Replacing individual items of equipment will be necessary during the life of the systems. Complete upgrades of the systems may be appropriate after ten years, as much because of the progress of technology and because of equipment usable life.

INFRASTRUCTURE VS. EQUIPMENT

The distinction between infrastructure and equipment must be emphasized: Infrastructure is part of the building construction including, but not limited to, conduit, raceways, junction and device boxes, and is not outlined in this program. Other infrastructure provisions, such as electrical power and grounding specified exclusively for audiovisual systems cabling and equipment may be required and should be carried in the electrical budget. Properly designed AV infrastructure allows for not only the installation of the initially specified equipment, but for the evolution of the systems over many years. If proper infrastructure is provided, additional capabilities and equipment can be added later as technology progresses.

Equipment refers to the devices that can be connected through the infrastructure. Equipment includes microphones, loudspeakers, mixers, signal processing gear, video projectors, flat panel displays, cameras, AV control systems, equipment racks, and many other devices that comprise an AV system. One thing is certain – equipment will change over the life of the room as user needs and technology change. For this reason, infrastructure is the key to the long-term success of a thoughtfully conceived AV design project because it governs what can and cannot be easily installed in the future.

EQUIPMENT NOTES AND DEFINITIONS

This program is not a technical specification and is insufficient to bid or build an AV system. Except where useful to illustrate a standard of performance or a specific user requirement, equipment manufacturers and model numbers are not used.

- Permanently installed refers to equipment that is part of the room systems and cannot easily be removed for use elsewhere.
- Portable refers to equipment that is available for connection at one or more locations, but is not hard-wired to the system. Portable equipment can be disconnected by the user or technical personnel and stored or used with systems elsewhere in the facility.
- Future Provisions refers to equipment that may be purchased and used or installed at a future date.
- Options refer to equipment or systems that are not at this point considered to be central to the needs of the Owner but may be chosen if desired. Optional equipment is not included in the budget estimate totals.
- OFE (Owner Furnished Equipment) refers to equipment that is either already owned by the Owner, or may be purchased in the future as needs arise. FBO (Furnished by Others), or “by others” refers to any service or equipment (e.g. lighting) required but not a part of the AV system design or installation.

SYSTEM CLASSIFICATIONS:

Presentation Systems

Presentation systems are the source, routing, and display devices that provide highly intelligible communication of speech, music, information, and graphics to groups of people. This includes equipment such as microphones, loudspeakers, video projectors, plasma displays, computers, and the interfacing, mixing, routing, and control equipment that connects these devices together and allows the user to select the appropriate sources and operate the system.

Assistive Listening Systems

Permanently installed Assistive Listening Systems (ALS) are required by the ADA (Americans with Disabilities Act), a 1990 federal law that forbids discrimination against persons who are handicapped. A 2010 revision states, “In each assembly area where audible communication is integral to the use of the space, an assistive listening system shall be provided” in the following quantities and versions:

Receivers for Assistive Listening Systems		
Capacity of Seating in Assembly Area	**Minimum Number of Required Receivers**	**Minimum Number of Required Receivers Required to be Hearing-aid Compatible**
50 or less	2	2
51 to 200	2, plus 1 per 25 seats over 50 seats[1]	2
201 to 500	2, plus 1 per 25 seats over 50 seats[1]	1 per 4 receivers*
501 to 1000	20, plus 1 per 33 seats over 500 seats[1]	1 per 4 receivers*
1001 to 2000	35, plus 1 per 50 seats over 1000 seats[1]	1 per 4 receivers*
2001 and over1	55 plus 1 per 100 seats over 2000 seats[1]	1 per 4 receivers*
		1 "Or Fraction thereof"

The term "assembly area" includes facilities used for entertainment, educational, or civic gatherings. Additionally, courtrooms are required to support Assistive Listening systems regardless of whether or not an installed sound system exists.

Audiovisual Control System

Audiovisual (AV) control systems are required to centralize the operation of the various functions of the AV system. This includes environmental controls such as lighting presets and shade and drape controls, as well as audiovisual functions such as system and projector power, source device selection and media transport controls, audio volume controls, and many other operational functions identified by the design team before the equipment is installed.

Advanced functions of the AV control system may include multi-level password protection for system operation to prevent unauthorized use, control of automatic system shut-down sequences (to reduce unnecessary wear and tear), and a help system interface for user experiencing technical problems (see below).

Remote Management

Permanently-installed AV control systems can be connected to the Owner LAN to enable remote control and diagnostics of the AV systems. An asset management hardware / software suite allows monitoring and operation of AV systems via the Owner's LAN. These products allow technical personnel to operate audiovisual systems in remote locations from any computer with a web browser. The features of remote management systems include:

- Real-time monitoring of system status, including notification of imminent problems in certain devices before they fail.
- Mobile management.
- A method of asset management by tracking equipment usage in real time.
- Will integrate with other control system hardware/software.

Video Conferencing/Distance Learning

Videoconferencing equipment (HD CODECs, software codecs, cameras, echo cancellers, telephone interfaces and related devices) is equipment specifically designed to transmit and receive audio and video signals over local and wide area networks. This capability is not currently planned for this project.

Broadcast Systems
Broadcast quality equipment and systems generally refer to audio and video devices (cameras, recorders, and editing equipment) of the highest quality, specifically designed for the recording, editing, and production at the commercial level, such as in network television studios. Broadcast equipment is an order of magnitude more expensive than “professional” quality equipment, and is not planned for this project.

PROPOSED AUDIOVISUAL SYSTEM DESCRIPTIONS

AUDITORIUM
The auditorium will be used for live music and theater performances, multimedia presentations with audio and video, lectures, and panel discussion. It is anticipated that the following will be required:

Sound System
- Microphones:
    - Wired Microphones: The system will include a stereo microphone that is hung in the room and used for audio recordings. Another microphone will be permanently installed over the stage/performance area and used for backstage monitoring. A gooseneck microphone will be provided for connection to a lectern (lectern, by others). Connections for wired microphones will be available at the sides of the stage, above the stage performance area, and along the side walls of the seating area.
    - Wireless Microphones: The system will include 4 wireless microphone systems. Each will include an interchangeable handheld and lavalier (clip-on) microphone transmitter.
- Audio Mixers: The system will operate in one of two microphone mixing modes; automatic or manual. These modes will be selectable from a control panel.
    - Automatic Microphone Mixing Mode: This mode will allow an end-user to simply connect a microphone to the system at one of multiple designated microphone receptacle locations. Master volume control will be accessible from the control panels. This will be the system's default setting and will be used for presentations, movies, and lectures.
    - Manual Microphone Mixing Mode: For events when more complex operation of the sound system is required, the automatic microphone-mixing can be bypassed and the system can be run by a trained operator. Volume levels of microphones and other audio playback sources will be controlled from a 32-channel digital mixing console; providing a flexible variety of audio outputs that can be used for special effects, recording, and speech reinforcement. The mixing console will be permanently located at a "tech position" within the house. The mixing location will require ample space for operation of the console and other items such as scripts required for rehearsals or performances. The mixing console will connect to the IT network and will have the capability of being controlled from an Owner-furnished tablet computer (such as an Apple iPad) that is connected via Wi-Fi to the same IT network.
- Audio Recorder: An audio recorder will used for recording events from the stereo microphone. The recorder will be capable of connecting to the IT network and can upload recorded audio tracks to another computer or server. The USB connection will allow recordings to be transferred to a thumb drive.
- Audio Signal Processing: A digital audio signal processor will be used for automatic microphone mixing, and equalizing the loudspeakers. The signal processor will be expandable so that, if required, additional input and output capacity can be added to the system in the future.
- Production Communications: A two-channel intercom system will be used for communication between production crew members at control locations, and the backstage spaces. AV connection panels within the performance space will include receptacles for the connection of intercom belt-packs. Wall-mounted speaker stations will be located in the music classrooms and other backstage spaces. The system will be provided with eight dual-channel belt-packs, headsets, and cables.
- Loudspeakers:

  - Installed Auditorium System: The loudspeaker system will provide uniform audio coverage through the audience area allowing the system to provide high levels of speech intelligibility and musical clarity.
  - The loudspeaker configuration will consist of a central loudspeaker cluster above and in-line with the primary stage area. It will be used for speech reinforcement and playback of audio. Supplementary "delay" loudspeakers will be provided to cover the rear seating areas. Front-fill loudspeakers will be used in the stage apron. Subwoofers will also be provided. Left and right loudspeakers will be used for stereo audio playback, and for sound effects; which can be panned across the left, center, and right loudspeakers. Amplifiers will be provided to power the loudspeakers.
  - Control Room: A pair of wall-mounted loudspeakers will be installed in the Control Booth and will be used by technicians in the booth to monitoring audio from the stage performance/event. Amplifiers will be provided to power the loudspeakers.
  - Portable: Four portable self-powered loudspeakers will be provided for use on stage as "wedge" monitor loudspeakers. These loudspeakers can also be used in the house or on stage as sound effects speakers. Additionally, the loudspeakers will slant for use as a "wedge" or fold back monitor loudspeaker for use on stage.
  - Backstage and Front of House: In addition to the Auditorium's loudspeakers, ceiling-mounted loudspeakers will be provided in backstage areas, dressing rooms, etc. for audio monitoring (for cues, etc.). Amplifiers will be provided to power the loudspeakers.
- Assistive Listening System: An FM-based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers (i.e., headphones) will be stored centrally and issued to participants as required. These receivers are intended to be used by patrons with hearing impairments.

Display System

- Video Projector: The system will display computer and motion video using a high brightness video projector with appropriate lens. The projector will be installed at the rear of the Auditorium in the control booth.
- Projection Screen: A motorized video projection screen with a high-contrast screen material will hang from above the stage.
- AV Sources: AV sources will include an Owner-furnished computer. Inputs for portable AV devices, such as a laptop computer or portable audio player, will be available at three locations (one on one side of the stage, one at the in-house audio mix location, and one in the Control Booth).
- Video Cameras: A high-definition video camera with integral pan/tilt head will be installed in the Theater. In addition, a night vision camera will also be provided for viewing of dark scenes. The cameras will be used to feed images of events in the space to backstage and front-of-house areas with video displays. Control of the cameras will be via presets on the touchscreen control panel.
- Video Routing and Processing: A matrix type switcher will be used to route video and audio sources to the displays and sound system. This will include video signal transmitters and receivers that are needed to send digital video signals longer distances. It will support playback and distribution of digital and analog video formats and the transport system will be compatible with newer generation 4K sources. Fiber optic transmitter outputs will be provided to send signals to the backstage areas with video displays, such as the Music Classrooms.

System Control

The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of three 10" LCD touch screens (one at the side of the stage, one at the in-house audio mix location, and one in the Control Booth). The control panels will be able to control all functions of the audiovisual system; including source selection and media transport controls, volume control, and can interface with other operational functions including lighting and HVAC.

Miscellaneous

Miscellaneous equipment will include a floor-standing and lockable equipment rack(s), AC power distribution, and sequencers in the racks, custom connection panels at the stage/performance area and

house mix position, audio press feed connections to locations within the room, and all cable, connectors, and additional hardware and labeling required to install the system.

MUSIC CLASSROOMS

The Music Classrooms will include the Band Room and Chorus Room. These spaces will be used for musical instruction and rehearsal for choir, jazz band, orchestra, and band groups. Each audiovisual system will comprise the following sub-systems:

Sound System

- Microphones: A stereo microphone will be provided and will hang from the ceiling. This microphone will tie into the AV system and can be used for recording performances.
- Audio Signal Processing: A digital audio signal processor will be used for signal routing and equalizing the loudspeakers.
- Audio Recording: A network USB/SD audio recorder will be provided.
- Loudspeakers: Wall-mounted loudspeakers will be wall-mounted at the front of the room for program audio playback. Amplifiers will be provided to power the loudspeakers.
- Assistive Listening System: An FM-based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers (i.e., headphones) will be stored centrally and issued to participants as required. These receivers are intended to be used by patrons with hearing impairments.

Display System

- Video Projector: The system will display computer and motion video using short-throw, 3,300 ANSI lumen video projectors (1280 x 800 WXGA resolution). The projectors will be installed on the wall above the whiteboard/projection screens in each room (whiteboard material to be provided by Others). Note that the whiteboard material should be of a projection quality and should not create reflections or hot spots from the projector.
- AV Sources: AV sources will include connectivity for an Owner-furnished computer. Inputs for portable AV devices, such as a laptop computer or portable audio player, will be available at locations at the front of the room. An overflow audio and video feed from the Auditorium will also be provided.
- Video Routing and Processing: A matrix type switcher will be used to route video and audio sources to the display and sound system. This will include video signal transmitters and receivers that are needed to send digital video signals longer distances. It will support playback and distribution of digital and analog video formats and the transport system will be compatible with newer generation 4K sources.

System Control

The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of a 7”LCD touch screen at the presentation area. The control panel will be able to control all functions of the audiovisual system; including source selection and media transport controls, and volume control. Control system processing will be embedded in the video matrix switch.

Miscellaneous

Miscellaneous equipment will include a floor-standing and lockable equipment rack, AC power distribution and sequencers in the racks, custom connection panels, and all cable, connectors, and additional hardware and labeling required to install the system.

CAFETERIA

The Cafeteria will include seating for a large number of students. An audiovisual system will be provided for lectures and will serve as an area to view and hear overflow AV feeds from the Auditorium. The audiovisual system will comprise the following sub-systems:

Sound System

- Microphones:

  - Wired Microphones: Connections for wired microphones will be available.
  - Wireless Microphones: The system will include a wireless microphone system. This will include lavalier (clip-on) microphone transmitter.
- Audio Signal Processing: A digital audio signal processor will be used for automatic microphone mixing and equalizing the loudspeakers.
- Loudspeakers: The loudspeaker configuration will consist of distributed ceiling-mounted loudspeakers and will be used for program audio and speech reinforcement. Amplifiers will be provided to power the loudspeakers.
- Assistive Listening System: An FM-based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers (i.e., headphones) will be stored centrally and issued to participants as required. These receivers are intended to be used by patrons with hearing impairments.

Video System

- Video Displays: Two wall-mounted video display panels will be provided to display computer and motion video. These can be used for digital signage with owner provided PC, local AV presentations, or overflow video feeds from the auditorium.
- AV Sources: Inputs for portable AV devices, such as a laptop computer or portable audio player, will be available at one location in the Cafeteria area.
- Video Routing and Processing: A matrix type switcher will be used to route video and audio sources to the display and sound system. This will include video signal transmitters and receivers that are needed to send digital video signals longer distances. It will support playback and distribution of digital and analog video formats and the transport system will be compatible with newer generation 4K sources.

System Control

The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of a 7” LCD touch screen. The control panel will be able to control all functions of the audiovisual system; including source selection and media transport controls, and volume control.

Miscellaneous

Miscellaneous equipment will include a floor-standing and lockable equipment rack, AC power distribution and sequencers in the racks, custom connection panels, and all cable, connectors, and additional hardware and labeling required to install the system.

ENTRY HALL

The Entry Hall is a public area where large murals are hung. A digital video wall will be used to display electronic artwork, and can also be used to display other images and announcements. The audiovisual system will comprise of the following sub-systems:

Display System:

- Video Display: The system will display computer and motion video using a wall-mounted video wall consisting of nine (9) x 55" video display panels arranged in a 3 x 3 grid. The overall image size will be approximately 81" high x 143.5" wide.
- AV Sources: Inputs for portable AV devices, such as a laptop computer, will be available at a wall-mounted receptacle panel in the main office area of the school. An Owner-furnished computer will connect to the system.
- Video Routing: A switcher will be used to route video and audio sources to the display and sound system. This will include video signal transmitters and receivers that are needed to send digital video signals longer distances. The video routing equipment will be compliant with newer generation digital video sources (4K).

System Control:

The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of a wall-mounted 7” LCD

touch screen. It will be able to control all functions of the audiovisual system; including source selection and media transport controls.

Miscellaneous:
Miscellaneous equipment will include an equipment rack, AC power distribution and sequencing, custom connection panels, and all cable, connectors, and additional hardware and labeling that are required to install the system.

CLASSROOMS
The classrooms (including the art classrooms) will be used for lectures and presentations. The audiovisual systems will each comprise of the following sub-systems:

Sound System
- Loudspeakers: A pair of wall-mounted loudspeakers will be used for program audio playback. Amplifiers will be provided to power the loudspeakers.
- Assistive Listening System: An infrared-based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers (i.e., headphones) will be stored centrally and issued to participants as required. These receivers are intended to be used by patrons with hearing impairments.

Display System
- Video Projector: The system will display computer and motion video using a wall-mounted short-throw video projector (1920 x 1200 WUXGA minimum resolution). The projector will display content on a wall-mounted white board suitable for projection (white board, by Others).
- AV Sources: AV sources will include inputs for portable AV devices, such as a laptop computer or portable audio player. It will be available at the front of the room on a wall-mounted receptacle panel.

System Control
The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of a wall-mounted button panel. It will be able to control all functions of the audiovisual system; including source selection, volume control, and power.

Miscellaneous
Miscellaneous equipment will include custom connection panels, and all cable, connectors, and additional hardware and labeling required to install the system.

LECTURE HALL (AKA LITTLE THEATER)
The Lecture Hall will be used for multimedia presentations with audio and video, lectures, panel discussions, and community events.

Sound System
- Microphones:
  - Wired Microphones: A gooseneck and handheld microphone will be provided for connection to a lectern (lectern, by others). Connections for additional wired microphones will be available.
  - Wireless Microphones: The system will include a wireless microphone system. The system will include handheld and lavalier (clip-on) microphone transmitters.
- Audio Signal Processing: A digital audio signal processor will be used for automatic microphone mixing and equalizing the loudspeakers.
- Loudspeakers: Loudspeakers will be provided for speech reinforcement and audio playback. Amplifiers will be provided to power the loudspeakers.
- Assistive Listening System: An FM-based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers (i.e., headphones) will be

stored centrally and issued to participants as required. These receivers are intended to be used by patrons with hearing impairments.

Display System:

- Video Projector: The system will display computer and motion video using a high-brightness video projector (1920 x 1200 WUXGA minimum resolution).
- Projection Screen: A motorized video projection screen with a high-contrast screen material will hang from the presentation wall.
- AV Sources: AV sources will an Owner-furnished computer. Inputs for portable AV devices, such as a laptop computer or portable audio player, will be available at two locations at the front of the room.
- Video Cameras: One high-definition video camera with integral pan/tilt head will be installed in the Lecture Hall on the rear wall. Control of the camera will be via presets on the touchscreen control panel.
- Video Routing and Processing: A matrix type switcher will be used to route video and audio sources to the display and sound system. This will include video signal transmitters and receivers that are needed to send digital video signals longer distances. It will support playback and distribution of digital and analog video formats and the transport system will be compatible with newer generation 4K sources.

System Control

The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of a 10" LCD touch screen at the presentation area. The control panel will be able to control all functions of the audiovisual system; including source selection and media transport controls, volume control, and can interface with other operational functions including lighting and HVAC. Control system processing will be embedded in the video matrix switch.

Miscellaneous

Miscellaneous equipment will include a floor-standing and lockable equipment rack, AC power distribution and sequencers in the racks, custom connection panels, and all cable, connectors, and additional hardware and labeling required to install the system.

Book Rooms

The Book Rooms will be used for workgroups and tutorial sessions. The audiovisual systems will each comprise of the following sub-systems:

Sound System

- Loudspeakers: A pair of wall-mounted loudspeakers will be used for program audio playback. Amplifiers will be provided to power the loudspeakers.
- Assistive Listening System: An infrared-based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers (i.e., headphones) will be stored centrally and issued to participants as required. These receivers are intended to be used by patrons with hearing impairments.

Display System

- Video Display Panel: The system will display computer and motion video using a wall-mounted video display panel.
- AV Sources: AV sources will include inputs for portable AV devices, such as a laptop computer or portable audio player. It will be available at the front of the room on a wall-mounted receptacle panel.

System Control

The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of a wall-mounted button panel. It will be able to control all functions of the audiovisual system; including source selection, volume control, and power.

Miscellaneous
Miscellaneous equipment will include custom connection panels, and all cable, connectors, and additional hardware and labeling required to install the system.

GYMNASIUM
The Gymnasium will be used for practice, large games, presentations, and events. The audiovisual system will comprise of a number of sub-systems that include the following:

Sound System
- Microphones: The system will include one wireless handheld microphone transmitter. Connections for wired microphones will be available at wall-mounted receptacle panels and on a portable equipment rack.
- Audio Processing and Mixing: A digital audio signal processor will be used for automatic microphone mixing, and equalizing the loudspeakers. An 8-channel audio mixer in the portable equipment rack will be used to mix microphones and other audio sources.
- Loudspeakers: Distributed ceiling-mounted loudspeakers will be provided for speech reinforcement and program audio playback. Loudspeakers will be zoned so that they can be used over the entire Gymnasium floor, or over the individual courts (please note that we not anticipate sufficient acoustical isolation between the courts, and it is not recommended to use the two courts simultaneously for different audio playback or reinforcement). For larger events and games, additional loudspeakers will be used to provide coverage to the bleacher seating area. Amplifiers will be used to power the loudspeakers.
- Assistive Listening System: An FM or infrared based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers, intended for use by patrons with hearing impairments, will be stored centrally and issued to participants as required. Inductive neck loop adapters will be provided along with the receivers for compatibility with telecoil-enabled hearing aids.

System Control
The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of one wall-mounted 5” LCD touch screen, and an additional 5” LCD touch screen in the portable equipment rack. The control panel will be able to control all functions of the audiovisual system; including source selection and media transport controls, and volume control.

Miscellaneous:
Miscellaneous equipment will include a floor-standing and lockable equipment rack, a portable equipment rack for use during events and games, AC power distribution and sequencers in the rack(s), custom connection panels, and all cable, connectors, and additional hardware and labeling required to install the system.

ARCHITECTURAL, MECHANICAL, AND ELECTRICAL CONSIDERATIONS

1. Architectural: The following items should be considered for proper coordination between audiovisual system components and other trades:
   a. Loudspeaker coverage must not be obstructed.
   b. Structure will be necessary to ensure that loudspeakers and the projection screen can be ceiling-mounted at recommended locations.
   c. Antennas for the assistive listening system and wireless microphones will be mounted on the wall.
   d. Wall-mounted connection panel locations will require coordination.
   e. Ceiling-mounted video projectors must be free from vibration.
2. AV Equipment Racks:
   a. Equipment racks will require coordination for space and cooling/airflow requirements. This will include floor-standing equipment racks, and any small equipment racks that may be installed within millwork.

i. Floor-standing AV equipment racks shall be fixed in position and will require front access for day-to-day operational needs. They will also require rear access for service. Clearances must be maintained around the AV equipment racks (36") to comply with the requirements of the Americans with Disabilities Act.
ii. AV equipment rack rooms may require oversized doors.

3. Auditorium Mixing Console:
   a. The Control Booth's mixing position will require ample space for operation of the console and other items such as scripts required for rehearsals or performances. The audio console is 48" wide by 36" deep.
   b. Control Booth:
      i. Please note the following guidelines:
         1. Coordination will be required with the acoustical consultant to maintain proper acoustical isolation between the Auditorium and the Control Booth.
         2. The glass in front of the video projector should be low iron. It should also be tilted between 2 and 5 degrees. Coordinate direction of tilt with the acoustical consultant.
4. Video Projection:
   a. In order to optimize the viewing experience and achieve the minimum recommended video display contrast ratio, ambient lighting within the spaces with projection will need to be reviewed. Additionally, overhead lighting should be zoned so that lighting areas directly above the projection screen surfaces can be switched off during presentations.
   b. Whiteboards & marker boards that are used as a projection surfaces shall be of projection quality so that they minimize reflections and projection hotspots.
5. Blocking will be required at all wall-mounted video display panel and loudspeaker locations.
6. Mechanical/Electrical: The following items should be considered for proper coordination between the audiovisual system components and other trades:
   a. The AC power system will be designed and specified by the electrical engineer and will include a dedicated power panel, transient voltage surge suppression, and AC outlets.
   b. Electrical outlets will be required at the equipment racks, mix location floor-box, and wall-mounted receptacle panels.
   c. IT data drops are strongly recommended at the equipment racks and all AV receptacle panels.
   d. If lighting control is desired from the audiovisual system control touch panel, the lighting system will require an interface for communication with the control system.
   e. Equipment Rack Locations:
      i. AC power requirements and heat loads will need to be considered at each equipment rack and video projector location.

* * * * * *

End of Feasibility Study

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

G. COST ESTIMATE

The OPM and designer's estimator conducted a level 2 estimate as required by the MSBA.

After completion of both estimates, a reconciliation process commenced and the final construction costs are noted herein. The OPM added the appropriated factor for soft cost to create the total project cost budget.

Option 1 – Base Repair

Grade 7-12

Proposed Construction Cost	$89,192,522
Project Total Project Budget	$111,490,653

Option 2.1 – Major Reno- Minor Add

Grade 7-12

Proposed Construction Cost	$241,676,850
Project Total Project Budget	$302,096,061

Option 2.3 – Minor Reno- Major Add

Grade 7-12

Proposed Construction Cost	$245,805,460
Project Total Project Budget	$307,256,825

Option 2.4 – Minor Reno- Major Add

Grade 7-12

Proposed Construction Cost	$245,770,439
Project Total Project Budget	$307,161,440

Option 3.1 – New Construction

Grade 7-12

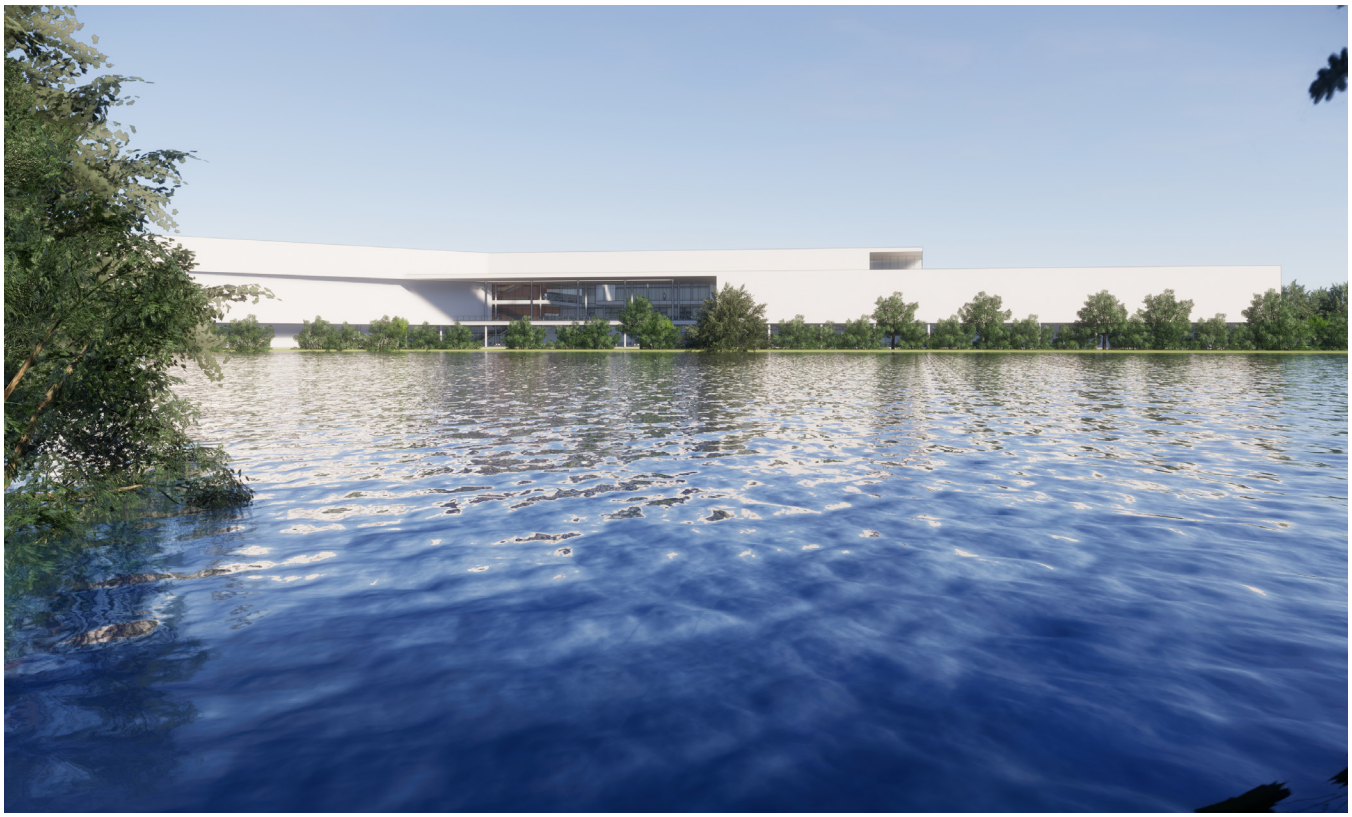
Proposed Construction Cost	$235,060,850
Project Total Project Budget	$293,826,063

DAEDALUS

Belmont High School
Preferred Schematic Option Selection Study
Belmont, MA

February 14, 2018

PSR Cost Estimate



Architect:
Perkins+Will
225 Franklin St,
Boston, MA 02110
(617) 478-0300

Owner's Project Manager:
Daedalus Projects, Inc.
1 Faneuil Hall Marketplace
South Market Bldg, Suite 4195
Boston, MA 02109
(617) 451 2717

INTRODUCTION

Project Description:

Analysis and comparison of Schematic Design Belmont High School Selection Study Options:
- hazardous material abatement
- partial or entire demolition of existing school building
- renovations, addition, and new construction
- new site utility infrastructure and improvements

Existing School Site Options:
- Option 1: Renovations and Repairs
- Option 2.1: Major Renovations and Minor Addition to existing School, phased
- Option 2.3: Minor Renovations and Major Addition, phased
- Option 2.4: Minor Renovations and Major Addition, phased
- Option 3.1: New Construction

Configuration of School Program applied to all Renovation and Addition options:
- 7-12 High School for 2,215 Students; 451,800gsf

Configuration of School Program applied to New Construction options:
- 7-12 High School for 2,215 Students; 422,925gsf

Project Particulars:

Schematic Design Documents received from Perkins+Will
- Site Plan and Building Plan Diagrams for Option C.2.1, C.2.3, C.2.4 and C.3.1 dated January 16, 2018
- Building Plan Diagrams for Option C.2.1 dated January 18, 2018
- Existing Building Floor Plans and Roof Plan received January 24, 2018

Structural Narratives for all Options by Engineers Design Group, Inc. dated January 22, 2018
Structural Narratives - Code Updates by Engineers Design Group, Inc. dated January 22, 2018
Detailed quantity takeoffs where possible from design documents and reports
Daedalus Projects, Inc. site visits
Daedalus Projects, Inc. experience with similar projects of this nature

Project Assumptions:

The project will be managed and built by a Construction Manager under a CM at Risk single prime contract
Our costs assume that there will be at least three subcontractors submitting unrestricted bids in each filed sub-trade
Unit rates are escalated to mid-point of construction duration and utilizing prevailing wage labor rates
Operation during normal working hours
Lay-down/storage area, jobsite shed and trailers, and construction site entrance will be located adjacent to Project area
Noise and vibration disturbances are anticipated and will be minimized or avoided during normal business hours
Phasing and logistics will be required where existing school is open and operational
Temporary electrical and water site utility connections will be available. General Conditions value includes utility connections and consumption costs
Existing water pressure is adequate for servicing the new building

INTRODUCTION

Project Assumptions: cont'd

Subcontractor's markups are included in each unit rate. These markups cover field and home office overhead and subcontractor's profit

Design and Pricing Contingency markup is an allowance for unforeseen design issues, design detail development and specification clarifications during the design period

Remainder of General Conditions covers general facilities to support Project, and site office overheads that are not attributable to the direct trade costs

Project Requirements value covers winter conditions, scaffolding, staging and access, temporary protection, and cleaning

Fee markup is calculated on a percentage of direct construction costs

Anticipated start of construction April 2020

- Option 2.1: Major Renovations and Minor Addition to existing School, phased, construction duration 48 months
- Option 2.3: Minor Renovations and Major Addition, phased, construction duration 42 months
- Option 2.4: Minor Renovations and Major Addition, phased, construction duration 42 months
- Option 3.1: New Construction, construction duration 36 months

Escalation allowance has been calculated at a rate of 3½% per year

Construction Cost Estimate Exclusions:

Work beyond the boundary of the site

Winter conditions

Pre-construction services

Unforeseen Conditions Contingency

Architectural/Engineering; Designer and other Professional fees, testing, printing, surveying

Owner's administration; legal fees, advertising, permitting, Owner's insurance, administration, interest expense

Project costs; utility company back charges prior to construction, construction of swing space and temporary facilities, program related phasing, relocation

Owner furnished and installed products; computer networking, desks, chairs, furnishings, equipment, artwork, loose case goods and other similar items

Utility company back charges during construction

Third Party testing & commissioning

Wetlands protection or restoration

Police details and street/sidewalk permits

G. COST ESTIMATE / OPM

GRADES 7-12 MAIN SUMMARY

ELEMENT				OPTION 1. Repairs Only 239,354 GSF 24 MTH	
Direct Trade Costs Details				$47,886,114	$200.06
Hazardous Material Abatement				$7,100,000	$27.61
Direct Trade Details SubTotal				**$54,986,114**	**$229.73**
Design and Pricing Contingency				$8,248,000	$34.46
Direct Trade Cost Total				**$63,234,114**	**$264.19**
Staffing, Supervision and Management				$4,800,000	$20.05
Remainder of General Conditions, Project Requirements				$3,200,000	$13.37
Phasing and Logistics				$1,580,900	$6.60
General Liability Insurance				$728,000	$3.04
Performance and Payment Bonds				$633,000	$2.64
GMP Contingency				$3,162,000	$13.21
Fee				$2,214,000	$9.25
Estimated Construction Cost Total				**$79,552,014**	**$332.36**
Escalation from now to start of Construction				$5,988,000	$25.02
Estimated Construction Cost at Start of Construction				**$85,541,000**	**$357.38**

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

G. COST ESTIMATE / OPM

GRADE 7-12 DIRECT TRADE COST SUMMARY

ELEMENT				OPTION 1. Repairs Only 239,354 GSF	
A10 Foundations				$615,439	$2.57
A SUBSTRUCTURE				**$615,439**	**$2.57**
B10 Superstructure				$738,385	$3.08
B20 Exterior Closure				$4,341,550	$18.14
B30 Roofing				$100,000	$0.42
B SHELL				**$5,179,935**	**$21.64**
C10 Interior Construction				$3,953,217	$16.52
C20 Stairs				$210,500	$0.88
C30 Interior Finishes				$5,549,580	$23.19
C INTERIORS				**$9,713,297**	**$40.58**
D10 Conveying				$275,000	$1.15
D20 Plumbing				$2,872,248	$12.00
D30 HVAC				$10,770,930	$45.00
D40 Fire Protection				$1,124,964	$4.70
D50 Electrical				$9,574,160	$40.00
D SERVICES				**$24,617,302**	**$102.85**
E10 Equipment				$1,914,832	$8.00
E20 Furnishings				$2,393,540	$10.00
E EQUIPMENT & FURNISHINGS				**$4,308,372**	**$18.00**
G1020 Site Demolition, Selective Demolition				$1,436,770	$6.00
G1030 Earthwork				$85,000	$0.36
G1040 Hazardous Material Abatement				$7,100,000	$29.66
G10 SITE PREPARATION				**$8.621.770**	**$36.02**
G2010 Paving and Surfacing				$1,475,000	$6.16
G2040 Site Improvements				$240,000	$1.00
G2050 Plantings, Soft Landscaping				$125,000	$0.52
G20 SITE IMPROVEMENTS				**$1,840,000**	**$7.69**
G3010 Water Supply and Distribution				$50,000	$0.21
G3020 Sanitary Sewer System				$40,000	$0.17
G30 SITE MECHANICAL UTILITIES				**$90,000**	**$0.38**
Direct Trade Details SubTotal				**$54,986,114**	**$229.73**

G. COST ESTIMATE / OPM

AEDALUS

Belmont High School

Preferred Schematic Option Selection Study

GRADE 7-12 DIRECT TRADE COST DETAILS

	ELEMENT	UNIT	UNIT RATE				OPTION 1. Repairs Only QUANTITY	OPTION 1. Repairs Only COST
10	***Repairs only at Existing Building***						***239,354***	***GSF***
11								
12	**A SUBSTRUCTURE**							
13								
14	**A10 Foundations**							
15	Miscellaneous crack repairs and resurfacing at foundations	LS	$25,000.00				**1**	$25,000
16	Cutting and patching for new MEP system installs	GSF	$0.25				**239,354**	$59,839
17	New slab on grade; bathrooms, showers, kitchen	SF	$20.00				**11,500**	$230,000
18	Repair slab on grade; Fieldhouse	SF	$1.50				**20,400**	$30,600
19	12" structured slab, piles; new ramps	AL	$250,000.00				**1**	$250,000
20	New equipment pads	LS	$20,000.00				**1**	$20,000
21	**A10 Foundations Total**							**$615,439**
22								
23								
24	**B SHELL**							
25								
26	**B10 Superstructure**							
27	Cutting and patching for new MEP system installs	GSF	$0.50				**239,354**	$119,677
28	New ramps at upper floors	AL	$90,000.00				**1**	$90,000
29	2hr fireproofing of existing structure	GSF	$2.00				**239,354**	$478,708
30	Roof dunnage and supports	LS	$50,000.00				**1**	$50,000
31	**B10 Superstructure Total**							**$738,385**
32								
33	**B20 Exterior Closure**							
34	Repair brick facade, repoint, clean, staging	SF	$40.00				**40,000**	$1,600,000
35	precast concrete panels and decoration trims	SF	$33.00				**13,000**	$429,000
36	Remove metal wall panels, new composite metal wall panels	SF	$68.50				**5,500**	$376,750
37	Remove fascia panels, new ribbon aluminum fascia panels	SF	$73.50				**5,700**	$418,950
38	colored aluminum fascia panels	SF	$78.50				**2,500**	$196,250
39	Recaulk existing control joints	LS	$40,000.00				**1**	$40,000
40	Upgrade Courtyard exist to ADA code compliance	LS	$20,000.00				**1**	$20,000
41	Remove glazed opening, new window/curtainwall/translucent panels	SF	$95.00				**9,500**	$902,500
42	Remove louver, new architectural louver	SF	$60.00				**700**	$42,000
43	Remove door, new exterior pair of glazed doors	PR	$8,500.00				**15**	$127,500
44	single glazed door	LEAF	$4,000.00				**3**	$12,000
45	Remove door, new exterior pair of doors	PR	$4,000.00				**23**	$92,000
46	single door	LEAF	$2,100.00				**3**	$6,300
47	Remove overhead door, new overhead door	OPEN	$10,000.00				**6**	$60,000
48	Rough carpentry at all openings	SF	$1.50				**12,200**	$18,300
49	**B20 Exterior Closure Total**							**$4,341,550**
50								
51	**B30 Roofing**							
52	Patch roofing at new MEP installs	LS	$35,000.00				**1**	$35,000

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

G. COST ESTIMATE / OPM

GRADE 7-12 DIRECT TRADE COST DETAILS

	ELEMENT	UNIT	UNIT RATE						OPTION 1. Repairs Only QUANTITY	OPTION 1. Repairs Only COST
53	New stage smoke hatch	OPEN	$10,000.00						4	$40,000
54	Replace roof ladder/hatch/etc.	LS	$25,000.00						1	$25,000
55	**B30 Roofing Total**									**$100,000**
56										
57										
58	**C INTERIORS**									
59										
60	**C10 Interior Construction**									
7	Repair interior partitions	GSF	$6.50						239,354	$1,555,801
62	Remove glazed interior openings, new borrowed lites/sidelights	AL	$75,000.00						1	$75,000
63	Modify door opening for code compliance, new door set	OPEN	$3,350.00						150	$502,500
64	Remove door, new door set	LEAF	$1,000.00						300	$300,000
65	Lockers	EA	$250.00						1,470	$367,500
66	Replace equipment; athletic, workshop, music, band	AL	$100,000.00						1	$100,000
67	New guardrails and railings	LF	$95.00						1,000	$95,000
68	Specialties	GSF	$4.00						239,354	$957,416
69	**C10 Interior Construction Total**									**$3,953,217**
70										
71	**C20 Stairs**									
72	Upgrade existing stair; replace railings	FLT	$10,000.00						9	$90,000
73	New stairs	FLT	$30,000.00						2	$60,000
74	New rubber treads, risers and landings	FLT	$5,500.00						11	$60,500
75	**C20 Stairs Total**									**$210,500**
76										
77	**C30 Interior Finishes**									
78	New tile flooring; bathrooms, lockers, corridors	SF	$20.00						25,000	$500,000
79	Floor finishes	GSF	$10.00						239,354	$2,393,540
80	Ceiling finishes	GSF	$7.75						239,354	$1,854,994
81	New wall finishes; Auditorium, Little Theater	AL	$150,000.00						1	$150,000
82	Acoustic wall panels; Gym	AL	$50,000.00						1	$50,000
83	Practice, Music	SF	$25.00						2,500	$62,500
84	Prep and paint	GSF	$2.25						239,354	$538,547
85	**C30 Interior Finishes Total**									**$5,549,580**
86										
87										
88	**D SERVICES**									
89										
90	**D10 Conveying**									
91	Elevator; demo and disposal	EA	$50,000.00						1	$50,000
92	Elevator; new	EA	$190,000.00						1	$190,000
93	Lift; new, Auditorium	EA	$35,000.00						1	$35,000
94	**D10 Conveying Total**									**$275,000**
95										

G. COST ESTIMATE / OPM

GRADE 7-12 DIRECT TRADE COST DETAILS

	ELEMENT	UNIT	UNIT RATE				OPTION 1. Repairs Only QUANTITY	OPTION 1. Repairs Only COST
96								
97								
98	**D20 Plumbing**							
99	Plumbing	GSF	$12.00				**239,354**	$2,872,248
100	**D20 Plumbing Total**							**$2,872,248**
101								
102	**D30 HVAC**							
103	HVAC	EA	$45.00				**239,354**	$10,770,930
104	**D30 HVAC Total**							**$10,770,930**
105								
106	**D40 Fire Protection**							
107	Sprinkler Coverage	GSF	$4.70				**239,354**	$1,124,964
108	**D40 Fire Protection Total**							**$1,124,964**
109								
110	**D50 Electrical**							
105	Interior Electrical	GSF	$40.00				**239,354**	$9,574,160
112	**D50 Electrical Total**							**$9,574,160**
113								
114								
115	**E EQUIPMENT & FURNISHINGS**							
116								
117	**E10 Equipment**							
118	Allowance	GSF	$8.00				**239,354**	$1,914,832
119	**E10 Equipment Total**							**$1,914,832**
120								
121	**E20 Furnishings**							
122	Allowance	GSF	$10.00				**239,354**	$2,393,540
123	**E20 Furnishings Total**							**$2,393,540**
124								
125								
126	**G10 SITE PREPARATION**							
127								
128	**G1020 Site Demolition, Selective Demolition**							
129	Selective Site Demolition	AL	$240,000.00				**1**	$240,000
130	Existing school program interior selective demolition	GSF	$5.00				**239,354**	$1,196,770
131	**G1020 Site Demolition, Selective Demolition Total**							**$1,436,770**
132								
133	**G1030 Earthwork**							
134	Allowance	AL	$85,000.00				**1**	$85,000
135	**G1030 Earthwork Total**							**$85,000**
136								
137	**G1040 Hazardous Material Abatement**							
138	Removal and disposal of all ACM, PCB and other hazardous materials	AL	$7,100,000.00				**1**	$7,100,000

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

G. COST ESTIMATE / OPM

GRADE 7-12 DIRECT TRADE COST DETAILS

	ELEMENT	UNIT	UNIT RATE					OPTION 1. Repairs Only QUANTITY	OPTION 1. Repairs Only COST
139	**G1040 Hazardous Material Abatement Total**								**$7,100,000**
140									
141									
142	**G20 SITE IMPROVEMENTS**								
143									
144	**G2010 Paving and Surfacing**								
145	Allowance	AL	$750,000.00					1	$750,000
146	Sports fields	AL	$725,000.00					1	$725,000
147	**G2010 Paving and Surfacing Total**								**$1,475,000**
148									
149	**G2040 Site Improvements**								
150	Allowance	AL	$240,000.00					1	$240,000
151	**G2040 Site Improvements Total**								**$240,000**
152									
153	**G2050 Plantings, Soft Landscaping**								
154	Allowance	AL	$125,000.00					1	$125,000
155	**G2050 Plantings, Soft Landscaping Total**								**$125,000**
156									
157									
158	**G30 SITE MECHANICAL UTILITIES**								
159									
160	**G3010 Water Supply and Distribution**								
161	Allowance	AL	$50,000.00					1	$50,000
162	**G3010 Water Supply and Distribution Total**								**$50,000**
163									
164	**G3020 Sanitary Sewer System**								
165	Allowance	AL	$40,000.00					1	$40,000
166	**G3020 Sanitary Sewer System Total**								**$40,000**
167									
168									
169									

G. COST ESTIMATE / OPM

GRADES 7-12 MAIN SUMMARY

ELEMENT	OPTION C.2.1 Major Reno/Minor Add 451,800 GSF 48 MTH		OPTION C.2.3 Minor Reno/Major Add 451,800 GSF 42 MTH		OPTION C.2.4 Minor Reno/Major Add 451,800 GSF 42 MTH		OPTION C.3.1 New Construction 422,925 GSF 36 MTH	
Direct Trade Costs Details	$165,505,920	$366.33	$154,951,614	$342.97	$164,364,161	$363.80	$158,838,979	$375.57
Building Demolition	$84,303	$8.50	$1,632,595	$8.50	$1,632,595	$8.50	$1,478,440	$5.75
Hazardous Material Abatement	$7,100,000	$27.61	$7,100,000	$27.61	$7,100,000	$27.61	$7,100,000	$27.61
Concord Ave. Traffic Mitigation	$2,000,000	$4.43	$2,000,000	$4.43	$2,000,000	$4.43	$2,000,000	$4.73
Direct Trade Details SubTotal	**$174,690,223**	**$386.65**	**$165,684,209**	**$366.72**	**$175,096,756**	**$387.55**	**$169,417,419**	**$400.59**
Design and Pricing Contingency	$20,963,000	$46.40	$19,883,000	$44.01	$17,510,000	$38.76	$16,942,000	$40.06
Direct Trade Cost Total	**$195,653,223**	**$433.05**	**$185,567,209**	**$410.73**	**$192,606,756**	**$426.31**	**$186,359,419**	**$440.64**
Staffing, Supervision and Management	$9,600,000	$21.25	$8,190,000	$18.13	$8,190,000	$18.13	$6,840,000	$16.17
Remainder of General Conditions, Project Requirements	$6,400,000	$14.17	$5,460,000	$12.08	$5,460,000	$12.08	$4,560,000	$10.78
Phasing and Logistics	$4,891,400	$10.83	$2,783,600	$6.16	$2,889,200	$6.39	$931,800	$2.20
General Liability Insurance	$2,251,000	$4.98	$2,135,000	$4.73	$2,215,000	$4.90	$2,144,000	$5.07
Performance and Payment Bonds	$1,957,000	$4.33	$1,856,000	$4.11	$1,927,000	$4.27	$1,864,000	$4.41
GMP Contingency	$9,783,000	$21.65	$9,279,000	$20.54	$9,631,000	$21.32	$4,659,000	$11.02
Fee	$6,848,000	$15.16	$6,031,000	$13.35	$6,260,000	$13.86	$5,591,000	$13.22
Estimated Construction Cost Total	**$237,383,623**	**$525.42**	**$221,301,809**	**$489.82**	**$229,178,956**	**$507.26**	**$212,949,219**	**$503.52**
Escalation from now to start of Construction	$17,867,000	$39.55	$16,657,000	$36.87	$17,250,000	$38.18	$16,028,000	$37.90
Estimated Construction Cost at Start of Construction	**$255,251,000**	**$564.96**	**$237,959,000**	**$526.69**	**$246,429,000**	**$545.44**	**$228,978,000**	**$541.42**

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

G. COST ESTIMATE / OPM

GRADE 7-12 DIRECT TRADE COST SUMMARY

ELEMENT	OPTION C.2.1 Major Reno/Minor Add 451,800 GSF		OPTION C.2.3 Minor Reno/Major Add 451,800 GSF		OPTION C.2.4 Minor Reno/Major Add 451,800 GSF		OPTION C.3.1 New Construction 422,925 GSF	
A10 Foundations	$14,139,581	$31.30	$14,629,208	$32.38	$14,216,828	$31.47	$17,114,941	$40.47
A SUBSTRUCTURE	**$14,139,581**	**$31.30**	**$14,629,208**	**$32.38**	**$14,216,828**	**$31.47**	**$17,114,941**	**$40.47**
B10 Superstructure	$9,703,272	$21.48	$16,630,192	$36.81	$16,381,833	$36.26	$17,441,657	$41.24
B20 Exterior Closure	$31,987,420	$70.80	$17,436,140	$38.59	$24,323,016	$53.84	$22,967,000	$54.31
B30 Roofing	$10,428,423	$23.08	$8,748,591	$19.36	$9,532,434	$21.10	$8,658,448	$20.47
B SHELL	**$52,119,114**	**$115.36**	**$42,814,923**	**$94.77**	**$50,237,283**	**$111.19**	**$49,067,105**	**$116.02**
C10 Interior Construction	$14,683,500	$32.50	$14,683,500	$32.50	$14,683,500	$32.50	$13,745,063	$32.50
C20 Stairs	$435,000	$0.96	$565,000	$1.25	$790,000	$1.75	$550,000	$1.30
C30 Interior Finishes	$13,022,885	$28.82	$12,580,250	$27.84	$12,580,250	$27.84	$11,630,438	$27.50
C INTERIORS	**$28,141,385**	**$62.29**	**$27,828,750**	**$61.60**	**$28,053,750**	**$62.09**	**$25,925,500**	**$61.30**
D10 Conveying	$430,000	$0.95	$430,000	$0.95	$430,000	$0.95	$380,000	$0.90
D20 Plumbing	$5,421,600	$12.00	$5,421,600	$12.00	$5,421,600	$12.00	$5,075,100	$12.00
D30 HVAC	$24,331,000	$53.85	$24,331,000	$53.85	$24,331,000	$53.85	$23,031,625	$54.46
D40 Fire Protection	$2,223,460	$4.92	$2,223,460	$4.92	$2,223,460	$4.92	$2,087,748	$4.94
D50 Electrical	$18,601,200	$41.17	$18,601,200	$41.17	$18,601,200	$41.17	$17,619,450	$41.66
D SERVICES	**$51,007,260**	**$112.90**	**$51,007,260**	**$112.90**	**$51,007,260**	**$112.90**	**$48,193,923**	**$113.95**
E10 Equipment	$1,879,500	$4.16	$1,879,500	$4.16	$1,879,500	$4.16	$1,057,313	$2.50
E20 Furnishings	$3,653,353	$8.09	$4,627,150	$10.24	$4,627,150	$10.24	$4,652,175	$11.00
E EQUIPMENT & FURNISHINGS	**$5,532,853**	**$12.25**	**$6,506,650**	**$14.40**	**$6,506,650**	**$14.40**	**$5,709,488**	**$13.50**
G1010 Site Clearing, Site Preparation	$685,272	$1.52	$685,272	$1.52	$685,272	$1.52	$685,272	$1.62
G1020 Building Demolition	$84,303	$0.19	$1,632,595	$3.61	$1,632,595	$3.61	$1,478,440	$3.50
G1020 Site Demolition, Selective Demolition	$2,819,087	$6.24	$1,048,547	$2.32	$1,048,547	$2.32	$425,547	$1.01
G1030 Earthwork	$467,310	$1.03	$505,535	$1.12	$513,184	$1.14	$462,640	$1.09
G1040 Hazardous Material Abatement	$7,100,000	$15.71	$7,100,000	$15.71	$7,100,000	$15.71	$7,100,000	$16.79
G10 SITE PREPARATION	**$11,155,972**	**$24.69**	**$10,971,950**	**$24.28**	**$10,979,598**	**$24.30**	**$10,151,899**	**$24.00**
G2010 Paving and Surfacing	$5,814,210	$12.87	$5,594,822	$12.38	$6,648,712	$14.72	$5,651,144	$13.36
G2040 Site Improvements	$171,400	$0.38	$171,400	$0.38	$305,660	$0.68	$171,400	$0.41
G2050 Plantings, Soft Landscaping	$624,934	$1.38	$526,897	$1.17	$659,831	$1.46	$959,905	$2.27
G20 SITE IMPROVEMENTS	**$6,610,544**	**$14.63**	**$6,293,119**	**$13.93**	**$7,614,203**	**$16.85**	**$6,782,449**	**$16.04**
G3010 Water Supply and Distribution	$417,850	$0.92	$417,850	$0.92	$417,850	$0.92	$417,850	$0.99
G3020 Sanitary Sewer System	$314,000	$0.69	$350,000	$0.77	$349,500	$0.77	$290,500	$0.69
G3030 Stormwater Management System	$1,868,514	$4.14	$1,623,348	$3.59	$2,366,184	$5.24	$2,423,215	$5.73
G4010 Site Electrical Utilities	$1,383,150	$3.06	$1,241,150	$2.75	$1,347,650	$2.98	$1,340,550	$3.17
G30 SITE MECHANICAL UTILITIES	**$3,983,514**	**$8.82**	**$3,632,348**	**$8.04**	**$4,481,184**	**$9.92**	**$4,472,115**	**$10.57**
Direct Trade Details SubTotal	**$172,690,223**	**$382.23**	**$163,684,209**	**$362.29**	**$173,096,756**	**$383.13**	**$167,417,419**	**$395.86**

G. COST ESTIMATE / OPM

GRADE 7-12 DIRECT TRADE COST DETAILS

	ELEMENT	UNIT	UNIT RATE	OPTION C.2.1 Major Reno/Minor Add QUANTITY	OPTION C.2.1 Major Reno/Minor Add COST	OPTION C.2.3 Minor Reno/Major Add QUANTITY	OPTION C.2.3 Minor Reno/Major Add COST	OPTION C.2.4 Minor Reno/Major Add QUANTITY	OPTION C.2.4 Minor Reno/Major Add COST	OPTION C.3.1 New Construction QUANTITY	OPTION C.3.1 New Construction COST
10	***Total***			***451,800***	***GSF***	***451,800***	***GSF***	***451,800***	***GSF***	***422,925***	***GSF***
11	*Renovation*			*239,354*	*GSF*	*62,300*	*GSF*	*62,300*	*GSF*		
12	*New Construction / Addition*			*212,446*	*GSF*	*389,500*	*GSF*	*389,500*	*GSF*	*422,925*	*GSF*
13	*Building Demolition*			*9,918*	*GSF*	*192,070*	*GSF*	*192,070*	*GSF*	*257,120*	*GSF*
14											
15	**A SUBSTRUCTURE**										
16											
17	**A10 Foundations**										
18	*Reinforced concrete pile caps, structural steel piles, structured slab*										
19	steel pile, 50-ton; assume 25'long	LF	$75.00	**92,250**	$6,918,750	**105,750**	$7,931,250	**102,750**	$7,706,250	**125,250**	$9,393,750
20	concrete pile; 8x8x4 at clusters, 2x2x2 at single pile	EA	$5,340.00	**500**	$2,670,000	**610**	$3,257,400	**590**	$3,150,600	**730**	$3,898,200
21	grade beam at perimeter; 5' deep	LF	$590.00	**3,075**	$1,814,250	**2,110**	$1,244,900	**2,070**	$1,221,300	**2,125**	$1,253,750
22	grade beam at slab on grade; assume 60'oc grid	LF	$590.00	**390**	$230,100	**620**	$365,800	**600**	$354,000	**780**	$460,200
23	12" structured slab on grade, 6#/sf reinforcing, vapor barrier, 2" rigid insu	SF	$12.00	**77,950**	$935,400	**122,633**	$1,471,596	**119,300**	$1,431,600	**155,585**	$1,867,020
24	compacted granular structural fill; assume 12"	CY	$40.00	**3,031**	$121,256	**4,769**	$190,762	**4,639**	$185,578	**6,051**	$242,021
25	*New brace frames in existing to renovation areas*										
26	demo sog for new pile, patch and repair after install	LOC	$4,000.00	**25**	$100,000	**9**	$36,000	**9**	$36,000		
27	install new pile and pile cap	EA	$8,700.00	**25**	$217,500	**9**	$78,300	**9**	$78,300		
28	demo sog for new tie beam, patch and repair after install	LF	$190.00	**760**	$144,400	**280**	$53,200	**280**	$53,200		
29	*New building over Level 2 for Level 3 additions*										
30	demo sog for new pile, patch and repair after install	LOC	$4,000.00	**54**	$216,000						
31	install new pile and pile cap	EA	$8,700.00	**54**	$469,800						
32	demo sog for new tie beam, patch and repair after install	LF	$190.00	**1,590**	$302,125						
33	**A10 Foundations Total**				**$14,139,581**		**$14,629,208**		**$14,216,828**		**$17,114,941**
34											
35											
36	**B SHELL**										
37											
38	**B10 Superstructure**										
39	*New brace frames in existing to renovation areas*										
40	addition of brace frames; assume 2#/sf face area	TNS	$5,000.00	**24**	$120,000						
41	new masonry shear wall at existing building	SF	$25.00	**23,270**	$581,750						
42	Anchor un-reinforced masonry walls to floor & roof structure	EA	$150.00	**991**	$148,650	**326**	$48,900	**477**	$71,550		
43	Reinforce existing roof diaphragms to resist uplift loads; assume 1#/covera	TNS	$5,000.00	**38**	$192,183	**28**	$138,390	**23**	$116,328		
44	*New building over Level 2 for Level 3 additions*										
45	new columns from Level 1 up per floor	EA	$2,500.00	**56**	$140,000						
46	Structural steel floor framing - 13#/gsf allowance provided	TNS	$3,900.00							**1,738**	$6,777,069
47	15#/gsf allowance provided	TNS	$3,900.00	**1,009**	$3,934,008	**2,002**	$7,805,860	**2,027**	$7,903,350		
48	above multi-purpose rooms & PE space; 18#/gsf	TNS	$3,900.00	**134**	$522,007	**292**	$1,136,889	**311**	$1,211,652	**376**	$1,465,636
49	Structural steel roof framing - 13#/gsf allowance provided	TNS	$3,900.00	**461**	$1,798,456	**819**	$3,194,006	**718**	$2,799,401	**1,112**	$4,338,513
50	15#/gsf @ Gym & mechanical zone/low roof; add 2#/gsf	TNS	$4,680.00	**14**	$66,456	**25**	$117,936	**22**	$103,428	**55**	$255,996
51	5½" LWT slab on composite metal deck, fireproofing; upper slabs	SF	$12.50	**134,496**	$1,681,200	**266,867**	$3,335,838	**270,200**	$3,377,500	**267,340**	$3,341,750
52	low roof; assume 20% of roof area	SF	$12.50	**14,200**	$177,500	**25,200**	$315,000	**22,100**	$276,250	**34,300**	$428,750

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

G. COST ESTIMATE / OPM

GRADE 7-12 DIRECT TRADE COST DETAILS

	ELEMENT	UNIT	UNIT RATE	OPTION C.2.1 Major Reno/Minor Add QUANTITY	OPTION C.2.1 Major Reno/Minor Add COST	OPTION C.2.3 Minor Reno/Major Add QUANTITY	OPTION C.2.3 Minor Reno/Major Add COST	OPTION C.2.4 Minor Reno/Major Add QUANTITY	OPTION C.2.4 Minor Reno/Major Add COST	OPTION C.3.1 New Construction QUANTITY	OPTION C.3.1 New Construction COST
53											
54	1½" Type B metal roof deck	SF	$3.75	**77,950**	$292,313	**122,633**	$459,874	**119,300**	$447,375	**155,585**	$583,444
55	5½" LWT slab on metal deck; mech zone assume 5% of roof area	SF	$12.50	**3,900**	$48,750	**6,200**	$77,500	**6,000**	$75,000	**7,800**	$97,500
56	3" Type NA acoustic metal roof deck; Gym	SF	$7.50							**20,400**	$153,000
57	**B10 Superstructure Total**				**$9,703,272**		**$16,630,192**		**$16,381,833**		**$17,441,657**
58											
59	**B20 Exterior Closure**										
60	Existing exterior façade to remain; repair, repoint, clean	SF	$40.00	**111,735**	$4,469,384	**20,090**	$803,580	**29,385**	$1,175,416		
61	remove and replace glazed openings; assume 20%	SF	$105.00	**22,350**	$2,346,750	**4,020**	$422,100	**5,880**	$617,400		
62	New façade; masonry, glass, doors	SF	$140.00	**179,795**	$25,171,286	**115,789**	$16,210,460	**160,930**	$22,530,200	**164,050**	$22,967,000
63	**B20 Exterior Closure Total**				**$31,987,420**		**$17,436,140**		**$24,323,016**		**$22,967,000**
64											
65	**B30 Roofing**										
66	Demo roof for new floor deck	SF	$15.00	**47,645**	$714,675						
67	Roofing; assume TPO	SF	$25.00	**70,945**	$1,773,625	**125,996**	$3,149,908	**110,430**	$2,760,750	**171,145**	$4,278,613
68	premium for green roof/teaching area - allowance agreed	AL	$500,000.00	**1**	$500,000	**1**	$500,000	**1**	$500,000	**1**	$500,000
69	add low roof/canopy	AL	$100.00	**14,800**	$1,480,000	**8,900**	$890,000	**20,800**	$2,080,000	**13,445**	$1,344,500
70	mechanical zone and screen - qty provided	LF	$750.00	**1,200**	$900,000	**1,200**	$900,000	**1,200**	$900,000	**1,200**	$900,000
71	soffits, fascia	LF	$425.00	**3,230**	$1,372,623	**2,215**	$941,184	**2,175**	$924,184	**2,230**	$947,835
72	Replace existing roofing w/new	SF	$30.00	**100,000**	$3,000,000	**56,000**	$1,680,000	**56,000**	$1,680,000		
73	Skylight - qty provided	SF	$125.00	**5,500**	$687,500	**5,500**	$687,500	**5,500**	$687,500	**5,500**	$687,500
74	**B30 Roofing Total**				**$10,428,423**		**$8,748,591**		**$9,532,434**		**$8,658,448**
75											
76											
77	**C INTERIORS**										
78											
79	**C10 Interior Construction**										
80	Renovate existing school	GSF	$32.50	**239,354**	$7,779,005	**62,300**	$2,024,750	**62,300**	$2,024,750		
81	Partitions	GSF	$20.00	**212,446**	$4,248,920	**389,500**	$7,790,000	**389,500**	$7,790,000	**422,925**	$8,458,500
82	Doors	GSF	$4.50	**212,446**	$956,007	**389,500**	$1,752,750	**389,500**	$1,752,750	**422,925**	$1,903,163
83	Storefront; assume 2% of interior walls	GSF	$1.75	**212,446**	$371,781	**389,500**	$681,625	**389,500**	$681,625	**422,925**	$740,119
84	Specialties	GSF	$6.25	**212,446**	$1,327,788	**389,500**	$2,434,375	**389,500**	$2,434,375	**422,925**	$2,643,281
85	**C10 Interior Construction Total**				**$14,683,500**		**$14,683,500**		**$14,683,500**		**$13,745,063**
86											
87	**C20 Stairs**										
88	Upgrade existing stair; assume replace railings	FLT	$15,000.00	**4**	$60,000	**1**	$15,000	**1**	$15,000		
89	New stairs	FLT	$35,000.00	**7**	$245,000	**12**	$420,000	**11**	$385,000	**12**	$420,000
90	Monumental/Open stair, allow	FLT	$65,000.00	**2**	$130,000	**2**	$130,000	**6**	$390,000	**2**	$130,000
91	**C20 Stairs Total**				**$435,000**		**$565,000**		**$790,000**		**$550,000**
92											
93	**C30 Interior Finishes**										
94	Renovate existing school	GSF	$30.00	**239,354**	$7,180,620	**62,300**	$1,869,000	**62,300**	$1,869,000		
95	*New School Building Construction*	*GSF*		***212,446***		***389,500***		***389,500***		***422,925***	

G. COST ESTIMATE / OPM

GRADE 7-12 DIRECT TRADE COST DETAILS

	ELEMENT	UNIT	UNIT RATE	OPTION C.2.1 Major Reno/Minor Add QUANTITY	OPTION C.2.1 Major Reno/Minor Add COST	OPTION C.2.3 Minor Reno/Major Add QUANTITY	OPTION C.2.3 Minor Reno/Major Add COST	OPTION C.2.4 Minor Reno/Major Add QUANTITY	OPTION C.2.4 Minor Reno/Major Add COST	OPTION C.3.1 New Construction QUANTITY	OPTION C.3.1 New Construction COST
96	wall finishes	GSF	$6.75	212,446	$1,434,011	389,500	$2,629,125	389,500	$2,629,125	422,925	$2,854,744
97	flooring	GSF	$10.75	212,446	$2,283,795	389,500	$4,187,125	389,500	$4,187,125	422,925	$4,546,444
98	ceiling finishes	GSF	$10.00	212,446	$2,124,460	389,500	$3,895,000	389,500	$3,895,000	422,925	$4,229,250
99	**C30 Interior Finishes Total**				**$13,022,885**		**$12,580,250**		**$12,580,250**		**$11,630,438**
100											
101											
102	**D SERVICES**										
103											
104	**D10 Conveying**										
105	Elevator; demo and disposal	EA	$50,000.00	1	$50,000	1	$50,000	1	$50,000		
106	Elevator; new	EA	$190,000.00	2	$380,000	2	$380,000	2	$380,000	2	$380,000
107	**D10 Conveying Total**				**$430,000**		**$430,000**		**$430,000**		**$380,000**
108											
109	**D20 Plumbing**										
110	Plumbing	GSF	$12.00	451,800	$5,421,600	451,800	$5,421,600	451,800	$5,421,600	422,925	$5,075,100
111	**D20 Plumbing Total**				**$5,421,600**		**$5,421,600**		**$5,421,600**		**$5,075,100**
112											
113	**D30 HVAC**										
114	HVAC	EA	$45.00	451,800	$20,331,000	451,800	$20,331,000	451,800	$20,331,000	422,925	$19,031,625
115	Geothermal wells; 6" dia borehole @ 20'oc grid x400' deep	EA	$10,000.00	400	$4,000,000	400	$4,000,000	400	$4,000,000	400	$4,000,000
116	**D30 HVAC Total**				**$24,331,000**		**$24,331,000**		**$24,331,000**		**$23,031,625**
117											
118	**D40 Fire Protection**										
119	Sprinkler Coverage	GSF	$4.70	451,800	$2,123,460	451,800	$2,123,460	451,800	$2,123,460	422,925	$1,987,748
120	Fire Pump	EA	$100,000.00	1	$100,000	1	$100,000	1	$100,000	1	$100,000
121	**D40 Fire Protection Total**				**$2,223,460**		**$2,223,460**		**$2,223,460**		**$2,087,748**
122											
123	**D50 Electrical**										
105	Interior Electrical	GSF	$34.00	451,800	$15,361,200	451,800	$15,361,200	451,800	$15,361,200	422,925	$14,379,450
125	Roof borne PV system - qty provided	SF	$36.00	90,000	$3,240,000	90,000	$3,240,000	90,000	$3,240,000	90,000	$3,240,000
126	**D50 Electrical Total**				**$18,601,200**		**$18,601,200**		**$18,601,200**		**$17,619,450**
127											
128											
129	**E EQUIPMENT & FURNISHINGS**										
130											
131	**E10 Equipment**										
132	Renovate existing school	GSF	$2.50	239,354	$598,385	62,300	$155,750	62,300	$155,750		
105	existing pool; new equipment - allowance agreed	AL	$750,000.00	1	$750,000	1	$750,000	1	$750,000		
134	New Construction / Addition	GSF	$2.50	212,446	$531,115	389,500	$973,750	389,500	$973,750	422,925	$1,057,313
135	**E10 Equipment Total**				**$1,879,500**		**$1,879,500**		**$1,879,500**		**$1,057,313**
136											
137											
138	**E20 Furnishings**										

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

G. COST ESTIMATE / OPM

GRADE 7-12 DIRECT TRADE COST DETAILS

	ELEMENT	UNIT	UNIT RATE	OPTION C.2.1 Major Reno/Minor Add		OPTION C.2.3 Minor Reno/Major Add		OPTION C.2.4 Minor Reno/Major Add		OPTION C.3.1 New Construction	
				QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST
139	Renovate existing school	GSF	$5.50	**239,354**	$1,316,447	**62,300**	$342,650	**62,300**	$342,650		
140	New Construction / Addition	GSF	$11.00	**212,446**	$2,336,906	**389,500**	$4,284,500	**389,500**	$4,284,500	**422,925**	$4,652,175
141	**E20 Furnishings Total**				**$3,653,353**		**$4,627,150**		**$4,627,150**		**$4,652,175**
142	**G10 SITE PREPARATION**										
143											
144	**G1010 Site Clearing, Site Preparation**										
145	Clearing and grubbing	ACRE	$4,000.00	**40**	$160,000	**40**	$160,000	**40**	$160,000	**40**	$160,000
146	Construction fence	LF	$12.00	**11,017**	$132,204	**11,017**	$132,204	**11,017**	$132,204	**11,017**	$132,204
147	Double construction gate	PR	$2,800.00	**4**	$11,200	**4**	$11,200	**4**	$11,200	**4**	$11,200
148	Strip and stockpile existing topsoil; assume avg. 6"	CY	$8.00	**13,383**	$107,064	**13,383**	$107,064	**13,383**	$107,064	**13,383**	$107,064
149	Temporary construction entrance including maintenance	EA	$9,000.00	**4**	$36,000	**4**	$36,000	**4**	$36,000	**4**	$36,000
150	Temp signs	LS	$1,800.00	**2**	$3,600	**2**	$3,600	**2**	$3,600	**2**	$3,600
151	Wash down/re-fueling	SF	$2.00	**6,000**	$12,000	**6,000**	$12,000	**6,000**	$12,000	**6,000**	$12,000
152	Protection of existing to remain	LS	$35,000.00	**1**	$35,000	**1**	$35,000	**1**	$35,000	**1**	$35,000
153	Temporary parking lot	AL	$15,000.00	**1**	$15,000	**1**	$15,000	**1**	$15,000	**1**	$15,000
154	Dewatering	LS	$35,000.00	**1**	$35,000	**1**	$35,000	**1**	$35,000	**1**	$35,000
155	Erosion control barrier	LF	$12.00	**11,017**	$132,204	**11,017**	$132,204	**11,017**	$132,204	**11,017**	$132,204
156	Erosion control barrier at temporary construction period soil stockpile	AL	$3,500.00	**1**	$3,500	**1**	$3,500	**1**	$3,500	**1**	$3,500
157	Inlet protection	AL	$2,500.00	**1**	$2,500	**1**	$2,500	**1**	$2,500	**1**	$2,500
158	**G1010 Site Clearing, Site Preparation Total**				**$685,272**		**$685,272**		**$685,272**		**$685,272**
159											
160	**G1020 Building Demolition**										
161	Building structure demolition, phased	GSF	$8.50	**9,918**	$84,303	**192,070**	$1,632,595	**192,070**	$1,632,595		
162	Building structure demolition	GSF	$5.75							**257,120**	$1,478,440
163	**G1020 Building Demolition Total**				**$84,303**		**$1,632,595**		**$1,632,595**		**$1,478,440**
164											
165	**G1020 Site Demolition, Selective Demolition**										
166	*Selective Site Demolition*										
167	saw cut existing pavement	LF	$12.00	**150**	$1,800	**150**	$1,800	**150**	$1,800	**150**	$1,800
168	asphalt pavement	SF	$1.20	**181,037**	$217,244	**181,037**	$217,244	**181,037**	$217,244	**181,037**	$217,244
169	concrete pavement	SF	$1.75	**46,573**	$81,503	**46,573**	$81,503	**46,573**	$81,503	**46,573**	$81,503
170	Cut, cap and remove existing utility	AL	$50,000.00	**1**	$50,000	**1**	$50,000	**1**	$50,000	**1**	$50,000
171	Misc. demolition other than above	AL	$75,000.00	**1**	$75,000	**1**	$75,000	**1**	$75,000	**1**	$75,000
172	Existing school program interior selective demolition	GSF	$10.00	**239,354**	$2,393,540	**62,300**	$623,000	**62,300**	$623,000		
173	**G1020 Site Demolition, Selective Demolition Total**				**$2,819,087**		**$1,048,547**		**$1,048,547**		**$425,547**
174											
175	**G1030 Earthwork**										
176	Cut and fill for parking lot	CY	$11.00	**8,602**	$94,617	**7,014**	$77,153	**8,284**	$91,124	**10,571**	$116,281
177	concrete pavement	CY	$11.00	**4,369**	$48,064	**2,940**	$32,337	**4,460**	$49,061	**1,858**	$20,437
178	remainder of site grades	CY	$10.00	**5,848**	$58,478	**9,835**	$98,354	**7,519**	$75,191	**5,327**	$53,267
179	Rough and fine grading	SF	$0.50	**532,303**	$266,152	**595,383**	$297,692	**595,617**	$297,809	**545,310**	$272,655
180	**G1030 Earthwork Total**				**$467,310**		**$505,535**		**$513,184**		**$462,640**
181	**G1040 Hazardous Material Abatement**										

GRADE 7-12 DIRECT TRADE COST DETAILS

	ELEMENT	UNIT	UNIT RATE	OPTION C.2.1 Major Reno/Minor Add		OPTION C.2.3 Minor Reno/Major Add		OPTION C.2.4 Minor Reno/Major Add		OPTION C.3.1 New Construction	
				QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST
182	Removal and disposal of all ACM, PCB and other hazardous materials	AL	$7,100,000.00	1	$7,100,000	1	$7,100,000	1	$7,100,000	1	$7,100,000
183	**G1040 Hazardous Material Abatement Total**				**$7,100,000**		**$7,100,000**		**$7,100,000**		**$7,100,000**
184											
185											
186	**G20 SITE IMPROVEMENTS**										
187											
188	**G2010 Paving and Surfacing**										
189	Asphalt paving at bus drop-off, deliveries, parent drop-off and parking lot	SF	$3.15	185,793	$585,248	151,500	$477,225	178,934	$563,642	228,334	$719,252
190	gravel base to asphalt pavement	CY	$32.00	7,569	$242,208	6,172	$197,504	7,290	$233,280	9,302	$297,664
191	paint crosswalk	AL	$2,500.00	1	$2,500	1	$2,500	1	$2,500	1	$2,500
192	parking stall	EA	$35.00	6	$210	6	$210	6	$210	6	$210
193	HC parking stall	EA	$85.00	424	$36,040	424	$36,040	424	$36,040	424	$36,040
194	misc. pavement marking	AL	$5,000.00	1	$5,000	1	$5,000	1	$5,000	1	$5,000
195	Patching to existing paving at street	LS	$5,000.00	1	$5,000	1	$5,000	1	$5,000	1	$5,000
196	Concrete sidewalk	SF	$7.25	46,573	$337,654	20,757	$150,488	32,368	$234,668	27,735	$201,079
197	Intergenerational walking path	SF	$3.50	16,405	$57,418	16,370	$57,295	16,350	$57,225	16,250	$56,875
198	Sport walk	SF	$7.50					3,084	$23,130	3,360	$25,200
199	curb cut	EA	$380.00	12	$4,560	12	$4,560	12	$4,560	12	$4,560
200	Cement concrete entrance	SF	$30.00	54,661	$1,639,830	37,194	$1,115,820	70,443	$2,113,290	13,834	$415,020
201	Loading dock	SF	$15.00	2,050	$30,750	8,082	$121,230			3,424	$51,360
202	Gravel base to concrete pavement	CY	$30.00	3,176	$95,280	1,938	$58,140	3,529	$105,870	1,129	$33,870
203	Curbing	LF	$38.00	8,818	$335,084	8,199	$311,562	9,853	$374,414	10,675	$405,650
204	*Baseball and Softball field:*	*SF*		*50,099*		*72,268*		*82,881*		*150,922*	
205	Rough/fine grading	SF	$0.75	50,099	$37,574	72,268	$54,201	82,881	$62,161	150,922	$113,192
206	Cut and fill	CY	$12.00	2,171	$26,052	3,132	$37,584	3,592	$43,104	6,540	$78,480
207	8" Stone base	CY	$70.00	1,361	$95,270	1,963	$137,410	2,251	$157,570	4,099	$286,930
208	Sand base	CY	$80.00	340	$27,200	491	$39,280	563	$45,040	1,025	$82,000
209	Underdrain	GSF	$1.75	50,099	$87,673	72,268	$126,469	82,881	$145,042	150,922	$264,114
210	Infield surfacing	SF	$2.50	15,995	$39,988	47,608	$119,020	40,076	$100,190	46,458	$116,145
211	Sod	SF	$1.50	34,104	$51,156	24,660	$36,990	42,805	$64,208	104,464	$156,696
212	Irrigation	SF	$0.75	34,104	$25,578	24,660	$18,495	42,805	$32,104	104,464	$78,348
213	Base plate	EA	$450.00	8	$3,600	12	$5,400	12	$5,400	12	$5,400
214	Removable foul poles	EA	$2,500.00	4	$10,000	6	$15,000	6	$15,000	6	$15,000
215	Removable soccer goal posts	EA	$1,400.00	2	$2,800	3	$4,200	3	$4,200	3	$4,200
216	Backstop	SF	$10.00	3,660	$36,600	3,660	$36,600	3,660	$36,600	3,660	$36,600
217	*Football/Rugby, Lacrosse 01, Soccer field:*	*SF*		*258,471*		*313,908*		*282,489*		*279,312*	
218	Rough/fine grading	SF	$0.75	258,471	$193,853	313,908	$235,431	282,489	$211,867	279,312	$209,484
219	Cut and fill	CY	$12.00	11,200	$134,400	13,603	$163,236	12,241	$146,892	12,104	$145,248
220	8" Stone base	CY	$70.00	7,020	$491,400	8,526	$596,820	7,673	$537,110	7,586	$531,020
221	Sand base	CY	$80.00	1,755	$140,400	2,131	$170,480	1,918	$153,440	1,897	$151,760
222	Underdrain	GSF	$1.75	258,471	$452,324	313,908	$549,339	282,489	$494,356	279,312	$488,796
223	Sod	SF	$1.50	258,471	$387,707	313,908	$470,862	282,489	$423,734	279,312	$418,968
224	Irrigation	SF	$0.75	258,471	$193,853	313,908	$235,431	282,489	$211,867	279,312	$209,484

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

G. COST ESTIMATE / OPM

GRADE 7-12 DIRECT TRADE COST DETAILS

	ELEMENT	UNIT	UNIT RATE	OPTION C.2.1 Major Reno/Minor Add		OPTION C.2.3 Minor Reno/Major Add		OPTION C.2.4 Minor Reno/Major Add		OPTION C.3.1 New Construction	
				QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST
225	**G2010 Paving and Surfacing Total**				**$5,814,210**		**$5,594,822**		**$6,648,712**		**$5,651,144**
226											
227	**G2040 Site Improvements**										
228	Bioretention terraces	SF	$35.00					**3,836**	$134,260		
229	Flag pole w/ foundation	EA	$7,500.00	**1**	$7,500	**1**	$7,500	**1**	$7,500	**1**	$7,500
230	Bench	AL	$15,000.00	**1**	$15,000	**1**	$15,000	**1**	$15,000	**1**	$15,000
231	Bike racks	AL	$3,500.00	**1**	$3,500	**1**	$3,500	**1**	$3,500	**1**	$3,500
232	Metal trash receptacles	EA	$800.00	**8**	$6,400	**8**	$6,400	**8**	$6,400	**8**	$6,400
233	Concrete fill steel bollard	AL	$12,000.00	**1**	$12,000	**1**	$12,000	**1**	$12,000	**1**	$12,000
234	Misc. site improvement other than above	LS	$100,000.00	**1**	$100,000	**1**	$100,000	**1**	$100,000	**1**	$100,000
235	Traffic signs	AL	$12,000.00	**1**	$12,000	**1**	$12,000	**1**	$12,000	**1**	$12,000
236	Building sign	AL	$15,000.00	**1**	$15,000	**1**	$15,000	**1**	$15,000	**1**	$15,000
237	**G2040 Site Improvements Total**				**$171,400**		**$171,400**		**$305,660**		**$171,400**
238											
239	**G2050 Plantings, Soft Landscaping**										
240	Respread topsoil	CY	$10.00	**13,383**	$133,830	**13,383**	$133,830	**13,383**	$133,830	**13,383**	$133,830
241	Topsoil for planting beds, shrubs and perennials	CY	$28.00	**338**	$9,471	**278**	$7,778	**278**	$7,778	**278**	$7,778
242	Mulch	CY	$50.00	**52**	$2,617	**46**	$2,315	**46**	$2,315	**46**	$2,315
243	Lawn	SF	$0.40	**217,000**	$86,800	**377,696**	$151,078	**284,352**	$113,741	**196,000**	$78,400
244	Sod - Outdoor classroom	SF	$1.75							**10,189**	$17,831
245	New trees	AL	$156,000.00	**1**	$156,000	**1**	$156,000	**1**	$156,000	**1**	$156,000
246	Gardens	SF	$8.00	**28,277**	$226,216	**8,237**	$65,896	**29,521**	$236,168	**69,219**	$553,752
247	Groundcovers	AL	$10,000.00	**1**	$10,000	**1**	$10,000	**1**	$10,000	**1**	$10,000
248	**G2050 Plantings, Soft Landscaping Total**				**$624,934**		**$526,897**		**$659,831**		**$959,905**
249											
250											
251	**G30 SITE MECHANICAL UTILITIES**										
252											
253	**G3010 Water Supply and Distribution**										
254	8" T & S & G.	EA	$4,200.00	**1**	$4,200	**1**	$4,200	**1**	$4,200	**1**	$4,200
255	4" Gate	EA	$1,200.00	**1**	$1,200	**1**	$1,200	**1**	$1,200	**1**	$1,200
256	Hydrant and gate	EA	$2,800.00	**4**	$11,200	**4**	$11,200	**4**	$11,200	**4**	$11,200
257	4" CLDI domestic water	LF	$65.00	**50**	$3,250	**50**	$3,250	**50**	$3,250	**50**	$3,250
258	6" CLDI Fire	LF	$80.00	**200**	$16,000	**200**	$16,000	**200**	$16,000	**200**	$16,000
259	8" CLDI fire service and loop	LF	$95.00	**4,000**	$380,000	**4,000**	$380,000	**4,000**	$380,000	**4,000**	$380,000
260	Thrust blocks	LS	$2,000.00	**1**	$2,000	**1**	$2,000	**1**	$2,000	**1**	$2,000
261	**G3010 Water Supply and Distribution Total**				**$417,850**		**$417,850**		**$417,850**		**$417,850**
262											
263	**G3020 Sanitary Sewer System**										
264	Relocate existing sewer	AL	$250,000.00	**1**	$250,000	**1**	$250,000	**1**	$250,000	**1**	$250,000
265	SMH	EA	$4,000.00	**6**	$24,000	**10**	$40,000	**10**	$40,000	**4**	$16,000
266	1,500 Grease trap	EA	$7,500.00	**1**	$7,500	**1**	$7,500	**1**	$7,500	**1**	$7,500
267	Pump station	LS	$30,000.00								

GRADE 7-12 DIRECT TRADE COST DETAILS

	ELEMENT	UNIT	UNIT RATE	OPTION C.2.1 Major Reno/Minor Add		OPTION C.2.3 Minor Reno/Major Add		OPTION C.2.4 Minor Reno/Major Add		OPTION C.3.1 New Construction	
				QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST
268	3" HDPE sewer force main	LF	$125.00								
269	8" sewer drain	LF	$65.00								
270	6" PVC sewer	LF	$50.00	**650**	$32,500	**1,050**	$52,500	**1,040**	$52,000	**340**	$17,000
271	**G3020 Sanitary Sewer System Total**				**$314,000**		**$350,000**		**$349,500**		**$290,500**
272											
273											
274	**G3030 Stormwater Management System**										
275	Temporary utilties to cover phasing and logisitcs - allowance agreed	AL	$150,000.00	**1**	$150,000	**1**	$150,000	**1**	$150,000	**1**	$150,000
276	Bioretention	SF	$24.00	**4,836**	$116,064	**8,802**	$211,248	**24,266**	$582,384	**30,925**	$742,200
277	Bioretention zone	SF	$5.00	**31,413**	$157,065	**34,887**	$174,435	**45,015**	$225,075	**32,876**	$164,380
278	Stormwater base in pavement area	GSF	$5.00	**289,077**	$1,445,385	**217,533**	$1,087,665	**281,745**	$1,408,725	**273,327**	$1,366,635
279	**G3030 Stormwater Management System Total**				**$1,868,514**		**$1,623,348**		**$2,366,184**		**$2,423,215**
280											
281									**$2,216,184**		
282	**G40 SITE ELECTRICAL UTILITIES**										
283											
284	**G4010 Site Electrical Utilities**										
285	*Primary and Secondary Service*										
286	Utility co. back charges	LS	$30,000.00	**1**	$30,000	**1**	$30,000	**1**	$30,000	**1**	$30,000
287	Electrical primary service riser	LS	$1,500.00	**1**	$1,500	**1**	$1,500	**1**	$1,500	**1**	$1,500
288	Primary ductbank 2-5" ductbank, empty; from East boundary	LF	$145.00	**1,750**	$253,750	**1,750**	$253,750	**1,750**	$253,750	**1,750**	$253,750
289	Transformer by utility company				By Utility Co.		By Utility Co.		By Utility Co.		By Utility Co.
290	Transformer pad	EA	$3,000.00	**1**	$3,000	**1**	$3,000	**1**	$3,000	**1**	$3,000
291	3000A secondary service	LF	$850.00	**60**	$51,000	**60**	$51,000	**60**	$51,000	**60**	$51,000
292	2500A secondary service	LF	$710.00	**340**	$241,400	**140**	$99,400	**290**	$205,900	**280**	$198,800
293	*Communications*										
294	Communications pole riser	EA	$1,500.00	**1**	$1,500	**1**	$1,500	**1**	$1,500	**1**	$1,500
295	Telecom ductbank 4-4" empty	LF	$152.00	**1,750**	$266,000	**1,750**	$266,000	**1,750**	$266,000	**1,750**	$266,000
296	Site CCTV (Security)	LS	$35,000.00	**1**	$35,000	**1**	$35,000	**1**	$35,000	**1**	$35,000
297	Sport field lighting; baseball, softball	AL	$200,000.00	**1**	$200,000	**1**	$200,000	**1**	$200,000	**1**	$200,000
298	Site lighting and circuitry	LS	$300,000.00	**1**	$300,000	**1**	$300,000	**1**	$300,000	**1**	$300,000
299	**G4010 Site Electrical Utilities Total**				**$1,383,150**		**$1,241,150**		**$1,347,650**		**$1,340,550**
300											
301											
302											

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

G. COST ESTIMATE / OPM

GRADES 8-12 MAIN SUMMARY

ELEMENT	OPTION C.2.1 Major Reno/Minor Add 393,786 GSF 46 MTH		OPTION C.2.3 Minor Reno/Major Add 393,786 GSF 46 MTH		OPTION C.2.4 Minor Reno/Major Add 393,786 GSF 39 MTH		OPTION C.3.1 New Construction 363,411 GSF 34 MTH	
Direct Trade Costs Details	$137,374,406	$348.86	$130,720,675	$331.96	$139,110,404	$353.26	$136,235,705	$374.88
Building Demolition	$84,303	$0.21	$1,632,595	$4.15	$1,632,595	$4.15	$1,478,440	$4.07
Hazardous Material Abatement	$7,100,000	$18.03	$7,100,000	$18.03	$7,100,000	$18.03	$7,100,000	$19.54
Direct Trade Details SubTotal	**$144,558,709**	**$367.10**	**$139,453,270**	**$354.13**	**$147,842,999**	**$375.44**	**$144,814,145**	**$398.49**
Design and Pricing Contingency	$17,348,000	$44.05	$16,735,000	$42.50	$14,785,000	$37.55	$14,482,000	$39.85
Direct Trade Cost Total	**$161,906,709**	**$411.15**	**$156,188,270**	**$396.63**	**$162,627,999**	**$412.99**	**$159,296,145**	**$438.34**
Staffing, Supervision and Management	$9,200,000	$23.36	$8,970,000	$22.78	$7,690,200	$19.53	$6,422,600	$17.67
Remainder of General Conditions, Project Requirements	$6,133,400	$15.58	$5,980,000	$15.19	$5,126,800	$13.02	$4,281,800	$11.78
Phasing and Logistics	$4,047,700	$10.28	$2,342,900	$5.95	$2,439,500	$6.19	$796,500	$2.19
General Liability Insurance	$1,862,000	$4.73	$1,797,000	$4.56	$1,871,000	$4.75	$1,832,000	$5.04
Performance and Payment Bonds	$1,620,000	$4.11	$1,562,000	$3.97	$1,627,000	$4.13	$1,593,000	$4.38
GMP Contingency	$8,096,000	$20.56	$7,810,000	$19.83	$8,132,000	$20.65	$3,983,000	$10.96
Fee	$5,667,000	$14.39	$5,077,000	$12.89	$5,286,000	$13.42	$4,779,000	$13.15
Estimated Construction Cost Total	**$198,532,809**	**$504.16**	**$189,727,170**	**$481.80**	**$194,800,499**	**$494.69**	**$182,984,045**	**$503.52**
Escalation from now to start of Construction	$14,943,000	$37.95	$14,280,000	$36.26	$14,662,000	$37.23	$13,773,000	$37.90
Estimated Construction Cost at Start of Construction	**$213,476,000**	**$542.11**	**$204,008,000**	**$518.07**	**$209,463,000**	**$531.92**	**$196,758,000**	**$541.42**

GRADE 8-12 DIRECT TRADE COST SUMMARY

ELEMENT	OPTION C.2.1 Major Reno/Minor Add 393,786 GSF		OPTION C.2.3 Minor Reno/Major Add 393,786 GSF		OPTION C.2.4 Minor Reno/Major Add 393,786 GSF		OPTION C.3.1 New Construction 363,411 GSF	
A10 Foundations	$21,903,449	$55.62	$19,505,911	$49.53	$22,032,388	$55.95	$22,203,711	$61.10
A SUBSTRUCTURE	**$21,903,449**	**$55.62**	**$19,505,911**	**$49.53**	**$22,032,388**	**$55.95**	**$22,203,711**	**$61.10**
B10 Superstructure	$8,184,615	$20.78	$16,016,401	$40.67	$15,592,464	$39.60	$17,315,007	$47.65
B20 Exterior Closure	$21,217,809	$53.88	$11,303,620	$28.70	$14,902,629	$37.84	$15,431,500	$42.46
B30 Roofing	$3,908,560	$9.93	$4,841,101	$12.29	$6,428,263	$16.32	$6,318,086	$17.39
B SHELL	**$33,310,983**	**$84.59**	**$32,161,121**	**$81.67**	**$36,923,355**	**$93.77**	**$39,064,593**	**$107.49**
C10 Interior Construction	$12,798,045	$32.50	$12,798,045	$32.50	$12,798,045	$32.50	$11,810,858	$32.50
C20 Stairs	$330,000	$0.84	$425,000	$1.08	$685,000	$1.74	$410,000	$1.13
C30 Interior Finishes	$11,041,420	$28.04	$10,169,900	$25.83	$10,169,900	$25.83	$9,085,275	$25.00
C INTERIORS	**$24,169,465**	**$61.38**	**$23,392,945**	**$59.41**	**$23,652,945**	**$60.07**	**$21,306,133**	**$58.63**
D10 Conveying	$240,000	$0.61	$240,000	$0.61	$240,000	$0.61	$380,000	$1.05
D20 Plumbing	$4,725,432	$12.00	$4,725,432	$12.00	$4,725,432	$12.00	$4,360,932	$12.00
D30 HVAC	$17,720,370	$45.00	$17,720,370	$45.00	$17,720,370	$45.00	$16,353,495	$45.00
D40 Fire Protection	$1,950,794	$4.95	$1,950,794	$4.95	$1,950,794	$4.95	$1,808,032	$4.98
D50 Electrical	$13,388,724	$34.00	$13,388,724	$34.00	$13,388,724	$34.00	$12,355,974	$34.00
D SERVICES	**$38,025,320**	**$96.56**	**$38,025,320**	**$96.56**	**$38,025,320**	**$96.56**	**$35,258,433**	**$97.02**
E10 Equipment	$2,953,395	$7.50	$2,953,395	$7.50	$2,953,395	$7.50	$2,725,583	$7.50
E20 Furnishings	$4,922,325	$12.50	$4,922,325	$12.50	$4,922,325	$12.50	$4,542,638	$12.50
E EQUIPMENT & FURNISHINGS	**$7,875,720**	**$20.00**	**$7,875,720**	**$20.00**	**$7,875,720**	**$20.00**	**$7,268,220**	**$20.00**
G1010 Site Clearing, Site Preparation	$685,272	$1.74	$685,272	$1.74	$685,272	$1.74	$685,272	$1.89
G1020 Building Demolition	$84,303	$0.21	$1,632,595	$4.15	$1,632,595	$4.15	$1,478,440	$4.07
G1020 Site Demolition, Selective Demolition	$2,819,087	$7.16	$1,076,047	$2.73	$1,076,047	$2.73	$425,547	$1.17
G1030 Earthwork	$451,847	$1.15	$482,900	$1.23	$454,052	$1.15	$459,148	$1.26
G1040 Hazardous Material Abatement	$7,100,000	$18.03	$7,100,000	$18.03	$7,100,000	$18.03	$7,100,000	$19.54
G10 SITE PREPARATION	**$11,140,509**	**$28.29**	**$10,976,814**	**$27.88**	**$10,947,966**	**$27.80**	**$10,148,407**	**$27.93**
G2010 Paving and Surfacing	$4,793,468	$12.17	$4,779,751	$12.14	$4,693,048	$11.92	$5,472,563	$15.06
G2040 Site Improvements	$171,400	$0.44	$171,400	$0.44	$305,660	$0.78	$171,400	$0.47
G2050 Plantings, Soft Landscaping	$624,934	$1.59	$526,897	$1.34	$659,831	$1.68	$959,905	$2.64
G20 SITE IMPROVEMENTS	**$5,589,802**	**$14.20**	**$5,478,048**	**$13.91**	**$5,658,539**	**$14.37**	**$6,603,868**	**$18.17**
G3010 Water Supply and Distribution	$75,850	$0.19	$52,100	$0.13	$71,100	$0.18	$70,150	$0.19
G3020 Sanitary Sewer System	$66,000	$0.17	$102,000	$0.26	$101,500	$0.26	$42,500	$0.12
G3030 Stormwater Management System	$1,619,410	$4.11	$1,302,490	$3.31	$1,822,315	$4.63	$2,126,350	$5.85
G4010 Site Electrical Utilities	$782,200	$1.99	$580,800	$1.47	$731,850	$1.86	$721,780	$1.99
G30 SITE MECHANICAL UTILITIES	**$2,543,460**	**$6.46**	**$2,037,390**	**$5.17**	**$2,726,765**	**$6.92**	**$2,960,780**	**$8.15**
Direct Trade Details SubTotal	**$144,558,709**	**$367.10**	**$139,453,270**	**$354.13**	**$147,842,999**	**$375.44**	**$144,814,145**	**$398.49**

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

G. COST ESTIMATE / OPM

GRADE 8-12 DIRECT TRADE COST DETAILS

	ELEMENT	UNIT	UNIT RATE	OPTION C.2.1 Major Reno/Minor Add QUANTITY	OPTION C.2.1 Major Reno/Minor Add COST	OPTION C.2.3 Minor Reno/Major Add QUANTITY	OPTION C.2.3 Minor Reno/Major Add COST	OPTION C.2.4 Minor Reno/Major Add QUANTITY	OPTION C.2.4 Minor Reno/Major Add COST	OPTION C.3.1 New Construction QUANTITY	OPTION C.3.1 New Construction COST
10	***Total***			***393,786 GSF***		***393,786 GSF***		***393,786 GSF***		***363,411 GSF***	
11	*Renovation*			*239,354 GSF*		*65,050 GSF*		*65,050 GSF*			
12	*New Construction / Addition*			*154,432 GSF*		*328,736 GSF*		*328,736 GSF*		*363,411 GSF*	
13	*Building Demolition*			*9,918 GSF*		*192,070 GSF*		*192,070 GSF*		*257,120 GSF*	
14											
15	**A SUBSTRUCTURE**										
16											
17	**A10 Foundations**										
18	*Reinforced concrete pile caps, structural steel piles, structured slab*										
19	steel pile, 50-ton; assume 25'long	LF	$85.00	**39,750**	$3,378,750	**42,750**	$3,633,750	**47,250**	$4,016,250	**50,000**	$4,250,000
20	concrete pile; 8x8x4 at clusters, 2x2x2 at single pile	EA	$7,550.00	**660**	$4,983,000	**770**	$5,813,500	**880**	$6,644,000	**920**	$6,946,000
21	grade beam at perimeter; 5' deep	LF	$1,500.00	**3,075**	$4,612,500	**2,110**	$3,165,000	**2,070**	$3,105,000	**2,125**	$3,187,500
22	grade beam at slab on grade; assume 60'oc grid	LF	$1,500.00	**1,800**	$2,700,000	**2,800**	$4,200,000	**3,400**	$5,100,000	**3,600**	$5,400,000
23	12" structured slab on grade, 6#/sf reinforcing, vapor barrier, 2" rigid insu	SF	$14.00	**77,950**	$1,091,300	**122,633**	$1,716,862	**150,185**	$2,102,590	**155,585**	$2,178,190
24	compacted granular structural fill; assume 12"	CY	$40.00	**3,031**	$121,256	**4,769**	$190,762	**5,841**	$233,621	**6,051**	$242,021
25	*New brace frames in existing to renovation areas*										
26	demo sog for new pile, patch and repair after install	LOC	$4,000.00	**181**	$724,000	**37**	$148,000	**39**	$156,000		
27	install new pile and pile cap	EA	$11,700.00	**181**	$2,117,700	**37**	$432,900	**39**	$456,300		
28	demo sog for new tie beam, patch and repair after install	LF	$190.00	**5,395**	$1,025,018	**1,080**	$205,137	**1,151**	$218,627		
29	*New building over Level 2 for Level 3 additions*										
30	demo sog for new pile, patch and repair after install	LOC	$4,000.00	**54**	$216,000						
31	install new pile and pile cap	EA	$11,700.00	**54**	$631,800						
32	demo sog for new tie beam, patch and repair after install	LF	$190.00	**1,590**	$302,125						
33	**A10 Foundations Total**				**$21,903,449**		**$19,505,911**		**$22,032,388**		**$22,203,711**
34											
35											
36	**B SHELL**										
37											
38	**B10 Superstructure**										
39	*New brace frames in existing to renovation areas*										
40	addition of brace frames; assume 2#/sf face area	TNS	$5,000.00	**24**	$120,000						
41	new masonry shear wall at existing building	SF	$25.00	**23,270**	$581,750						
42	Anchor un-reinforced masonry walls to floor & roof structure	EA	$150.00	**991**	$148,650	**326**	$48,900	**477**	$71,550		
43	Reinforce existing roof diaphragms to resist uplift loads; assume 1#/covera	TNS	$5,000.00	**38**	$192,183	**28**	$138,390	**23**	$116,328		
44	*New building over Level 2 for Level 3 additions*										
45	new columns from Level 1 up per floor	EA	$2,500.00	**56**	$140,000						
46	Structural steel floor framing - 13#/gsf allowance provided	TNS	$3,900.00							**1,351**	$5,268,389
47	15#/gsf allowance provided	TNS	$3,900.00	**574**	$2,237,099	**1,546**	$6,028,513	**1,339**	$5,222,617		
48	above multi-purpose rooms & PE space; 18#/gsf	TNS	$3,900.00	**134**	$522,007	**292**	$1,136,889	**311**	$1,211,652	**376**	$1,465,636
49	Structural steel framing, columns & braced frames; assume 3#/gsf	TNS	$3,900.00	**232**	$903,427	**493**	$1,923,106	**493**	$1,923,106	**545**	$2,125,954
50	Structural steel roof framing - 13#/gsf allowance provided	TNS	$3,900.00	**461**	$1,798,456	**819**	$3,194,006	**939**	$3,660,629	**1,112**	$4,338,513
51	15#/gsf @ Gym & mechanical zone/low roof; add 2#/gsf	TNS	$4,680.00	**14**	$66,456	**25**	$117,936	**29**	$135,252	**55**	$255,996
52	5½" LWT slab on composite metal deck, fireproofing; upper slabs	SF	$12.50	**76,482**	$956,025	**206,103**	$2,576,288	**178,551**	$2,231,888	**207,826**	$2,597,825

G. COST ESTIMATE / OPM

GRADE 8-12 DIRECT TRADE COST DETAILS

	ELEMENT	UNIT	UNIT RATE	OPTION C.2.1 Major Reno/Minor Add QUANTITY	OPTION C.2.1 Major Reno/Minor Add COST	OPTION C.2.3 Minor Reno/Major Add QUANTITY	OPTION C.2.3 Minor Reno/Major Add COST	OPTION C.2.4 Minor Reno/Major Add QUANTITY	OPTION C.2.4 Minor Reno/Major Add COST	OPTION C.3.1 New Construction QUANTITY	OPTION C.3.1 New Construction COST
53	low roof; assume 20% of roof area	SF	$12.50	**14,200**	$177,500	**25,200**	$315,000	**28,900**	$361,250	**34,300**	$428,750
54	1½" Type B metal roof deck	SF	$3.75	**77,950**	$292,313	**122,633**	$459,874	**150,185**	$563,194	**155,585**	$583,444
55	5½" LWT slab on metal deck; mech zone assume 5% of roof area	SF	$12.50	**3,900**	$48,750	**6,200**	$77,500	**7,600**	$95,000	**7,800**	$97,500
56	3" Type NA acoustic metal roof deck; Gym	SF	$7.50							**20,400**	$153,000
57	**B10 Superstructure Total**				**$8,184,615**		**$16,016,401**		**$15,592,464**		**$17,315,007**
58											
59	**B20 Exterior Closure**										
60	Existing exterior façade to remain; patch and repair only	SF	$10.00	**111,735**	$1,117,346	**20,090**	$200,895	**29,385**	$293,854		
61	remove and replace glazed openings; assume 20%	SF	$105.00	**22,350**	$2,346,750	**4,020**	$422,100	**5,880**	$617,400		
62	New façade; masonry, glass, doors	SF	$125.00	**142,030**	$17,753,713	**85,445**	$10,680,625	**111,931**	$13,991,375	**123,452**	$15,431,500
63	**B20 Exterior Closure Total**				**$21,217,809**		**$11,303,620**		**$14,902,629**		**$15,431,500**
64											
65	**B30 Roofing**										
66	Demo roof for new floor deck	SF	$15.00	**47,645**	$714,675						
67	Roofing; assume TPO	SF	$22.50	**70,945**	$1,596,263	**125,996**	$2,834,917	**144,404**	$3,249,079	**171,145**	$3,850,751
68	add low roof/canopy	AL	$100.00	**14,800**	$50,000	**8,900**	$890,000	**20,800**	$2,080,000	**13,445**	$1,344,500
69	mechanical zone and screen	LS	$175,000.00	**1**	$175,000	**1**	$175,000	**1**	$175,000	**1**	$175,000
70	soffits, fascia	LF	$425.00	**3,230**	$1,372,623	**2,215**	$941,184	**2,175**	$924,184	**2,230**	$947,835
71	**B30 Roofing Total**				**$3,908,560**		**$4,841,101**		**$6,428,263**		**$6,318,086**
72											
73											
74	**C INTERIORS**										
75											
76	**C10 Interior Construction**										
77	Renovate existing school	GSF	$32.50	**239,354**	$7,779,005	**65,050**	$2,114,125	**65,050**	$2,114,125		
78	Partitions	GSF	$20.00	**154,432**	$3,088,640	**328,736**	$6,574,720	**328,736**	$6,574,720	**363,411**	$7,268,220
79	Doors	GSF	$4.50	**154,432**	$694,944	**328,736**	$1,479,312	**328,736**	$1,479,312	**363,411**	$1,635,350
80	Storefront; assume 2% of interior walls	GSF	$1.75	**154,432**	$270,256	**328,736**	$575,288	**328,736**	$575,288	**363,411**	$635,969
81	Specialties	GSF	$6.25	**154,432**	$965,200	**328,736**	$2,054,600	**328,736**	$2,054,600	**363,411**	$2,271,319
82	**C10 Interior Construction Total**				**$12,798,045**		**$12,798,045**		**$12,798,045**		**$11,810,858**
83											
84											
85	**C20 Stairs**										
86	Upgrade existing stair; assume replace railings	FLT	$15,000.00	**4**	$60,000	**1**	$15,000	**1**	$15,000		
87	New stairs	FLT	$35,000.00	**4**	$140,000	**8**	$280,000	**8**	$280,000	**8**	$280,000
88	Monumental/Open stair, allow	FLT	$65,000.00	**2**	$130,000	**2**	$130,000	**6**	$390,000	**2**	$130,000
89	**C20 Stairs Total**				**$330,000**		**$425,000**		**$685,000**		**$410,000**
90											
91	**C30 Interior Finishes**										
92	Renovate existing school	GSF	$30.00	**239,354**	$7,180,620	**65,050**	$1,951,500	**65,050**	$1,951,500		
93	*New School Building Construction*	*GSF*		***154,432***		***328,736***		***328,736***		***363,411***	
94	wall finishes	GSF	$6.75	**154,432**	$1,042,416	**328,736**	$2,218,968	**328,736**	$2,218,968	**363,411**	$2,453,024
95	flooring	GSF	$10.75	**154,432**	$1,660,144	**328,736**	$3,533,912	**328,736**	$3,533,912	**363,411**	$3,906,668

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

G. COST ESTIMATE / OPM

GRADE 8-12 DIRECT TRADE COST DETAILS

	ELEMENT	UNIT	UNIT RATE	OPTION C.2.1 Major Reno/Minor Add QUANTITY	OPTION C.2.1 Major Reno/Minor Add COST	OPTION C.2.3 Minor Reno/Major Add QUANTITY	OPTION C.2.3 Minor Reno/Major Add COST	OPTION C.2.4 Minor Reno/Major Add QUANTITY	OPTION C.2.4 Minor Reno/Major Add COST	OPTION C.3.1 New Construction QUANTITY	OPTION C.3.1 New Construction COST
96	ceiling finishes	GSF	$7.50	154,432	$1,158,240	328,736	$2,465,520	328,736	$2,465,520	363,411	$2,725,583
97	**C30 Interior Finishes Total**				**$11,041,420**		**$10,169,900**		**$10,169,900**		**$9,085,275**
98	**D SERVICES**										
99											
100	**D10 Conveying**										
101	Elevator; ETR, new cab	EA	$50,000.00	1	$50,000	1	$50,000	1	$50,000		
102	Elevator; new	EA	$190,000.00	1	$190,000	1	$190,000	1	$190,000	2	$380,000
103	**D10 Conveying Total**				**$240,000**		**$240,000**		**$240,000**		**$380,000**
104											
105	**D20 Plumbing**										
106	Plumbing	GSF	$12.00	393,786	$4,725,432	393,786	$4,725,432	393,786	$4,725,432	363,411	$4,360,932
107	**D20 Plumbing Total**				**$4,725,432**		**$4,725,432**		**$4,725,432**		**$4,360,932**
108											
109	**D30 HVAC**										
110	HVAC	EA	$45.00	393,786	$17,720,370	393,786	$17,720,370	393,786	$17,720,370	363,411	$16,353,495
111	**D30 HVAC Total**				**$17,720,370**		**$17,720,370**		**$17,720,370**		**$16,353,495**
112											
113	**D40 Fire Protection**										
114	Sprinkler Coverage	GSF	$4.70	393,786	$1,850,794	393,786	$1,850,794	393,786	$1,850,794	363,411	$1,708,032
115	Fire Pump	EA	$100,000.00	1	$100,000	1	$100,000	1	$100,000	1	$100,000
116	**D40 Fire Protection Total**				**$1,950,794**		**$1,950,794**		**$1,950,794**		**$1,808,032**
117											
118	**D50 Electrical**										
105	Interior Electrical	GSF	$34.00	393,786	$13,388,724	393,786	$13,388,724	393,786	$13,388,724	363,411	$12,355,974
120	**D50 Electrical Total**				**$13,388,724**		**$13,388,724**		**$13,388,724**		**$12,355,974**
121											
122											
123	**E EQUIPMENT & FURNISHINGS**										
124											
125	**E10 Equipment**										
126	Renovate existing school	GSF	$7.50	239,354	$1,795,155	65,050	$487,875	65,050	$487,875		
127	New Construction / Addition	GSF	$7.50	154,432	$1,158,240	328,736	$2,465,520	328,736	$2,465,520	363,411	$2,725,583
128	**E10 Equipment Total**				**$2,953,395**		**$2,953,395**		**$2,953,395**		**$2,725,583**
129											
130	**E20 Furnishings**										
131	Renovate existing school	GSF	$12.50	239,354	$2,991,925	65,050	$813,125	65,050	$813,125		
132	New Construction / Addition	GSF	$12.50	154,432	$1,930,400	328,736	$4,109,200	328,736	$4,109,200	363,411	$4,542,638
133	**E20 Furnishings Total**				**$4,922,325**		**$4,922,325**		**$4,922,325**		**$4,542,638**
134											
135											
136	**G10 SITE PREPARATION**										
137											
138	**G1010 Site Clearing, Site Preparation**										

G. COST ESTIMATE / OPM

GRADE 8-12 DIRECT TRADE COST DETAILS

	ELEMENT	UNIT	UNIT RATE	OPTION C.2.1 Major Reno/Minor Add		OPTION C.2.3 Minor Reno/Major Add		OPTION C.2.4 Minor Reno/Major Add		OPTION C.3.1 New Construction	
				QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST
139	Clearing and grubbing	ACRE	$4,000.00	40	$160,000	40	$160,000	40	$160,000	40	$160,000
140	Manter Well site; grassed	ACRE	$2,000.00								
141	Construction fence	LF	$12.00	11,017	$132,204	11,017	$132,204	11,017	$132,204	11,017	$132,204
142	Double construction gate	PR	$2,800.00	4	$11,200	4	$11,200	4	$11,200	4	$11,200
143	Strip and stockpile existing topsoil; assume avg. 6"	CY	$8.00	13,383	$107,064	13,383	$107,064	13,383	$107,064	13,383	$107,064
144	Temporary construction entrance including maintenance	EA	$9,000.00	4	$36,000	4	$36,000	4	$36,000	4	$36,000
145	Temp signs	LS	$1,800.00	2	$3,600	2	$3,600	2	$3,600	2	$3,600
146	Wash down/re-fueling	SF	$2.00	6,000	$12,000	6,000	$12,000	6,000	$12,000	6,000	$12,000
147	Protection of existing to remain	LS	$35,000.00	1	$35,000	1	$35,000	1	$35,000	1	$35,000
148	Temporary parking lot	AL	$15,000.00	1	$15,000	1	$15,000	1	$15,000	1	$15,000
149	Dewatering	LS	$35,000.00	1	$35,000	1	$35,000	1	$35,000	1	$35,000
150	Erosion control barrier	LF	$12.00	11,017	$132,204	11,017	$132,204	11,017	$132,204	11,017	$132,204
151	Erosion control barrier at temporary construction period soil stockpile	AL	$3,500.00	1	$3,500	1	$3,500	1	$3,500	1	$3,500
152	Inlet protection	AL	$2,500.00	1	$2,500	1	$2,500	1	$2,500	1	$2,500
153	**G1010 Site Clearing, Site Preparation Total**				**$685,272**		**$685,272**		**$685,272**		**$685,272**
154											
155	**G1020 Building Demolition**										
156	Building structure demolition, phased	GSF	$8.50	9,918	$84,303	192,070	$1,632,595	192,070	$1,632,595		
157	Building structure demolition	GSF	$5.75							257,120	$1,478,440
158	**G1020 Building Demolition Total**				**$84,303**		**$1,632,595**		**$1,632,595**		**$1,478,440**
159											
160	**G1020 Site Demolition, Selective Demolition**										
161	*Selective Site Demolition*										
162	saw cut existing pavement	LF	$12.00	150	$1,800	150	$1,800	150	$1,800	150	$1,800
163	asphalt pavement	SF	$1.20	181,037	$217,244	181,037	$217,244	181,037	$217,244	181,037	$217,244
164	concrete pavement	SF	$1.75	46,573	$81,503	46,573	$81,503	46,573	$81,503	46,573	$81,503
165	Cut, cap and remove existing utility	AL	$50,000.00	$1.00	$50,000	1	$50,000	1	$50,000	1	$50,000
166	Misc. demolition other than above	AL	$75,000.00	1	$75,000	1	$75,000	1	$75,000	1	$75,000
167	Existing school program interior selective demolition	GSF	$10.00	239,354	$2,393,540	65,050	$650,500	65,050	$650,500		
168	**G1020 Site Demolition, Selective Demolition Total**				**$2,819,087**		**$1,076,047**		**$1,076,047**		**$425,547**
169											
170	**G1030 Earthwork**										
171	Cut and fill for parking lot	CY	$11.00	8,381	$92,195	6,826	$75,091	8,284	$91,124	10,176	$111,935
172	concrete pavement	CY	$11.00	3,836	$42,199	1,935	$21,287	1,783	$19,609	2,011	$22,121
173	remainder of site grades	CY	$10.00	5,848	$58,478	9,835	$98,354	7,519	$75,191	5,327	$53,267
174	Rough and fine grading	SF	$0.50	517,951	$258,976	576,335	$288,168	536,256	$268,128	543,651	$271,826
175	**G1030 Earthwork Total**				**$451,847**		**$482,900**		**$454,052**		**$459,148**
176											
177	**G1040 Hazardous Material Abatement**										
178	Removal and disposal of all ACM, PCB and other hazardous materials	AL	$7,100,000.00	1	$7,100,000	1	$7,100,000	1	$7,100,000	1	$7,100,000
179	**G1040 Hazardous Material Abatement Total**				**$7,100,000**		**$7,100,000**		**$7,100,000**		**$7,100,000**
180											
181											

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

G. COST ESTIMATE / OPM

GRADE 8-12 DIRECT TRADE COST DETAILS

	ELEMENT	UNIT	UNIT RATE	OPTION C.2.1 Major Reno/Minor Add		OPTION C.2.3 Minor Reno/Major Add		OPTION C.2.4 Minor Reno/Major Add		OPTION C.3.1 New Construction	
				QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST
182	**G20 SITE IMPROVEMENTS**										
183											
184	**G2010 Paving and Surfacing**										
185	Asphalt paving at bus drop-off, deliveries, parent drop-off and parking lot	SF	$3.15	**181,037**	$570,267	**147,452**	$464,474	**178,934**	$563,642	**219,800**	$692,370
186	gravel base to asphalt pavement	CY	$32.00	**7,376**	$236,032	**6,007**	$192,224	**7,290**	$233,280	**8,955**	$286,560
187	paint crosswalk	AL	$2,500.00	**1**	$2,500	**1**	$2,500	**1**	$2,500	**1**	$2,500
188	parking stall	EA	$35.00	**6**	$210	**6**	$210	**6**	$210	**6**	$210
189	HC parking stall	EA	$85.00	**424**	$36,040	**424**	$36,040	**424**	$36,040	**424**	$36,040
190	misc. pavement marking	AL	$5,000.00	**1**	$5,000	**1**	$5,000	**1**	$5,000	**1**	$5,000
191	Patching to existing paving at street	LS	$5,000.00	**1**	$5,000	**1**	$5,000	**1**	$5,000	**1**	$5,000
192	Concrete sidewalk	SF	$7.25	**46,573**	$337,654	**5,757**	$41,738	**24,722**	$179,235	**27,735**	$201,079
193	Intergenerational walking path	SF	$3.50	**16,405**	$57,418	**16,370**	$57,295	**16,350**	$57,225	**16,250**	$56,875
194	Sport walk	SF	$7.50					**3,084**	$23,130	**3,360**	$25,200
195	curb cut	EA	$380.00	**12**	$4,560	**12**	$4,560	**12**	$4,560	**12**	$4,560
196	Cement concrete entrance	SF	$15.00	**45,065**	$675,975	**37,194**	$557,910	**18,728**	$280,920	**20,709**	$310,635
197	Loading dock	SF	$15.00	**450**	$6,750					**450**	$6,750
198	Gravel base to concrete pavement	CY	$30.00	**2,785**	$83,550	**1,633**	$48,990	**1,267**	$38,010	**1,409**	$42,270
199	Curbing	LF	$38.00	**8,818**	$335,084	**8,199**	$311,562	**9,853**	$374,414	**10,675**	$405,650
200	*Baseball and Softball field:*	*SF*		***50,099***		***72,268***		***82,881***		***150,922***	
201	Rough/fine grading	SF	$0.75	**50,099**	$37,574	**72,268**	$54,201	**82,881**	$62,161	**150,922**	$113,192
202	Cut and fill	CY	$12.00	**2,171**	$26,052	**3,132**	$37,584	**3,592**	$43,104	**6,540**	$78,480
203	8" Stone base	CY	$70.00	**1,361**	$95,270	**1,963**	$137,410	**2,251**	$157,570	**4,099**	$286,930
204	Sand base	CY	$80.00	**340**	$27,200	**491**	$39,280	**563**	$45,040	**1,025**	$82,000
205	Underdrain	GSF	$1.75	**50,099**	$87,673	**72,268**	$126,469	**82,881**	$145,042	**150,922**	$264,114
206	Infield surfacing	SF	$2.50	**15,995**	$39,988	**47,608**	$119,020	**40,076**	$100,190	**46,458**	$116,145
207	Sod	SF	$1.50	**34,104**	$51,156	**24,660**	$36,990	**42,805**	$64,208	**104,464**	$156,696
208	Irrigation	SF	$0.75	**34,104**	$25,578	**24,660**	$18,495	**42,805**	$32,104	**104,464**	$78,348
209	Base plate	EA	$450.00	**8**	$3,600	**12**	$5,400	**12**	$5,400	**12**	$5,400
210	Removable foul poles	EA	$2,500.00	**4**	$10,000	**6**	$15,000	**6**	$15,000	**6**	$15,000
211	Removable soccer goal posts	EA	$1,400.00	**2**	$2,800	**3**	$4,200	**3**	$4,200	**3**	$4,200
212	Backstop	SF	$10.00	**3,660**	$36,600	**3,660**	$36,600	**3,660**	$36,600	**3,660**	$36,600
213	*Football/Rugby, Lacrosse 01, Soccer field:*	*SF*		***258,471***		***313,908***		***282,489***		***279,312***	
214	Rough/fine grading	SF	$0.75	**258,471**	$193,853	**313,908**	$235,431	**282,489**	$211,867	**279,312**	$209,484
215	Cut and fill	CY	$12.00	**11,200**	$134,400	**13,603**	$163,236	**12,241**	$146,892	**12,104**	$145,248
216	8" Stone base	CY	$70.00	**7,020**	$491,400	**8,526**	$596,820	**7,673**	$537,110	**7,586**	$531,020
217	Sand base	CY	$80.00	**1,755**	$140,400	**2,131**	$170,480	**1,918**	$153,440	**1,897**	$151,760
218	Underdrain	GSF	$1.75	**258,471**	$452,324	**313,908**	$549,339	**282,489**	$494,356	**279,312**	$488,796
219	Sod	SF	$1.50	**258,471**	$387,707	**313,908**	$470,862	**282,489**	$423,734	**279,312**	$418,968
220	Irrigation	SF	$0.75	**258,471**	$193,853	**313,908**	$235,431	**282,489**	$211,867	**279,312**	$209,484
221	**G2010 Paving and Surfacing Total**				**$4,793,468**		**$4,779,751**		**$4,693,048**		**$5,472,563**
222											
223	**G2040 Site Improvements**										
224	Bioretention terraces	SF	$35.00					**3,836**	$134,260		

G. COST ESTIMATE / OPM

GRADE 8-12 DIRECT TRADE COST DETAILS

	ELEMENT	UNIT	UNIT RATE	OPTION C.2.1 Major Reno/Minor Add		OPTION C.2.3 Minor Reno/Major Add		OPTION C.2.4 Minor Reno/Major Add		OPTION C.3.1 New Construction	
				QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST
225	Flag pole w/ foundation	EA	$7,500.00	1	$7,500	1	$7,500	1	$7,500	1	$7,500
226	Bench	AL	$15,000.00	1	$15,000	1	$15,000	1	$15,000	1	$15,000
227	Bike racks	AL	$3,500.00	1	$3,500	1	$3,500	1	$3,500	1	$3,500
228	Metal trash receptacles	EA	$800.00	8	$6,400	8	$6,400	8	$6,400	8	$6,400
229	Concrete fill steel bollard	AL	$12,000.00	1	$12,000	1	$12,000	1	$12,000	1	$12,000
230	Misc. site improvement other than above	LS	$100,000.00	1	$100,000	1	$100,000	1	$100,000	1	$100,000
231	Traffic signs	AL	$12,000.00	1	$12,000	1	$12,000	1	$12,000	1	$12,000
232	Building sign	AL	$15,000.00	1	$15,000	1	$15,000	1	$15,000	1	$15,000
233	**G2040 Site Improvements Total**				**$171,400**		**$171,400**		**$305,660**		**$171,400**
234											
235	**G2050 Plantings, Soft Landscaping**										
236	Respread topsoil	CY	$10.00	13,383	$133,830	13,383	$133,830	13,383	$133,830	13,383	$133,830
237	Topsoil for planting beds, shrubs and perennials	CY	$28.00	338	$9,471	278	$7,778	278	$7,778	278	$7,778
238	Mulch	CY	$50.00	52	$2,617	46	$2,315	46	$2,315	46	$2,315
239	Lawn	SF	$0.40	217,000	$86,800	377,696	$151,078	284,352	$113,741	196,000	$78,400
240	Sod - Outdoor classroom	SF	$1.75							10,189	$17,831
241	New trees	AL	$156,000.00	1	$156,000	1	$156,000	1	$156,000	1	$156,000
242	Gardens	SF	$8.00	28,277	$226,216	8,237	$65,896	29,521	$236,168	69,219	$553,752
243	Groundcovers	AL	$10,000.00	1	$10,000	1	$10,000	1	$10,000	1	$10,000
244	**G2050 Plantings, Soft Landscaping Total**				**$624,934**		**$526,897**		**$659,831**		**$959,905**
245											
246											
247	**G30 SITE MECHANICAL UTILITIES**										
248											
249	**G3010 Water Supply and Distribution**										
250	8" T & S & G.	EA	$4,200.00	1	$4,200	1	$4,200	1	$4,200	1	$4,200
251	4" Gate	EA	$1,200.00	1	$1,200	1	$1,200	1	$1,200	1	$1,200
252	Hydrant and gate	EA	$2,800.00	4	$11,200	4	$11,200	4	$11,200	4	$11,200
253	4" CLDI domestic water	LF	$65.00	50	$3,250	50	$3,250	50	$3,250	50	$3,250
254	6" CLDI Fire	LF	$80.00	200	$16,000	200	$16,000	200	$16,000	200	$16,000
255	8" CLDI fire service and loop	LF	$95.00	400	$38,000	150	$14,250	350	$33,250	340	$32,300
256	Thrust blocks	LS	$2,000.00	1	$2,000	1	$2,000	1	$2,000	1	$2,000
257	**G3010 Water Supply and Distribution Total**				**$75,850**		**$52,100**		**$71,100**		**$70,150**
258											
259	**G3020 Sanitary Sewer System**										
260	Connect to existing sewer	EA	$2,000.00	1	$2,000	1	$2,000	1	$2,000	1	$2,000
261	SMH	EA	$4,000.00	6	$24,000	10	$40,000	10	$40,000	4	$16,000
262	1,500 Grease trap	EA	$7,500.00	1	$7,500	1	$7,500	1	$7,500	1	$7,500
263	Pump station	LS	$30,000.00								
264	3" HDPE sewer force main	LF	$125.00								
265	8" sewer drain	LF	$65.00								
266	6" PVC sewer	LF	$50.00	650	$32,500	1,050	$52,500	1,040	$52,000	340	$17,000
267	**G3020 Sanitary Sewer System Total**				**$66,000**		**$102,000**		**$101,500**		**$42,500**
268											
269	**G3030 Stormwater Management System**										
270	Bioretention	SF	$20.00	4,836	$96,720	8,802	$176,040	24,266	$485,320	30,925	$618,500
271	Bioretention zone	SF	$5.00	31,413	$157,065	34,887	$174,435	45,015	$225,075	32,876	$164,380
272	Stormwater base in pavement area	GSF	$5.00	273,125	$1,365,625	190,403	$952,015	222,384	$1,111,920	268,694	$1,343,470
273	**G3030 Stormwater Management System Total**				**$1,619,410**		**$1,302,490**		**$1,822,315**		**$2,126,350**
274	**G40 SITE ELECTRICAL UTILITIES**										
275											
276	**G4010 Site Electrical Utilities**										
277	*Primary and Secondary Service*										
278	Utility co. back charges	LS	$30,000.00	1	$30,000	1	$30,000	1	$30,000	1	$30,000
279	Electrical primary service riser	LS	$1,500.00	1	$1,500	1	$1,500	1	$1,500	1	$1,500
280	Primary ductbank 2-5" ductbank, empty	LF	$145.00	400	$58,000	200	$29,000	350	$50,750	340	$49,300
281	Transformer by utility company				By Utility Co.		By Utility Co.		By Utility Co.		By Utility Co.
282	Transformer pad	EA	$3,000.00	1	$3,000	1	$3,000	1	$3,000	1	$3,000
283	3000A secondary service	LF	$850.00	60	$51,000	60	$51,000	60	$51,000	60	$51,000
284	2500A secondary service	LF	$710.00	340	$241,400	140	$99,400	290	$205,900	280	$198,800
285	*Communications*										
286	Communications pole riser	EA	$1,500.00	1	$1,500	1	$1,500	1	$1,500	1	$1,500
287	Telecom ductbank 4-4" empty	LF	$152.00	400	$60,800	200	$30,400	350	$53,200	340	$51,680
288	Site CCTV (Security)	LS	$35,000.00	1	$35,000	1	$35,000	1	$35,000	1	$35,000
289	Site lighting and circuitry	LS	$300,000.00	1	$300,000	1	$300,000	1	$300,000	1	$300,000
290	**G4010 Site Electrical Utilities Total**				**$782,200**		**$580,800**		**$731,850**		**$721,780**
291											
292											
293											

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

G. COST ESTIMATE / OPM

GRADES 9-12 MAIN SUMMARY

ELEMENT	OPTION C.2.1 Major Reno/Minor Add 343,719 GSF 42 MTH		OPTION C.2.3 Minor Reno/Major Add 343,719 GSF 37 MTH		OPTION C.2.4 Minor Reno/Major Add 343,719 GSF 37 MTH		OPTION C.3.1 New Construction 311,844 GSF 32 MTH	
Direct Trade Costs Details	$118,782,399	$345.58	$115,974,006	$337.41	$122,230,111	$355.61	$120,095,572	$385.11
Building Demolition	$84,303	$0.25	$1,632,595	$4.75	$1,632,595	$4.75	$1,478,440	$4.74
Hazardous Material Abatement	$7,100,000	$20.66	$7,100,000	$20.66	$7,100,000	$20.66	$7,100,000	$22.77
Direct Trade Details SubTotal	**$125,966,702**	**$366.48**	**$124,706,601**	**$362.82**	**$130,962,706**	**$381.02**	**$128,674,012**	**$412.62**
Design and Pricing Contingency	$15,117,000	$43.98	$14,965,000	$43.54	$13,097,000	$38.10	$12,868,000	$41.26
Direct Trade Cost Total	**$141,083,702**	**$410.46**	**$139,671,601**	**$406.35**	**$144,059,706**	**$419.12**	**$141,542,012**	**$453.89**
Staffing, Supervision and Management	$8,600,000	$25.02	$7,410,000	$21.56	$7,410,000	$21.56	$6,080,000	$19.50
Remainder of General Conditions, Project Requirements	$5,733,400	$16.68	$4,940,000	$14.37	$4,940,000	$14.37	$4,053,400	$13.00
Phasing and Logistics	$3,527,100	$10.26	$2,095,100	$6.10	$2,160,900	$6.29	$707,800	$2.27
General Liability Insurance	$1,623,000	$4.72	$1,607,000	$4.68	$1,657,000	$4.82	$1,628,000	$5.22
Performance and Payment Bonds	$1,411,000	$4.11	$1,397,000	$4.06	$1,441,000	$4.19	$1,416,000	$4.54
GMP Contingency	$7,055,000	$20.53	$6,984,000	$20.32	$7,203,000	$20.96	$3,539,000	$11.35
Fee	$4,938,000	$14.37	$4,540,000	$13.21	$4,682,000	$13.62	$4,247,000	$13.62
Estimated Construction Cost Total	**$173,971,202**	**$506.14**	**$168,644,701**	**$490.65**	**$173,553,606**	**$504.93**	**$163,213,212**	**$523.38**
Escalation from now to start of Construction	$13,095,000	$38.10	$12,694,000	$36.93	$13,063,000	$38.00	$12,285,000	$39.39
Estimated Construction Cost at Start of Construction	**$187,067,000**	**$544.24**	**$181,339,000**	**$527.58**	**$186,617,000**	**$542.93**	**$175,499,000**	**$562.78**

GRADE 9-12 DIRECT TRADE COST SUMMARY

ELEMENT	OPTION C.2.1 Major Reno/Minor Add 343,719 GSF		OPTION C.2.3 Minor Reno/Major Add 343,719 GSF		OPTION C.2.4 Minor Reno/Major Add 343,719 GSF		OPTION C.3.1 New Construction 311,844 GSF	
A10 Foundations	$20,753,524	$60.38	$19,505,911	$56.75	$22,032,388	$64.10	$22,203,711	$71.20
A SUBSTRUCTURE	**$20,753,524**	**$60.38**	**$19,505,911**	**$56.75**	**$22,032,388**	**$64.10**	**$22,203,711**	**$71.20**
B10 Superstructure	$5,801,425	$16.88	$13,633,212	$39.66	$13,209,275	$38.43	$15,061,529	$48.30
B20 Exterior Closure	$14,830,521	$43.15	$7,751,745	$22.55	$9,182,129	$26.71	$10,616,250	$34.04
B30 Roofing	$3,908,560	$11.37	$4,841,101	$14.08	$6,428,263	$18.70	$6,318,086	$20.26
B SHELL	**$24,540,506**	**$71.40**	**$26,226,057**	**$76.30**	**$28,819,666**	**$83.85**	**$31,995,865**	**$102.60**
C10 Interior Construction	$11,170,868	$32.50	$11,170,868	$32.50	$11,170,868	$32.50	$10,134,930	$32.50
C20 Stairs	$330,000	$0.96	$285,000	$0.83	$580,000	$1.69	$270,000	$0.87
C30 Interior Finishes	$9,789,745	$28.48	$8,918,225	$25.95	$8,918,225	$25.95	$7,796,100	$25.00
C INTERIORS	**$21,290,613**	**$61.94**	**$20,374,093**	**$59.28**	**$20,669,093**	**$60.13**	**$18,201,030**	**$58.37**
D10 Conveying	$240,000	$0.70	$240,000	$0.70	$240,000	$0.70	$380,000	$1.22
D20 Plumbing	$4,124,628	$12.00	$4,124,628	$12.00	$4,124,628	$12.00	$3,742,128	$12.00
D30 HVAC	$15,467,355	$45.00	$15,467,355	$45.00	$15,467,355	$45.00	$14,032,980	$45.00
D40 Fire Protection	$1,715,479	$4.99	$1,715,479	$4.99	$1,715,479	$4.99	$1,565,667	$5.02
D50 Electrical	$11,686,446	$34.00	$11,686,446	$34.00	$11,686,446	$34.00	$10,602,696	$34.00
D SERVICES	**$33,233,908**	**$96.69**	**$33,233,908**	**$96.69**	**$33,233,908**	**$96.69**	**$30,323,471**	**$97.24**
E10 Equipment	$2,577,893	$7.50	$2,577,893	$7.50	$2,577,893	$7.50	$2,338,830	$7.50
E20 Furnishings	$4,296,488	$12.50	$4,296,488	$12.50	$4,296,488	$12.50	$3,898,050	$12.50
E EQUIPMENT & FURNISHINGS	**$6,874,380**	**$20.00**	**$6,874,380**	**$20.00**	**$6,874,380**	**$20.00**	**$6,236,880**	**$20.00**
G1010 Site Clearing, Site Preparation	$685,272	$1.99	$685,272	$1.99	$685,272	$1.99	$685,272	$2.20
G1020 Building Demolition	$84,303	$0.25	$1,632,595	$4.75	$1,632,595	$4.75	$1,478,440	$4.74
G1020 Site Demolition, Selective Demolition	$2,819,087	$8.20	$1,076,047	$3.13	$1,076,047	$3.13	$425,547	$1.36
G1030 Earthwork	$451,847	$1.31	$482,900	$1.40	$454,052	$1.32	$459,148	$1.47
G1040 Hazardous Material Abatement	$7,100,000	$20.66	$7,100,000	$20.66	$7,100,000	$20.66	$7,100,000	$22.77
G10 SITE PREPARATION	**$11,140,509**	**$32.41**	**$10,976,814**	**$31.94**	**$10,947,966**	**$31.85**	**$10,148,407**	**$32.54**
G2010 Paving and Surfacing	$4,793,468	$13.95	$4,779,751	$13.91	$4,693,048	$13.65	$5,472,563	$17.55
G2040 Site Improvements	$171,400	$0.50	$171,400	$0.50	$305,660	$0.89	$171,400	$0.55
G2050 Plantings, Soft Landscaping	$624,934	$1.82	$526,897	$1.53	$659,831	$1.92	$959,905	$3.08
G20 SITE IMPROVEMENTS	**$5,589,802**	**$16.26**	**$5,478,048**	**$15.94**	**$5,658,539**	**$16.46**	**$6,603,868**	**$21.18**
G3010 Water Supply and Distribution	$75,850	$0.22	$52,100	$0.15	$71,100	$0.21	$70,150	$0.22
G3020 Sanitary Sewer System	$66,000	$0.19	$102,000	$0.30	$101,500	$0.30	$42,500	$0.14
G3030 Stormwater Management System	$1,619,410	$4.71	$1,302,490	$3.79	$1,822,315	$5.30	$2,126,350	$6.82
G4010 Site Electrical Utilities	$782,200	$2.28	$580,800	$1.69	$731,850	$2.13	$721,780	$2.31
G30 SITE MECHANICAL UTILITIES	**$2,543,460**	**$7.40**	**$2,037,390**	**$5.93**	**$2,726,765**	**$7.93**	**$2,960,780**	**$9.49**
Direct Trade Details SubTotal	**$125,966,702**	**$366.48**	**$124,706,601**	**$362.82**	**$130,962,706**	**$381.02**	**$128,674,012**	**$412.62**

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

G. COST ESTIMATE / OPM

GRADE 9-12 DIRECT TRADE COST DETAILS

	ELEMENT	UNIT	UNIT RATE	OPTION C.2.1 Major Reno/Minor Add QUANTITY	OPTION C.2.1 Major Reno/Minor Add COST	OPTION C.2.3 Minor Reno/Major Add QUANTITY	OPTION C.2.3 Minor Reno/Major Add COST	OPTION C.2.4 Minor Reno/Major Add QUANTITY	OPTION C.2.4 Minor Reno/Major Add COST	OPTION C.3.1 New Construction QUANTITY	OPTION C.3.1 New Construction COST
10	***Total***			***343,719 GSF***		***343,719 GSF***		***343,719 GSF***		***311,844 GSF***	
11	*Renovation*			*239,354 GSF*		*65,050 GSF*		*65,050 GSF*			
12	*New Construction / Addition*			*104,365 GSF*		*278,669 GSF*		*278,669 GSF*		*311,844 GSF*	
13	*Building Demolition*			*9,918 GSF*		*192,070 GSF*		*192,070 GSF*		*257,120 GSF*	
14											
15	**A SUBSTRUCTURE**										
16											
17	**A10 Foundations**										
18	*Reinforced concrete pile caps, structural steel piles, structured slab*										
19	steel pile, 50-ton; assume 25'long	LF	$85.00	**39,750**	$3,378,750	**42,750**	$3,633,750	**47,250**	$4,016,250	**50,000**	$4,250,000
20	concrete pile; 8x8x4 at clusters, 2x2x2 at single pile	EA	$7,550.00	**660**	$4,983,000	**770**	$5,813,500	**880**	$6,644,000	**920**	$6,946,000
21	grade beam at perimeter; 5' deep	LF	$1,500.00	**3,075**	$4,612,500	**2,110**	$3,165,000	**2,070**	$3,105,000	**2,125**	$3,187,500
22	grade beam at slab on grade; assume 60'oc grid	LF	$1,500.00	**1,800**	$2,700,000	**2,800**	$4,200,000	**3,400**	$5,100,000	**3,600**	$5,400,000
23	12" structured slab on grade, 6#/sf reinforcing, vapor barrier, 2" rigid insu	SF	$14.00	**77,950**	$1,091,300	**122,633**	$1,716,862	**150,185**	$2,102,590	**155,585**	$2,178,190
24	compacted granular structural fill; assume 12"	CY	$40.00	**3,031**	$121,256	**4,769**	$190,762	**5,841**	$233,621	**6,051**	$242,021
25	*New brace frames in existing to renovation areas*										
26	demo sog for new pile, patch and repair after install	LOC	$4,000.00	**181**	$724,000	**37**	$148,000	**39**	$156,000		
27	install new pile and pile cap	EA	$11,700.00	**181**	$2,117,700	**37**	$432,900	**39**	$456,300		
28	demo sog for new tie beam, patch and repair after install	LF	$190.00	**5,395**	$1,025,018	**1,080**	$205,137	**1,151**	$218,627		
29	**A10 Foundations Total**				**$20,753,524**		**$19,505,911**		**$22,032,388**		**$22,203,711**
30											
31											
32	**B SHELL**										
33											
34	**B10 Superstructure**										
35	*New brace frames in existing to renovation areas*										
36	addition of brace frames; assume 2#/sf face area	TNS	$5,000.00	**24**	$120,000						
37	new masonry shear wall at existing building	SF	$25.00	**23,270**	$581,750						
38	Anchor un-reinforced masonry walls to floor & roof structure	EA	$150.00	**991**	$148,650	**326**	$48,900	**477**	$71,550		
39	Reinforce existing roof diaphragms to resist uplift loads; assume 1#/covera	TNS	$5,000.00	**38**	$192,183	**28**	$138,390	**23**	$116,328		
40	*New building over Level 2 for Level 3 additions*										
41	new columns from Level 1 up per floor	EA	$2,500.00	**56**	$140,000						
42	Structural steel floor framing - 13#/gsf allowance provided	TNS	$3,900.00							**1,016**	$3,961,166
43	15#/gsf allowance provided	TNS	$3,900.00	**198**	$772,639	**1,170**	$4,564,053	**964**	$3,758,157		
44	above multi-purpose rooms & PE space; 18#/gsf	TNS	$3,900.00	**134**	$522,007	**292**	$1,136,889	**311**	$1,211,652	**376**	$1,465,636
45	Structural steel framing, columns & braced frames; assume 3#/gsf	TNS	$3,900.00	**157**	$610,535	**418**	$1,630,214	**418**	$1,630,214	**468**	$1,824,287
46	Structural steel roof framing - 13#/gsf allowance provided	TNS	$3,900.00	**461**	$1,798,456	**819**	$3,194,006	**939**	$3,660,629	**1,112**	$4,338,513
47	15#/gsf @ Gym & mechanical zone/low roof; add 2#/gsf	TNS	$4,680.00	**14**	$66,456	**25**	$117,936	**29**	$135,252	**55**	$255,996
48	5½" LWT slab on composite metal deck, fireproofing; upper slabs	SF	$12.50	**26,415**	$330,188	**156,036**	$1,950,450	**128,484**	$1,606,050	**156,259**	$1,953,238
49	low roof; assume 20% of roof area	SF	$12.50	**14,200**	$177,500	**25,200**	$315,000	**28,900**	$361,250	**34,300**	$428,750
50	1½" Type B metal roof deck	SF	$3.75	**77,950**	$292,313	**122,633**	$459,874	**150,185**	$563,194	**155,585**	$583,444
51	5½" LWT slab on metal deck; mech zone assume 5% of roof area	SF	$12.50	**3,900**	$48,750	**6,200**	$77,500	**7,600**	$95,000	**7,800**	$97,500
52	3" Type NA acoustic metal roof deck; Gym	SF	$7.50							**20,400**	$153,000

G. COST ESTIMATE / OPM

GRADE 9-12 DIRECT TRADE COST DETAILS

	ELEMENT	UNIT	UNIT RATE	OPTION C.2.1 Major Reno/Minor Add QUANTITY	OPTION C.2.1 Major Reno/Minor Add COST	OPTION C.2.3 Minor Reno/Major Add QUANTITY	OPTION C.2.3 Minor Reno/Major Add COST	OPTION C.2.4 Minor Reno/Major Add QUANTITY	OPTION C.2.4 Minor Reno/Major Add COST	OPTION C.3.1 New Construction QUANTITY	OPTION C.3.1 New Construction COST
53	**B10 Superstructure Total**				**$5,801,425**		**$13,633,212**		**$13,209,275**		**$15,061,529**
54	**B20 Exterior Closure**										
55	Existing exterior façade to remain; patch and repair only	SF	$10.00	**111,735**	$1,117,346	**20,090**	$200,895	**29,385**	$293,854		
56	remove and replace glazed openings; assume 20%	SF	$105.00	**22,350**	$2,346,750	**4,020**	$422,100	**5,880**	$617,400		
57	New façade; masonry, glass, doors	SF	$125.00	**90,931**	$11,366,425	**57,030**	$7,128,750	**66,167**	$8,270,875	**84,930**	$10,616,250
58	**B20 Exterior Closure Total**				**$14,830,521**		**$7,751,745**		**$9,182,129**		**$10,616,250**
59											
60	**B30 Roofing**										
61	Demo roof for new floor deck	SF	$15.00	**47,645**	$714,675						
62	Roofing; assume TPO	SF	$22.50	**70,945**	$1,596,263	**125,996**	$2,834,917	**144,404**	$3,249,079	**171,145**	$3,850,751
63	add low roof/canopy	AL	$100.00	**14,800**	$50,000	**8,900**	$890,000	**20,800**	$2,080,000	**13,445**	$1,344,500
64	mechanical zone and screen	LS	$175,000.00	**1**	$175,000	**1**	$175,000	**1**	$175,000	**1**	$175,000
65	soffits, fascia	LF	$425.00	**3,230**	$1,372,623	**2,215**	$941,184	**2,175**	$924,184	**2,230**	$947,835
66	**B30 Roofing Total**				**$3,908,560**		**$4,841,101**		**$6,428,263**		**$6,318,086**
67											
68											
69	**C INTERIORS**										
70											
71	**C10 Interior Construction**										
72	Renovate existing school	GSF	$32.50	**239,354**	$7,779,005	**65,050**	$2,114,125	**65,050**	$2,114,125		
73	Partitions	GSF	$20.00	**104,365**	$2,087,300	**278,669**	$5,573,380	**278,669**	$5,573,380	**311,844**	$6,236,880
74	Doors	GSF	$4.50	**104,365**	$469,643	**278,669**	$1,254,011	**278,669**	$1,254,011	**311,844**	$1,403,298
75	Storefront; assume 2% of interior walls	GSF	$1.75	**104,365**	$182,639	**278,669**	$487,671	**278,669**	$487,671	**311,844**	$545,727
76	Specialties	GSF	$6.25	**104,365**	$652,281	**278,669**	$1,741,681	**278,669**	$1,741,681	**311,844**	$1,949,025
77	**C10 Interior Construction Total**				**$11,170,868**		**$11,170,868**		**$11,170,868**		**$10,134,930**
78											
79	**C20 Stairs**										
80	Upgrade existing stair; assume replace railings	FLT	$15,000.00	**4**	$60,000	**1**	$15,000	**1**	$15,000		
81	New stairs	FLT	$35,000.00	**4**	$140,000	**4**	$140,000	**5**	$175,000	**4**	$140,000
82	Monumental/Open stair, allow	FLT	$65,000.00	**2**	$130,000	**2**	$130,000	**6**	$390,000	**2**	$130,000
83	**C20 Stairs Total**				**$330,000**		**$285,000**		**$580,000**		**$270,000**
84											
85	**C30 Interior Finishes**										
86	Renovate existing school	GSF	$30.00	**239,354**	$7,180,620	**65,050**	$1,951,500	**65,050**	$1,951,500		
87	*New School Building Construction*	*GSF*		***104,365***		***278,669***		***278,669***		***311,844***	
88	wall finishes	GSF	$6.75	**104,365**	$704,464	**278,669**	$1,881,016	**278,669**	$1,881,016	**311,844**	$2,104,947
89	flooring	GSF	$10.75	**104,365**	$1,121,924	**278,669**	$2,995,692	**278,669**	$2,995,692	**311,844**	$3,352,323
90	ceiling finishes	GSF	$7.50	**104,365**	$782,738	**278,669**	$2,090,018	**278,669**	$2,090,018	**311,844**	$2,338,830
91	**C30 Interior Finishes Total**				**$9,789,745**		**$8,918,225**		**$8,918,225**		**$7,796,100**
92											
93											
94	**D SERVICES**										
95											

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

G. COST ESTIMATE / OPM

GRADE 9-12 DIRECT TRADE COST DETAILS

	ELEMENT	UNIT	UNIT RATE	OPTION C.2.1 Major Reno/Minor Add QUANTITY	OPTION C.2.1 Major Reno/Minor Add COST	OPTION C.2.3 Minor Reno/Major Add QUANTITY	OPTION C.2.3 Minor Reno/Major Add COST	OPTION C.2.4 Minor Reno/Major Add QUANTITY	OPTION C.2.4 Minor Reno/Major Add COST	OPTION C.3.1 New Construction QUANTITY	OPTION C.3.1 New Construction COST
96	**D10 Conveying**										
97	Elevator; ETR, new cab	EA	$50,000.00	**1**	$50,000	**1**	$50,000	**1**	$50,000		
98	Elevator; new	EA	$190,000.00	**1**	$190,000	**1**	$190,000	**1**	$190,000	**2**	$380,000
99	**D10 Conveying Total**				**$240,000**		**$240,000**		**$240,000**		**$380,000**
100											
101	**D20 Plumbing**										
102	Plumbing	GSF	$12.00	**343,719**	$4,124,628	**343,719**	$4,124,628	**343,719**	$4,124,628	**311,844**	$3,742,128
103	**D20 Plumbing Total**				**$4,124,628**		**$4,124,628**		**$4,124,628**		**$3,742,128**
104											
105	**D30 HVAC**										
106	HVAC	EA	$45.00	**343,719**	$15,467,355	**343,719**	$15,467,355	**343,719**	$15,467,355	**311,844**	$14,032,980
107	**D30 HVAC Total**				**$15,467,355**		**$15,467,355**		**$15,467,355**		**$14,032,980**
108											
109	**D40 Fire Protection**										
110	Sprinkler Coverage	GSF	$4.70	**343,719**	$1,615,479	**343,719**	$1,615,479	**343,719**	$1,615,479	**311,844**	$1,465,667
111	Fire Pump	EA	$100,000.00	**1**	$100,000	**1**	$100,000	**1**	$100,000	**1**	$100,000
112	**D40 Fire Protection Total**				**$1,715,479**		**$1,715,479**		**$1,715,479**		**$1,565,667**
113											
114	**D50 Electrical**										
105	Interior Electrical	GSF	$34.00	**343,719**	$11,686,446	**343,719**	$11,686,446	**343,719**	$11,686,446	**311,844**	$10,602,696
116	**D50 Electrical Total**				**$11,686,446**		**$11,686,446**		**$11,686,446**		**$10,602,696**
117											
118											
119	**E EQUIPMENT & FURNISHINGS**										
120											
121	**E10 Equipment**										
122	Renovate existing school	GSF	$7.50	**239,354**	$1,795,155	**65,050**	$487,875	**65,050**	$487,875		
123	New Construction / Addition	GSF	$7.50	**104,365**	$782,738	**278,669**	$2,090,018	**278,669**	$2,090,018	**311,844**	$2,338,830
124	**E10 Equipment Total**				**$2,577,893**		**$2,577,893**		**$2,577,893**		**$2,338,830**
125											
126	**E20 Furnishings**										
127	Renovate existing school	GSF	$12.50	**239,354**	$2,991,925	**65,050**	$813,125	**65,050**	$813,125		
128	New Construction / Addition	GSF	$12.50	**104,365**	$1,304,563	**278,669**	$3,483,363	**278,669**	$3,483,363	**311,844**	$3,898,050
129	**E20 Furnishings Total**				**$4,296,488**		**$4,296,488**		**$4,296,488**		**$3,898,050**
130											
131											
132	**G10 SITE PREPARATION**										
133											
134	**G1010 Site Clearing, Site Preparation**										
135	Clearing and grubbing	ACRE	$4,000.00	**40**	$160,000	**40**	$160,000	**40**	$160,000	**40**	$160,000
136	Manter Well site; grassed	ACRE	$2,000.00								
137	Construction fence	LF	$12.00	**11,017**	$132,204	**11,017**	$132,204	**11,017**	$132,204	**11,017**	$132,204
138	Double construction gate	PR	$2,800.00	**4**	$11,200	**4**	$11,200	**4**	$11,200	**4**	$11,200

GRADE 9-12 DIRECT TRADE COST DETAILS

	ELEMENT	UNIT	UNIT RATE	OPTION C.2.1 Major Reno/Minor Add		OPTION C.2.3 Minor Reno/Major Add		OPTION C.2.4 Minor Reno/Major Add		OPTION C.3.1 New Construction	
				QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST
139	Strip and stockpile existing topsoil; assume avg. 6"	CY	$8.00	13,383	$107,064	13,383	$107,064	13,383	$107,064	13,383	$107,064
140	Temporary construction entrance including maintenance	EA	$9,000.00	4	$36,000	4	$36,000	4	$36,000	4	$36,000
141	Temp signs	LS	$1,800.00	2	$3,600	2	$3,600	2	$3,600	2	$3,600
142	Wash down/re-fueling	SF	$2.00	6,000	$12,000	6,000	$12,000	6,000	$12,000	6,000	$12,000
143	Protection of existing to remain	LS	$35,000.00	1	$35,000	1	$35,000	1	$35,000	1	$35,000
144	Temporary parking lot	AL	$15,000.00	1	$15,000	1	$15,000	1	$15,000	1	$15,000
145	Dewatering	LS	$35,000.00	1	$35,000	1	$35,000	1	$35,000	1	$35,000
146	Erosion control barrier	LF	$12.00	11,017	$132,204	11,017	$132,204	11,017	$132,204	11,017	$132,204
147	Erosion control barrier at temporary construction period soil stockpile	AL	$3,500.00	1	$3,500	1	$3,500	1	$3,500	1	$3,500
148	Inlet protection	AL	$2,500.00	1	$2,500	1	$2,500	1	$2,500	1	$2,500
149	**G1010 Site Clearing, Site Preparation Total**				**$685,272**		**$685,272**		**$685,272**		**$685,272**
150											
151	**G1020 Building Demolition**										
152	Building structure demolition, phased	GSF	$8.50	9,918	$84,303	192,070	$1,632,595	192,070	$1,632,595		
153	Building structure demolition	GSF	$5.75							257,120	$1,478,440
154	**G1020 Building Demolition Total**				**$84,303**		**$1,632,595**		**$1,632,595**		**$1,478,440**
155											
156	**G1020 Site Demolition, Selective Demolition**										
157	*Selective Site Demolition*										
158	saw cut existing pavement	LF	$12.00	150	$1,800	150	$1,800	150	$1,800	150	$1,800
159	asphalt pavement	SF	$1.20	181,037	$217,244	181,037	$217,244	181,037	$217,244	181,037	$217,244
160	concrete pavement	SF	$1.75	46,573	$81,503	46,573	$81,503	46,573	$81,503	46,573	$81,503
161	Cut, cap and remove existing utility	AL	$50,000.00	$1.00	$50,000	1	$50,000	1	$50,000	1	$50,000
162	Misc. demolition other than above	AL	$75,000.00	1	$75,000	1	$75,000	1	$75,000	1	$75,000
163	Existing school program interior selective demolition	GSF	$10.00	239,354	$2,393,540	65,050	$650,500	65,050	$650,500		
164	**G1020 Site Demolition, Selective Demolition Total**				**$2,819,087**		**$1,076,047**		**$1,076,047**		**$425,547**
165											
166	**G1030 Earthwork**										
167	Cut and fill for parking lot	CY	$11.00	8,381	$92,195	6,826	$75,091	8,284	$91,124	10,176	$111,935
168	concrete pavement	CY	$11.00	3,836	$42,199	1,935	$21,287	1,783	$19,609	2,011	$22,121
169	remainder of site grades	CY	$10.00	5,848	$58,478	9,835	$98,354	7,519	$75,191	5,327	$53,267
170	Rough and fine grading	SF	$0.50	517,951	$258,976	576,335	$288,168	536,256	$268,128	543,651	$271,826
171	**G1030 Earthwork Total**				**$451,847**		**$482,900**		**$454,052**		**$459,148**
172											
173	**G1040 Hazardous Material Abatement**										
174	Removal and disposal of all ACM, PCB and other hazardous materials	AL	$7,100,000.00	1	$7,100,000	1	$7,100,000	1	$7,100,000	1	$7,100,000
175	**G1040 Hazardous Material Abatement Total**				**$7,100,000**		**$7,100,000**		**$7,100,000**		**$7,100,000**
176											
177											
178	**G20 SITE IMPROVEMENTS**										
179											
180	**G2010 Paving and Surfacing**										
181	Asphalt paving at bus drop-off, deliveries, parent drop-off and parking lot	SF	$3.15	181,037	$570,267	147,452	$464,474	178,934	$563,642	219,800	$692,370

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

G. COST ESTIMATE / OPM

GRADE 9-12 DIRECT TRADE COST DETAILS

	ELEMENT	UNIT	UNIT RATE	OPTION C.2.1 Major Reno/Minor Add		OPTION C.2.3 Minor Reno/Major Add		OPTION C.2.4 Minor Reno/Major Add		OPTION C.3.1 New Construction	
				QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST
182	gravel base to asphalt pavement	CY	$32.00	7,376	$236,032	6,007	$192,224	7,290	$233,280	8,955	$286,560
183	paint crosswalk	AL	$2,500.00	1	$2,500	1	$2,500	1	$2,500	1	$2,500
184	parking stall	EA	$35.00	6	$210	6	$210	6	$210	6	$210
185	HC parking stall	EA	$85.00	424	$36,040	424	$36,040	424	$36,040	424	$36,040
186	misc. pavement marking	AL	$5,000.00	1	$5,000	1	$5,000	1	$5,000	1	$5,000
187	Patching to existing paving at street	LS	$5,000.00	1	$5,000	1	$5,000	1	$5,000	1	$5,000
188	Concrete sidewalk	SF	$7.25	46,573	$337,654	5,757	$41,738	24,722	$179,235	27,735	$201,079
189	Intergenerational walking path	SF	$3.50	16,405	$57,418	16,370	$57,295	16,350	$57,225	16,250	$56,875
190	Sport walk	SF	$7.50					3,084	$23,130	3,360	$25,200
191	curb cut	EA	$380.00	12	$4,560	12	$4,560	12	$4,560	12	$4,560
192	Cement concrete entrance	SF	$15.00	45,065	$675,975	37,194	$557,910	18,728	$280,920	20,709	$310,635
193	Loading dock	SF	$15.00	450	$6,750					450	$6,750
194	Gravel base to concrete pavement	CY	$30.00	2,785	$83,550	1,633	$48,990	1,267	$38,010	1,409	$42,270
195	Curbing	LF	$38.00	8,818	$335,084	8,199	$311,562	9,853	$374,414	10,675	$405,650
196	*Baseball and Softball field:*	*SF*		*50,099*		*72,268*		*82,881*		*150,922*	
197	Rough/fine grading	SF	$0.75	50,099	$37,574	72,268	$54,201	82,881	$62,161	150,922	$113,192
198	Cut and fill	CY	$12.00	2,171	$26,052	3,132	$37,584	3,592	$43,104	6,540	$78,480
199	8" Stone base	CY	$70.00	1,361	$95,270	1,963	$137,410	2,251	$157,570	4,099	$286,930
200	Sand base	CY	$80.00	340	$27,200	491	$39,280	563	$45,040	1,025	$82,000
201	Underdrain	GSF	$1.75	50,099	$87,673	72,268	$126,469	82,881	$145,042	150,922	$264,114
202	Infield surfacing	SF	$2.50	15,995	$39,988	47,608	$119,020	40,076	$100,190	46,458	$116,145
203	Sod	SF	$1.50	34,104	$51,156	24,660	$36,990	42,805	$64,208	104,464	$156,696
204	Irrigation	SF	$0.75	34,104	$25,578	24,660	$18,495	42,805	$32,104	104,464	$78,348
205	Base plate	EA	$450.00	8	$3,600	12	$5,400	12	$5,400	12	$5,400
206	Removable foul poles	EA	$2,500.00	4	$10,000	6	$15,000	6	$15,000	6	$15,000
207	Removable soccer goal posts	EA	$1,400.00	2	$2,800	3	$4,200	3	$4,200	3	$4,200
208	Backstop	SF	$10.00	3,660	$36,600	3,660	$36,600	3,660	$36,600	3,660	$36,600
209	*Football/Rugby, Lacrosse 01, Soccer field:*	*SF*		*258,471*		*313,908*		*282,489*		*279,312*	
210	Rough/fine grading	SF	$0.75	258,471	$193,853	313,908	$235,431	282,489	$211,867	279,312	$209,484
211	Cut and fill	CY	$12.00	11,200	$134,400	13,603	$163,236	12,241	$146,892	12,104	$145,248
212	8" Stone base	CY	$70.00	7,020	$491,400	8,526	$596,820	7,673	$537,110	7,586	$531,020
213	Sand base	CY	$80.00	1,755	$140,400	2,131	$170,480	1,918	$153,440	1,897	$151,760
214	Underdrain	GSF	$1.75	258,471	$452,324	313,908	$549,339	282,489	$494,356	279,312	$488,796
215	Sod	SF	$1.50	258,471	$387,707	313,908	$470,862	282,489	$423,734	279,312	$418,968
216	Irrigation	SF	$0.75	258,471	$193,853	313,908	$235,431	282,489	$211,867	279,312	$209,484
217	**G2010 Paving and Surfacing Total**				**$4,793,468**		**$4,779,751**		**$4,693,048**		**$5,472,563**
218											
219	**G2040 Site Improvements**										
220	Bioretention terraces	SF	$35.00					3,836	$134,260		
221	Flag pole w/ foundation	EA	$7,500.00	1	$7,500	1	$7,500	1	$7,500	1	$7,500
222	Bench	AL	$15,000.00	1	$15,000	1	$15,000	1	$15,000	1	$15,000
223	Bike racks	AL	$3,500.00	1	$3,500	1	$3,500	1	$3,500	1	$3,500
224	Metal trash receptacles	EA	$800.00	8	$6,400	8	$6,400	8	$6,400	8	$6,400

G. COST ESTIMATE / OPM

GRADE 9-12 DIRECT TRADE COST DETAILS

	ELEMENT	UNIT	UNIT RATE	OPTION C.2.1 Major Reno/Minor Add		OPTION C.2.3 Minor Reno/Major Add		OPTION C.2.4 Minor Reno/Major Add		OPTION C.3.1 New Construction	
				QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST
225	Concrete fill steel bollard	AL	$12,000.00	1	$12,000	1	$12,000	1	$12,000	1	$12,000
226	Misc. site improvement other than above	LS	$100,000.00	1	$100,000	1	$100,000	1	$100,000	1	$100,000
227	Traffic signs	AL	$12,000.00	1	$12,000	1	$12,000	1	$12,000	1	$12,000
228	Building sign	AL	$15,000.00	1	$15,000	1	$15,000	1	$15,000	1	$15,000
229	**G2040 Site Improvements Total**				**$171,400**		**$171,400**		**$305,660**		**$171,400**
230	**G2050 Plantings, Soft Landscaping**										
231	Respread topsoil	CY	$10.00	13,383	$133,830	13,383	$133,830	13,383	$133,830	13,383	$133,830
232	Topsoil for planting beds, shrubs and perennials	CY	$28.00	338	$9,471	278	$7,778	278	$7,778	278	$7,778
233	Mulch	CY	$50.00	52	$2,617	46	$2,315	46	$2,315	46	$2,315
234	Lawn	SF	$0.40	217,000	$86,800	377,696	$151,078	284,352	$113,741	196,000	$78,400
235	Sod - Outdoor classroom	SF	$1.75							10,189	$17,831
236	New trees	AL	$156,000.00	1	$156,000	1	$156,000	1	$156,000	1	$156,000
237	Gardens	SF	$8.00	28,277	$226,216	8,237	$65,896	29,521	$236,168	69,219	$553,752
238	Groundcovers	AL	$10,000.00	1	$10,000	1	$10,000	1	$10,000	1	$10,000
239	**G2050 Plantings, Soft Landscaping Total**				**$624,934**		**$526,897**		**$659,831**		**$959,905**
240											
241											
242	**G30 SITE MECHANICAL UTILITIES**										
243											
244	**G3010 Water Supply and Distribution**										
245	8" T & S & G.	EA	$4,200.00	1	$4,200	1	$4,200	1	$4,200	1	$4,200
246	4" Gate	EA	$1,200.00	1	$1,200	1	$1,200	1	$1,200	1	$1,200
247	Hydrant and gate	EA	$2,800.00	4	$11,200	4	$11,200	4	$11,200	4	$11,200
248	4" CLDI domestic water	LF	$65.00	50	$3,250	50	$3,250	50	$3,250	50	$3,250
249	6" CLDI Fire	LF	$80.00	200	$16,000	200	$16,000	200	$16,000	200	$16,000
250	8" CLDI fire service and loop	LF	$95.00	400	$38,000	150	$14,250	350	$33,250	340	$32,300
251	Thrust blocks	LS	$2,000.00	1	$2,000	1	$2,000	1	$2,000	1	$2,000
252	**G3010 Water Supply and Distribution Total**				**$75,850**		**$52,100**		**$71,100**		**$70,150**
253											
254	**G3020 Sanitary Sewer System**										
255	Connect to existing sewer	EA	$2,000.00	1	$2,000	1	$2,000	1	$2,000	1	$2,000
256	SMH	EA	$4,000.00	6	$24,000	10	$40,000	10	$40,000	4	$16,000
257	1,500 Grease trap	EA	$7,500.00	1	$7,500	1	$7,500	1	$7,500	1	$7,500
258	Pump station	LS	$30,000.00								
259	3" HDPE sewer force main	LF	$125.00								
260	8" sewer drain	LF	$65.00								
261	6" PVC sewer	LF	$50.00	650	$32,500	1,050	$52,500	1,040	$52,000	340	$17,000
262	**G3020 Sanitary Sewer System Total**				**$66,000**		**$102,000**		**$101,500**		**$42,500**
263											
264											
265	**G3030 Stormwater Management System**										
266	Bioretention	SF	$20.00	4,836	$96,720	8,802	$176,040	24,266	$485,320	30,925	$618,500
267	Bioretention zone	SF	$5.00	31,413	$157,065	34,887	$174,435	45,015	$225,075	32,876	$164,380
268	Stormwater base in pavement area	GSF	$5.00	273,125	$1,365,625	190,403	$952,015	222,384	$1,111,920	268,694	$1,343,470
269	**G3030 Stormwater Management System Total**				**$1,619,410**		**$1,302,490**		**$1,822,315**		**$2,126,350**
270											
271											
272											
273											
274	**G40 SITE ELECTRICAL UTILITIES**										
275											
276	**G4010 Site Electrical Utilities**										
277	*Primary and Secondary Service*										
278	Utility co. back charges	LS	$30,000.00	1	$30,000	1	$30,000	1	$30,000	1	$30,000
279	Electrical primary service riser	LS	$1,500.00	1	$1,500	1	$1,500	1	$1,500	1	$1,500
280	Primary ductbank 2-5" ductbank, empty	LF	$145.00	400	$58,000	200	$29,000	350	$50,750	340	$49,300
281	Transformer by utility company				By Utility Co.		By Utility Co.		By Utility Co.		By Utility Co.
282	Transformer pad	EA	$3,000.00	1	$3,000	1	$3,000	1	$3,000	1	$3,000
283	3000A secondary service	LF	$850.00	60	$51,000	60	$51,000	60	$51,000	60	$51,000
284	2500A secondary service	LF	$710.00	340	$241,400	140	$99,400	290	$205,900	280	$198,800
285	*Communications*										
286	Communications pole riser	EA	$1,500.00	1	$1,500	1	$1,500	1	$1,500	1	$1,500
287	Telecom ductbank 4-4" empty	LF	$152.00	400	$60,800	200	$30,400	350	$53,200	340	$51,680
288	Site CCTV (Security)	LS	$35,000.00	1	$35,000	1	$35,000	1	$35,000	1	$35,000
289	Site lighting and circuitry	LS	$300,000.00	1	$300,000	1	$300,000	1	$300,000	1	$300,000
290	**G4010 Site Electrical Utilities Total**				**$782,200**		**$580,800**		**$731,850**		**$721,780**
291											
292											
293											

PSR Estimate

Belmont High School

Design Options - GRADES 7-12

Belmont, MA

FINAL LEVEL 2 ESTIMATE

PM&C LLC
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Prepared for:

Perkins + Will Architects, Inc.

February 12, 2018

G. COST ESTIMATE / Design Team

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Belmont High School
Design Options - GRADES 7-12
Belmont, MA

12-Feb-18

PSR Estimate

MAIN CONSTRUCTION COST SUMMARY

				Gross Floor Area	$/sf	Estimated Construction Cost
1 RENOVATION ONLY OPTION						
C.1 (grades 7-12) - Renovation Only Option Does Not Satisfy Program						
RENOVATE EXISTING HIGH SCHOOL				257,120	$184.94	$47,552,567
REMOVE HAZARDOUS MATERIALS [1]						$7,100,000
SITEWORK - Allowance						$2,305,833
SUB-TOTAL				257,120	$221.52	$56,958,400
DESIGN AND PRICING CONTINGENCY	15%					$8,543,760
ESCALATION to Mid-Point	12%					$6,835,008
SUB-TOTAL						$72,337,168
GENERAL CONDITIONS [2]		24	MTHS		$150,000	$3,600,000
GENERAL REQUIREMENTS [2]	4%					$2,893,487
BONDS	0.75%					$542,529
INSURANCE	1.10%					$795,709
PERMIT						NIC
SUB-TOTAL						$80,168,893
OVERHEAD AND FEE	2.50%					$1,808,429
GMP CONTINGENCY	3%					$2,405,067
PHASING	6%					$4,810,134
TEMPORARY CLASSROOMS						By Owner
TOTAL OF ALL CONSTRUCTION OPTION C.1				257,120	$346.89	**$89,192,523**

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Belmont High School
Design Options - GRADES 7-12
Belmont, MA

12-Feb-18

PSR Estimate

OPTION C2.1 MAJOR RENOVATION + MINOR ADDITION

RENOVATIONS TO EXISTING SCHOOL		239,354	$297.04	$71,097,101
ADDITIONS		212,446	$320.53	$68,095,552
DEMOLISH EXISTING SCHOOL - PARTIAL (phased)		9,918	$10.00	$99,180
REMOVE HAZARDOUS MATERIALS				$7,100,000
TRAFFIC MITIGATION at CONCORD AVE				$2,000,000
SITEWORK				$14,209,864
SUB-TOTAL		451,800	$359.90	$162,601,697
DESIGN AND PRICING CONTINGENCY	10%			$16,260,170
ESCALATION	12%			$21,463,424
SUB-TOTAL		451,800	$443.39	$200,325,291
GENERAL CONDITIONS (48 MTHS SCHEDULE)				$9,600,000
GENERAL REQUIREMENTS	4.00%			$8,013,012
BONDS	0.75%			$1,502,440
INSURANCE	1.10%			$2,203,578
PERMIT				Waived
CM FEE	3%			$6,009,759
CM/GMP CONTINGENCY	2%			$4,006,506
PHASING PREMIUM	5.0%			$10,016,265
TOTAL OF ALL CONSTRUCTION		451,800	$534.92	**$241,676,851**

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Belmont High School
Design Options - GRADES 7-12
Belmont, MA

12-Feb-18

PSR Estimate

		Gross Floor Area	$/sf	Estimated Construction Cost
OPTION C2.3 MAJOR ADDITION + MINOR RENOVATION				
RENOVATIONS TO EXISTING SCHOOL		65,050	$216.21	$14,064,267
ADDITIONS		386,750	$340.21	$131,574,348
DEMOLISH EXISTING SCHOOL - PARTIAL (phased)		192,070	$8.00	$1,536,560
REMOVE HAZARDOUS MATERIALS				$7,100,000
TRAFFIC MITIGATION at CONCORD AVE				$2,000,000
SITEWORK				$14,481,792
SUB-TOTAL		451,800	$377.95	$170,756,967
DESIGN AND PRICING CONTINGENCY	10%			$17,075,697
ESCALATION	12%			$22,539,920
SUB-TOTAL		451,800	$465.63	$210,372,584
GENERAL CONDITIONS (42 MTHS SCHEDULE)				$8,400,000
GENERAL REQUIREMENTS	4.00%			$8,414,903
BONDS	0.75%			$1,577,794
INSURANCE	1.10%			$2,314,098
PERMIT				Waived
CM FEE	3%			$6,311,178
CM/GMP CONTINGENCY	2%			$4,207,452
PHASING PREMIUM	2.0%			$4,207,452
TOTAL OF ALL CONSTRUCTION		451,800	$544.06	**$245,805,461**

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Belmont High School
Design Options - GRADES 7-12
Belmont, MA

12-Feb-18

PSR Estimate

		Gross Floor Area	$/sf	Estimated Construction Cost
OPTION C2.4 MAJOR ADDITION + MINOR RENOVATION				
RENOVATIONS TO EXISTING SCHOOL		62,300	$217.33	$13,539,413
ADDITIONS		389,500	$334.65	$130,345,510
DEMOLISH EXISTING SCHOOL - PARTIAL (phased)		194,820	$8.00	$1,558,560
REMOVE HAZARDOUS MATERIALS				$7,100,000
TRAFFIC MITIGATION at CONCORD AVE				$2,000,000
SITEWORK				$14,688,674
SUB-TOTAL		451,800	$374.57	$169,232,157
DESIGN AND PRICING CONTINGENCY	10%			$16,923,216
ESCALATION	12%			$22,338,645
SUB-TOTAL		451,800	$461.47	$208,494,018
GENERAL CONDITIONS (42 MTHS SCHEDULE)				$8,400,000
GENERAL REQUIREMENTS	4.00%			$8,339,761
BONDS	0.75%			$1,563,705
INSURANCE	1.10%			$2,293,434
PERMIT				Waived
CM FEE	3%			$6,254,821
CM/GMP CONTINGENCY	2%			$4,169,880
PHASING PREMIUM	3.0%			$6,254,821
TOTAL OF ALL CONSTRUCTION		451,800	$543.98	**$245,770,440**

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Belmont High School
Design Options - GRADES 7-12
Belmont, MA

12-Feb-18

PSR Estimate

		Gross Floor Area	$/sf	Estimated Construction Cost
OPTION C3.1 ALL NEW CONSTRUCTION				
NEW BUILDING		422,925	$334.94	$141,655,831
DEMOLISH EXISTING SCHOOL		257,120	$6.00	$1,542,720
REMOVE HAZARDOUS MATERIALS				$7,100,000
TRAFFIC MITIGATION at CONCORD AVE				$2,000,000
SITEWORK				$14,550,334
SUB-TOTAL		422,925	$394.51	$166,848,885
DESIGN AND PRICING CONTINGENCY	10%			$16,684,889
ESCALATION	12%			$22,024,053
SUB-TOTAL		422,925	$486.04	$205,557,827
GENERAL CONDITIONS (36 MTHS SCHEDULE)				$7,200,000
GENERAL REQUIREMENTS	4.00%			$8,222,313
BONDS	0.75%			$1,541,684
INSURANCE	1.10%			$2,261,136
PERMIT				Waived
CM FEE	3%			$6,166,735
CM/GMP CONTINGENCY	2%			$4,111,157
TOTAL OF ALL CONSTRUCTION		422,925	$555.80	**$235,060,852**

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

G. COST ESTIMATE / Design Team

PM&C

Belmont High School
Design Options - GRADES 7-12 12-Feb-18
Belmont, MA

PSR Estimate

This PSR cost estimate was produced from drawings, narratives and other documentation prepared by Perkins + Wills Architects Inc. and their design team received January 12, 2018. Design and engineering changes occurring subsequent to the issue of these documents have not been incorporated in this estimate.

This estimate includes all direct construction costs, construction manager's overhead, fee and design contingency. Cost escalation assumes start dates indicated.

Bidding conditions are expected to be public bidding under Chapter 149a of the Massachusetts General Laws to pre-qualified construction managers, and pre-qualified sub-contractors, open specifications for materials and manufactures.

The estimate is based on prevailing wage rates for construction in this market and represents a reasonable opinion of cost. It is not a prediction of the successful bid from a contractor as bids will vary due to fluctuating market conditions, errors and omissions, proprietary specifications, lack or surplus of bidders, perception of risk, etc. Consequently the estimate is expected to fall within the range of bids from a number of competitive contractors or subcontractors, however we do not warrant that bids or negotiated prices will not vary from the final construction cost estimate.

ITEMS NOT CONSIDERED IN THIS ESTIMATE

Items not included in this estimate are:

- Relocation of Town wide fiber system
- Land acquisition, feasibility, and financing costs
- All professional fees and insurance
- Site or existing conditions surveys investigations costs, including to determine subsoil conditions
- All Furnishings, Fixtures and Equipment
- Items identified in the design as Not In Contract (NIC)
- Items identified in the design as by others
- Owner supplied and/or installed items as indicated in the estimate
- Utility company back charges, including work required off-site
- Work to City streets and sidewalks, (except as noted in this estimate)
- Construction contingency (GMP Contingency is included)
- Contaminated soils removal

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Belmont High School
Design Options
Belmont, MA

15-Nov-17

Feasibility Estimate

GFA 257,120

CONSTRUCTION COST SUMMARY

	BUILDING SYSTEM		*SUB-TOTAL*	*TOTAL*	*$/SF*	*%*
HIGH SCHOOL C.1 BASE RENOVATION						
A10	**FOUNDATIONS**					
	A1010	Standard Foundations	$25,000			
	A1020	Special Foundations	$0			
	A1030	Lowest Floor Construction	$581,034	**$606,034**	$2.36	1.3%
B10	**SUPERSTRUCTURE**					
	B1010	Upper Floor Construction	$718,560			
	B1020	Roof Construction	$50,000	**$768,560**	$2.99	1.6%
B20	**EXTERIOR CLOSURE**					
	B2010	Exterior Walls	$3,128,209			
	B2020	Windows/Curtainwall	$1,067,797			
	B2030	Exterior Doors	$305,052	**$4,501,058**	$17.51	9.5%
B30	**ROOFING**					
	B3010	Roof Coverings	$30,000			
	B3020	Roof Openings	$57,000	**$87,000**	$0.34	0.2%
C10	**INTERIOR CONSTRUCTION**					
	C1010	Partitions	$1,617,720			
	C1020	Interior Doors	$986,450			
	C1030	Specialties/Millwork	$1,435,076	**$4,039,246**	$15.71	8.5%
C20	**STAIRCASES**					
	C2010	Stair Construction	$132,000			
	C2020	Stair Finishes	$66,000	**$198,000**	$0.77	0.4%
C30	**INTERIOR FINISHES**					
	C3010	Wall Finishes	$1,465,800			
	C3020	Floor Finishes	$2,184,956			
	C3030	Ceiling Finishes	$1,829,048	**$5,479,804**	$21.31	11.5%
D10	**CONVEYING SYSTEMS**					
	D1010	Elevator	$240,000	**$240,000**	$0.93	0.5%
D20	**PLUMBING**					
	D20	Plumbing	$3,085,440	**$3,085,440**	$12.00	6.5%
D30	**HVAC**					
	D30	HVAC	$11,570,400	**$11,570,400**	$45.00	24.3%
D40	**FIRE PROTECTION**					
	D40	Fire Protection	$1,157,040	**$1,157,040**	$4.50	2.4%
D50	**ELECTRICAL**					
	D5010	Electrical Systems	$10,239,008	**$10,239,008**	$39.82	21.5%
E10	**EQUIPMENT**					
	E10	Equipment	$1,915,240	**$1,915,240**	$7.45	4.0%

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

G. COST ESTIMATE / Design Team

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Belmont High School
Design Options
Belmont, MA

15-Nov-17

Feasibility Estimate

GFA 257,120

CONSTRUCTION COST SUMMARY

	BUILDING SYSTEM		*SUB-TOTAL*	*TOTAL*	*$/SF*	*%*
HIGH SCHOOL C.1 BASE RENOVATION						
E20	**FURNISHINGS**					
	E2010	Fixed Furnishings	$2,406,493			
	E2020	Movable Furnishings	NIC	**$2,406,493**	$9.36	5.1%
F10	**SPECIAL CONSTRUCTION**					
	F10	Special Construction	$0	**$0**	$0.00	0.0%
F20	**SELECTIVE BUILDING DEMOLITION**					
	F2010	Building Elements Demolition	$1,259,244			
	F2020	Hazardous Components Abatement	$0	**$1,259,244**	$4.90	2.6%
TOTAL DIRECT COST (Trade Costs)				***$47,552,567***	*$184.94*	*100.0%*

G. COST ESTIMATE / Design Team

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Belmont High School 15-Nov-17
Design Options
Belmont, MA

Feasibility Estimate **GFA** 257,120

	DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
	HIGH SCHOOL C.1 BASE RENOVATION						
1	***GROSS FLOOR AREA CALCULATION***						
2							
3	***First Floor***				172,000		
4	***Second Floor***				85,120		
5							
6	***TOTAL GROSS FLOOR AREA (GFA)***				**257,120** ***sf***		
7							
8							
9	***A10 FOUNDATIONS***						
10							
11	**A1010 STANDARD FOUNDATIONS**						
12	Miscellaneous repairs/ resurfacing of cracks at exposed concrete foundations	**1**	ls	25,000.00	25,000		
13	SUBTOTAL					25,000	
14							
15	**A1020 SPECIAL FOUNDATIONS**						
16	No work in this section						
17	SUBTOTAL						
18							
19	**A1030 LOWEST FLOOR CONSTRUCTION**						
20	Cutting and patching for MEP	**1**	ls	50,000.00	50,000		
21	New slab at bathrooms, shower areas and kitchen	**11,455**	sf	20.00	229,100		
22	Slab on grade repair in Fieldhouse at water infiltration locations	**27,956**	sf	1.50	41,934		
23	Allowance for ramps on grade; 12" structural supported slab on piles - allowance	**8**	loc	30,000.00	240,000		
24	New equipment pads	**1**	ls	20,000.00	20,000		
25	Loading dock				ETR		
26	Elevator pit				ETR		
27	SUBTOTAL					581,034	
28							
29	***TOTAL - FOUNDATIONS***						**$606,034**
30							
31							
32	***B10 SUPERSTRUCTURE***						
33							
34	**B1010 FLOOR CONSTRUCTION**						
35	Openings in structure for MEP systems	**257,120**	gsf	0.50	128,560		
36	Allowance for ramps at upper floor including reinforcing existing structure	**6**	loc	15,000.00	90,000		
36	2hr Fireproofing to existing structure (excluding Pool, Fieldhouse, Auditorium, Tiered Lecture Hall & Modular building) approx 200,000sf	**1**	ls	500,000.00	500,000		
37	SUBTOTAL					718,560	
38							
39	**B1020 ROOF CONSTRUCTION**						
40	Support framing for new MEP systems	**1**	ls	50,000.00	50,000		
41	SUBTOTAL					50,000	
42							
43	***TOTAL - SUPERSTRUCTURE***						**$768,560**
44							
45							
46	***B20 EXTERIOR CLOSURE***						
47							
48	**B2010 EXTERIOR WALLS**	*62,796*	*sf*				
49	Repair and repoint exterior walls- brick; assume 100%	**39,835**	sf	32.00	1,274,720		
50	Repairs to precast concrete panels, fins and banding	**13,058**	sf	25.00	326,450		
51	Clean all exterior walls; includes staging	**50,493**	sf	8.00	403,944		

Belmont High School PSR Estimate 2.12.18 GR 7-12 Page 10 PMC - Project Management Cost

PM&C

Belmont High School 15-Nov-17
Design Options
Belmont, MA

Feasibility Estimate **GFA** 257,120

	DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
	HIGH SCHOOL C.1 BASE RENOVATION						
52	Replace composite metal panels	**5,431**	sf	75.00	407,325		
53	Replace ribbon aluminum fascia panels	**5,684**	sf	80.00	454,720		
54	Replace colored aluminum fascia panels	**2,388**	sf	85.00	202,980		
55	Re-caulk existing CJ	**2,538**	lf	15.00	38,070		
56	Allowance for work at exits for ADA access to Courtyard	**1**	ls	20,000.00	20,000		
57	Seismic clips at masonry partitions				NR		
58	SUBTOTAL					3,128,209	
59							
60	**B2020 WINDOWS/CURTAINWALL**	*18,517*	*sf*				
61	Replace existing windows/curtainwall etc.; 50%	**5,860**	sf	110.00	644,600		
62	Replace existing translucent panels; 50%	**3,399**	sf	80.00	271,920		
63	Replace louvers	**700**	sf	65.00	45,500		
64	Backer rod & double sealant	**10,074**	lf	9.00	90,666		
64	Wood blocking at openings	**5,037**	lf	3.00	15,111		
65	SUBTOTAL					1,067,797	
65							
66	**B2030 EXTERIOR DOORS**						
66	Replace exterior glazed door, double	**15**	pr	8,500.00	127,500		
67	Replace exterior glazed door, single	**3**	ea	4,000.00	12,000		
67	Replace exterior single door	**3**	ea	2,100.00	6,300		
67	Replace exterior double door	**23**	pr	4,000.00	92,000		
67	Replace overhead doors; 8'x8'	**5**	ea	7,040.00	35,200		
68	Replace overhead doors; 12'x15'	**1**	ea	19,800.00	19,800		
68	Backer rod & double sealant	**1,021**	lf	9.00	9,189		
68	Wood blocking at openings	**1,021**	lf	3.00	3,063		
68	SUBTOTAL					305,052	
69							
69	***TOTAL - EXTERIOR CLOSURE***						**$4,501,058**
69							
69							
70	***B30 ROOFING***						
70							
70	**B3010 ROOF COVERINGS**						
70	Membrane roof system	**164,000**	sf		ETR		
71	Modular building roofing	**8,000**	sf		ETR		
71	Allowance for patching at new MEP penetrations	**1**	ls	30,000.00	30,000		
71	SUBTOTAL					30,000	
71							
72	**B3020 ROOF OPENINGS**						
72	New stage smoke hatches	**4**	ea	8,000.00	32,000		
72	Replace roof ladders/hatches etc.	**1**	ls	25,000.00	25,000		
72	SUBTOTAL					57,000	
73							
73	***TOTAL - ROOFING***						**$87,000**
73							
73							
74	***C10 INTERIOR CONSTRUCTION***						
74							
74	**C1010 PARTITIONS**						
74	Seismic clips at masonry partitions				NR		
75	Repair existing interior partitions disturbed by new work/ at ACM demo/ at ADA new access locations	**257,120**	sf	6.00	1,542,720		
75	Allowance to replace 20% interior borrowed lites/sidelights	**1**	ls	75,000.00	75,000		
75	SUBTOTAL					1,617,720	
75							
76	**C1020 INTERIOR DOORS**						

G. COST ESTIMATE / Design Team

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Belmont High School 15-Nov-17
Design Options
Belmont, MA

Feasibility Estimate **GFA** 257,120

		DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
		HIGH SCHOOL C.1 BASE RENOVATION						
76		Adjust door openings, install new door frame to meet code requirements (door carried below)	**148**	ea	2,000.00	296,000		
76		New door & hardware at demolished doors/ ADA upgraded opes	**310**	ea	1,350.00	418,500		
76		Remove and replace doors	**281**	ea	500.00	140,500		
77		New hardware at existing to remain doors	**281**	ea	450.00	126,450		
77		Repalce wire glass vision lites at stair doors - allow	**1**	ls	5,000.00	5,000		
78		SUBTOTAL					986,450	
78								
79	**C1030**	**SPECIALTIES / MILLWORK**						
79		Toilet Partitions and accessories	**257,120**	gsf	0.80	205,696		
80		New markerboards/tackboards	**257,120**	gsf	1.00	257,120		
80		Academic lockers, full height	**1,470**	ea	190.00	279,300		
81		Replace athletic/workshop/music/band lockers - allowance	**1**	ls	100,000.00	100,000		
81		New guardrail at Fieldhouse bleachers	**150**	lf	200.00	30,000		
82		Rails at new ramps	**840**	lf	75.00	63,000		
82		Allowance for miscellaneous specialties; wall protection, fire extinguishers etc	**1**	ls	50,000.00	50,000		
83								
83	*055000*	*MISCELLANEOUS METALS*						
84		Miscellaneous metals throughout building	**257,120**	sf	0.50	128,560		
84								
85	*061000*	*ROUGH CARPENTRY*						
85		Rough blocking	**257,120**	sf	0.15	38,568		
86								
86	*070001*	*WATERPROOFING, DAMPPROOFING AND CAULKING*						
87		Miscellaneous sealants throughout building	**257,120**	sf	0.75	192,840		
87								
88	*101400*	*SIGNAGE*						
88		Code compliant signage	**257,120**	sf	0.35	89,992		
89		SUBTOTAL					1,435,076	
89								
90		***TOTAL - INTERIOR CONSTRUCTION***						**$4,039,246**
90								
91								
91	***C20***	***STAIRCASES***						
92								
92	**C2010**	**STAIR CONSTRUCTION**						
93		Upgrade existing stair rails and nosings for code upgrades	**9**	flt	8,000.00	72,000		
93		New stairs at Theater in Library	**2**	flts	30,000.00	60,000		
94		SUBTOTAL					132,000	
94								
95	**C2020**	**STAIR FINISHES**						
95		New stair finishes; rubber treads/risers/landing and painting	**11**	flt	6,000.00	66,000		
96		SUBTOTAL					66,000	
96								
97		***TOTAL - STAIRCASES***						**$198,000**
97								
98								
98	***C30***	***INTERIOR FINISHES***						
99								
99	**C3010**	**WALL FINISHES**						
100		Painting throughout	**257,120**	gsf	2.50	642,800		
100		New tile in bathrooms, lockers rooms and corridors	**25,000**	sf	22.00	550,000		
101		Replace wall finishes in auditorium & little theater	**1**	ls	150,000.00	150,000		

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

G. COST ESTIMATE / Design Team

PM&C

Belmont High School 15-Nov-17
Design Options
Belmont, MA

Feasibility Estimate **GFA** 257,120

		DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
		HIGH SCHOOL C.1 BASE RENOVATION						
101		Acoustic panels at gym	**1**	ls	60,000.00	60,000		
102		Allowance for acoustic panels in Practice & Music rooms	**2,520**	sf	25.00	63,000		
102		SUBTOTAL					1,465,800	
103								
103	**C3020**	**FLOOR FINISHES**	*244,507*	*sf*				
104		New resilient flooring throughout including floor prep	**140,322**	sf	8.00	1,122,576		
104		VCT in storage areas	**6,919**	sf	4.00	27,676		
105		Wood gym floor	**5,621**	sf	18.00	101,178		
105		Tile flooring in bathrooms	**4,683**	sf	22.00	103,026		
106		Tile flooring in kitchen/servery	**4,081**	sf	24.00	97,944		
106		Tile flooring in locker rooms	**11,442**	sf	22.00	251,724		
107		Stage flooring	**2,870**	sf	26.00	74,620		
107		Carpet in Admin areas	**2,446**	sy	45.00	110,070		
108		Fieldhouse flooring; patch at slab repairs	**27,956**	sf	2.00	55,912		
108		Sealed concrete at mech/elec areas	**7,933**	sf	1.50	11,900		
109		Resinous flooring in woodshop	**1,768**	sf	9.00	15,912		
109		Athletic flooring in Weight room	**1,721**	sf	14.00	24,094		
110		Pool area; assume ETR, allowance to patch/repair as necessary	**7,177**	sf	5.00	35,885		
110		Allowance for new bases	**1**	ls	152,438.78	152,439		
111		SUBTOTAL					2,184,956	
111								
112	**C3030**	**CEILING FINISHES**						
112		Allowance for gypsum ceiling on sound rated absorption panels in auditorium & lecture hall	**10,557**	sf	30.00	316,710		
113		ACT ceilings	**184,835**	sf	6.50	1,201,428		
113		Cafeteria ceiling allowance for acoustic baffles	**8,361**	sf	25.00	209,025		
114		Paint ceilings in Gym, Fieldhouse & Pool	**40,754**	sf	2.50	101,885		
114		SUBTOTAL					1,829,048	
115								
115		***TOTAL - INTERIOR FINISHES***						**$5,479,804**
116								
116								
117	***D10***	***CONVEYING SYSTEMS***						
117								
118		Remove existing elevator	**1**	ls	25,000.00	25,000		
118		New elevator in existing shaft	**2**	stp	90,000.00	180,000		
119		New lift in Auditorium	**1**	stp	35,000.00	35,000		
119		SUBTOTAL					240,000	
120								
120		***TOTAL - CONVEYING SYSTEMS***						**$240,000**
121								
121								
122	***D20***	***PLUMBING***						
122								
123	**D20**	**PLUMBING, GENERALLY**						
123		Plumbing upgrades	**257,120**	gsf	12.00	3,085,440		
124		SUBTOTAL					3,085,440	
124								
125		***TOTAL - PLUMBING***						**$3,085,440**
125								
126								
126	***D30***	***HVAC***						
127								
127	**D30**	**HVAC, GENERALLY**						
128		New HVAC system; full AC	**257,120**	gsf	45.00	11,570,400		
128		SUBTOTAL					11,570,400	
129								
129		***TOTAL - HVAC***						**$11,570,400**

G. COST ESTIMATE / Design Team

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Belmont High School 15-Nov-17
Design Options
Belmont, MA

Feasibility Estimate **GFA** 257,120

	DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
	HIGH SCHOOL C.1 BASE RENOVATION						
	D40 FIRE PROTECTION						
	D40 FIRE PROTECTION, GENERALLY						
	New sprinkler system	**257,120**	gsf	4.50	1,157,040		
	SUBTOTAL					1,157,040	
	TOTAL - FIRE PROTECTION						**$1,157,040**
	D50 ELECTRICAL						
	D5010 SERVICE & DISTRIBUTION						
	Gear & Distribution						
	2000 amp switchgear				ETR		
	Normal power distribution switchgear & feeders	**257,120**	sf	4.00	1,028,480		
	Emergency power						
	Emergency power distribution switchgear & feeders; 275 kW diesel generator	**257,120**	sf	4.00	1,028,480		
	UPS system						
	30kVA UPS system and switchgear	**1**	ea	30,000.00	30,000		
	Equipment Wiring						
	Equipment wiring	**257,120**	sf	2.25	578,520		
	SUBTOTAL					2,665,480	
	D5020 LIGHTING & POWER						
	Lighting & Branch Power				-		
	Lighting fixtures (LED as BOD) with installation labor	**257,120**	sf	7.00	1,799,840		
	Lighting control system						
	Lighting controls including interface with DDC	**257,120**	sf	1.75	449,960		
	Branch devices						
	Branch devices	**257,120**	sf	0.50	128,560		
	Lighting and branch circuitry						
	Lighting & branch circuitry	**257,120**	sf	5.00	1,285,600		
	SUBTOTAL					3,663,960	
	D5030 COMMUNICATION & SECURITY SYSTEMS						
	Fire Alarm						
	Fire alarm system	**257,120**	sf	2.50	642,800		
	Bi-Directional System						
	BDA system	**257,120**	sf	0.50	128,560		
	Security System						
	Security System	**257,120**	sf	2.00	514,240		
	Telephone/Data/CATV						
	Network switches, PBX, IP, VP, CCTV (By owner)				By Owner		
	Telecommunications rough in	**257,120**	sf	1.50	385,680		
	Telecommunications devices and cabling	**257,120**	sf	3.00	771,360		
	Public Address/Clock System						
	PA/Master Clock system	**257,120**	sf	1.25	321,400		
	Audio Visual (rough-in and power only)						
	AV equipment				By Owner		
	Rough-In conduit and backboxes only	**257,120**	sf	0.50	128,560		
	Auditorium						
	Rigging system equipment & installation				See equipment		
	Power to rigging equipment	**1**	ls	12,000.00	12,000		
	Stage dimming system with performance fixture package, allow	**1**	ls	275,000.00	275,000		
	Installation, rough-in & 120V power to dimming equipment	**1**	ls	70,000.00	70,000		
	Performance audio visual equipment, installation & LV cabling, allow	**1**	ls	150,000.00	150,000		

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Belmont High School 15-Nov-17
Design Options
Belmont, MA

Feasibility Estimate **GFA** 257,120

	DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
	HIGH SCHOOL C.1 BASE RENOVATION						
159	Performance audio visual rough-in and power	**1**	ls	60,000.00	60,000		
159	Gymnasium						
160	Sound system	**1**	ls	15,000.00	15,000		
160	Scoreboard/ shot clocks with feed and connection	**1**	ea	15,000.00	15,000		
161	Misc. gym equipment feed and connections	**1**	ls	15,000.00	15,000		
161	SUBTOTAL					3,504,600	
162							
162	**D5040 OTHER ELECTRICAL SYSTEMS**						
163	Miscellaneous						
163	Demolition & make safe	**1**	ls	30,000.00	30,000		
164	Temp power and lights	**257,120**	sf	0.45	115,704		
164	Seismic restraints	**1**	ls	15,000.00	15,000		
165	Lightning Protection System, UL Master label	**257,120**	sf	0.45	115,704		
165	Fees & Permits	**257,120**	sf	0.50	128,560		
166	SUBTOTAL					404,968	
166							
167	***TOTAL - ELECTRICAL***						**$10,239,008**
167							
168							
168	***E10 EQUIPMENT***						
169							
169	**E10 EQUIPMENT, GENERALLY**						
170	Gym wall pads	**1**	ls	20,000.00	20,000		
170	Basketball backstops; swing up; electric operated	**6**	loc	10,000.00	60,000		
171	Gymnasium dividing net; electrically operated; 60 lf	**1**	ea	30,000.00	30,000		
171	Volleyball net and standards	**1**	ls	5,000.00	5,000		
172	Score boards in Gym & Fieldhouse	**2**	loc	15,000.00	30,000		
172	Telescoping bleachers, electronic retracting (1008 seats)	**1**	ls	131,040.00	131,040		
173	Theatrical Equipment Stage curtains, rigging and controls (Auditorium & Lecture Hall)	**1**	ls	350,000.00	350,000		
173	Theatrical AV allowance (Auditorium & Lecture Hall)	**1**	ls	200,000.00	200,000		
174	Kitchen equipment	**1**	ls	550,000.00	550,000		
174	Fume hoods	**9**	ea	15,000.00	135,000		
175	Kiln	**1**	ea	5,000.00	5,000		
175	Allowance for new manual operable partitions in Cafeteria & Classrooms	**356**	lf	700.00	249,200		
176	Allowance for miscellaneous equipment; projection screens, residential appliances, loading dock equipment, wood workshop etc	**1**	ls	150,000.00	150,000		
176	SUBTOTAL					1,915,240	
177							
177	***TOTAL - EQUIPMENT***						**$1,915,240**
178							
178							
179	***E20 FURNISHINGS***						
179							
180	**E2010 FIXED FURNISHINGS**						
180	Window shades	**11,719**	sf	7.00	82,033		
181	Entrance mats	**1**	ls	20,000.00	20,000		
181	Replace auditorium seats	**600**	seat	350.00	210,000		
182	Replace lecture hall seats	**150**	seat	250.00	37,500		
182							
183	*123553 CASEWORK*						
183	Allowance for new casework throughout	**257,120**	sf	8.00	2,056,960		
184	SUBTOTAL					2,406,493	
184							

G. COST ESTIMATE / Design Team

PM&C

Belmont High School 15-Nov-17
Design Options
Belmont, MA

Feasibility Estimate **GFA** 257,120

	DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
	HIGH SCHOOL C.1 BASE RENOVATION						
185	**E2020 MOVABLE FURNISHINGS**						
185	All movable furnishings to be provided and installed by owner						
186	SUBTOTAL					NIC	
186							
187	***TOTAL - FURNISHINGS***						**$2,406,493**
187							
188							
188	***F10 SPECIAL CONSTRUCTION***						
189							
189	**F10 SPECIAL CONSTRUCTION**						
190	Pool repairs				w/ MEP		
190	SUBTOTAL					-	
191							
191	***TOTAL - SPECIAL CONSTRUCTION***						
192							
192							
193	***F20 SELECTIVE BUILDING DEMOLITION***						
193							
194	**F2010 BUILDING ELEMENTS DEMOLITION**						
194	Remove exterior glazing, metal panels & transulucent panels	**23,462**	sf	6.00	140,772		
195	Interior demolition	**257,120**	gsf	4.00	1,028,480		
195	Temporary enclosures/protection	**257,120**	sf	0.35	89,992		
196	SUBTOTAL					1,259,244	
196							
197	**F2020 HAZARDOUS COMPONENTS ABATEMENT**						
197	See summary						
198	SUBTOTAL						
198							
199	***TOTAL - SELECTIVE BUILDING DEMOLITION***						**$1,259,244**
200							

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

G. COST ESTIMATE / Design Team

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Belmont High School
Design Options
Belmont, MA

15-Nov-17

Feasibility Estimate

CSI CODE	DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
SITEWORK C.1 RENOVATE HIGH SCHOOL							
	G SITEWORK						
G10	**SITE PREPARATION & DEMOLITION**						
	Site construction fence/barricades	**5,000**	lf	12.00	60,000		
	Site construction fence gates	**1**	ea	10,000.00	10,000		
	Stabilized construction entrance	**1**	ls	15,000.00	15,000		
	Tennis Court demolition including perimeter fence	**63,000**	sf	1.25	78,750		
	Rear building paving demolition	**55,000**	sf	1.00	55,000		
	Miscellaneous demolition	**1**	ls	25,000.00	25,000		
	Site Earthwork						
	Strip topsoil and remove	**24,774**	cy	12.00	ETR		
	Fine grading	**118,000**	sf	0.20	23,600		
	Silt fence/erosion control, wash bays, stock piles	**3,750**	lf	12.00	45,000		
	Silt fence maintenance and monitoring	**1**	ls	15,000.00	15,000		
	Hazardous Waste Remediation						
	Remove existing underground fuel storage tanks	**1**	ls		NIC		
	Dispose/treat contaminated soils	**1**	ls		NIC		
	SUBTOTAL					327,350	
G20	**SITE IMPROVEMENTS**						
	Asphalt Paving; Rear building parking and roadway	*55,000*	sf				
	gravel base; 12" thick	**2,037**	cy	35.00	71,295		
	heavy duty asphalt; 4" thick	**6,111**	sy	24.00	146,664		
	Asphalt Paving; parking lot and roadway; mill and pave only	*260,000*	sf				
	gravel base; 12" thick	**9,630**	cy	35.00	ETR		
	asphalt; mill and pave	**28,889**	sy	16.00	462,224		
	VGC	**13,984**	lf	34.00	ETR		
	Single solid lines, 4" thick (343 spaces)	**1**	ls	10,000.00	10,000		
	Crosswalk hatchings, other road markings	**1**	ls	7,500.00	7,500		
	HC curb cuts; allow	**8**	loc	350.00	2,800		
	Signage	**1**	ls	20,000.00	20,000		
	Allowance for Courtyard upgrades	**4,000**	sf	15.00	60,000		
	Allowance for repairs/ replacement of existing paving and sidewalks	**25,000**	sf	7.00	175,000		
	Site Improvements						
	Tennis Courts; new asphalt surface & markings	**63,000**	sf	5.00	315,000		
	10' Chain-link fence w/ gates at Tennis Courts	**1,750**	lf	65.00	113,750		
	Tennis Court net system	**10**	ea	2,000.00	20,000		
	Other site improvements; existing field accessibility improvements, ADA ramps & entry pads, new walls, rails, fences etc.	**1**	ls	100,000.00	100,000		
	Allowance for fixed athletic equipment upgrades at existing softball & baseball fields; dugouts & backstop fencing etc	**4**	loc	20,000.00	80,000		
	Site furnishings; bollards, benches, bike racks, trash receptacles etc.	**1**	ls	50,000.00	50,000		
	Flag pole 50' high	**1**	ea	6,500.00	6,500		
	Community Path; connection at Alexander Ave			assumed separate project			
	Claypit Pond Improvements; Multi-Generational walkway path, Memorial & Water access points	**20,000**	sf		ETR		
	Skating rink	**30,000**	sf		ETR		
	Pressbox & bleachers				ETR		
	Field irrigation				ETR		
	SUBTOTAL					1,640,733	
	Landscaping						
	Synthetic turf field	**132,000**	sf		ETR		
	Playing fields/ Baseball fields; allowance to aerate and reseed	**340,200**	sf	0.25	85,050		
	Allowance to aerate & reseed existing grass areas	**498,800**	sf	0.25	124,700		
	New plantings/ mulch allowance	**1**	ls	30,000.00	30,000		

G. COST ESTIMATE / Design Team

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Belmont High School
Design Options
Belmont, MA

15-Nov-17

Feasibility Estimate

	CSI CODE	DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
	SITEWORK C.1 RENOVATE HIGH SCHOOL							
42		SUBTOTAL					239,750	
43								
41	**G30**	**CIVIL MECHANICAL UTILITIES**						
42		Water supply; allowance, pricing includes E&B and bedding						
43		New DI piping; 8" Fire	**200**	lf	100.00	20,000		
44		Tap existing water line for new hydrants	**3**	loc	5,000.00	15,000		
42		FD connection	**1**	ea	2,000.00	2,000		
43		Gate valves	**3**	ea	750.00	2,250		
44		Fire hydrant	**3**	ea	5,000.00	15,000		
45		Storm & Sanitary sewer lines						
43		Allowance to clean and video inspect piping (approx 6000 lf)	**1**	ls	25,000.00	25,000		
44		Allowance to spot repair broken lines	**250**	lf	75.00	18,750		
45		Gas service						
46		E&B trench for new gas pipe - install by plumbing				ETR		
44		SUBTOTAL					98,000	
45								
46	**G40**	**ELECTRICAL UTILITIES**						
47		Electrical utilities & lighting				ETR		
45		SUBTOTAL					-	
46								
47		**TOTAL - SITE DEVELOPMENT**						***$2,305,833***

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

G. COST ESTIMATE / Design Team

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Belmont High School
Design Options - GRADES 7-12
Belmont, MA

12-Feb-18

PSR Estimate

GFA 239,354

CONSTRUCTION COST SUMMARY

	BUILDING SYSTEM		*SUB-TOTAL*	*TOTAL*	*$/SF*	*%*
OPTION 2.1 RENOVATION						
A10	**FOUNDATIONS**					
	A1010	Standard Foundations	$1,275,920			
	A1020	Special Foundations	$0			
	A1030	Lowest Floor Construction	$581,034	**$1,856,954**	$7.76	2.6%
B10	**SUPERSTRUCTURE**					
	B1010	Upper Floor Construction	$2,568,708			
	B1020	Roof Construction	$500,000	**$3,068,708**	$12.82	4.3%
B20	**EXTERIOR CLOSURE**					
	B2010	Exterior Walls	$3,105,859			
	B2020	Windows/Curtainwall	$1,984,317			
	B2030	Exterior Doors	$305,052	**$5,395,228**	$22.54	7.6%
B30	**ROOFING**					
	B3010	Roof Coverings	$5,478,220			
	B3020	Roof Openings	$557,000	**$6,035,220**	$25.21	8.5%
C10	**INTERIOR CONSTRUCTION**					
	C1010	Partitions	$6,298,204			
	C1020	Interior Doors	$986,450			
	C1030	Specialties/Millwork	$1,970,392	**$9,255,046**	$38.67	13.0%
C20	**STAIRCASES**					
	C2010	Stair Construction	$132,000			
	C2020	Stair Finishes	$90,000	**$222,000**	$0.93	0.3%
C30	**INTERIOR FINISHES**					
	C3010	Wall Finishes	$1,436,124			
	C3020	Floor Finishes	$2,632,894			
	C3030	Ceiling Finishes	$2,393,540	**$6,462,558**	$27.00	9.1%
D10	**CONVEYING SYSTEMS**					
	D1010	Elevator	$240,000	**$240,000**	$1.00	0.3%
D20	**PLUMBING**					
	D20	Plumbing	$2,872,248	**$2,872,248**	$12.00	4.0%
D30	**HVAC**					
	D30	HVAC	$14,770,930	**$14,770,930**	$61.71	20.8%
D40	**FIRE PROTECTION**					
	D40	Fire Protection	$1,224,964	**$1,224,964**	$5.12	1.7%
D50	**ELECTRICAL**					
	D5010	Electrical Systems	$12,138,036	**$12,138,036**	$50.71	17.1%
E10	**EQUIPMENT**					
	E10	Equipment	$1,915,240	**$1,915,240**	$8.00	2.7%

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Belmont High School
Design Options - GRADES 7-12
Belmont, MA

12-Feb-18

PSR Estimate

GFA 239,354

CONSTRUCTION COST SUMMARY

	BUILDING SYSTEM		*SUB-TOTAL*	*TOTAL*	*$/SF*	*%*
OPTION 2.1 RENOVATION						
E20	**FURNISHINGS**					
	E2010	Fixed Furnishings	$2,790,659			
	E2020	Movable Furnishings	NIC	**$2,790,659**	$11.66	3.9%
F10	**SPECIAL CONSTRUCTION**					
	F10	Special Construction	$750,000	**$750,000**	$3.13	1.1%
F20	**SELECTIVE BUILDING DEMOLITION**					
	F2010	Building Elements Demolition	$2,099,310			
	F2020	Hazardous Components Abatement	$0	**$2,099,310**	$8.77	3.0%
TOTAL DIRECT COST (Trade Costs)				***$71,097,101***	*$297.04*	*100.0%*

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Belmont High School 12-Feb-18
Design Options - GRADES 7-12
Belmont, MA

PSR Estimate **GFA** 239,354

	DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
	OPTION 2.1 RENOVATION						
	GROSS FLOOR AREA CALCULATION						
	First Floor				156,365		
	Second Floor				82,989		
	TOTAL GROSS FLOOR AREA (GFA)				**239,354**	***sf***	
	A10 FOUNDATIONS						
	A1010 STANDARD FOUNDATIONS						
	Repair cracks and resurface exposed concrete foundations	**1**	ls	25,000	25,000		
	Foundation work as a result of increased loads	**156,365**	sf	8.00	1,250,920		
	SUBTOTAL					1,275,920	
	A1020 SPECIAL FOUNDATIONS						
	No work in this section						
	SUBTOTAL						
	A1030 LOWEST FLOOR CONSTRUCTION						
	Cutting and patching for MEP	**1**	ls	50,000.00	50,000		
	New slab at bathrooms, shower areas and kitchen	**11,455**	sf	20.00	229,100		
	Slab on grade repair in Fieldhouse at water infiltration locations	**27,956**	sf	1.50	41,934		
	Allowance for ramps on grade; 12" structural supported slab on piles - allowance	**8**	loc	30,000.00	240,000		
	New equipment pads	**1**	ls	20,000.00	20,000		
	Loading dock				ETR		
	Elevator pit				ETR		
	SUBTOTAL					581,034	
	TOTAL - FOUNDATIONS						**$1,856,954**
	B10 SUPERSTRUCTURE						
	B1010 FLOOR CONSTRUCTION						
	Openings in structure for MEP systems	**239,354**	gsf	2.00	478,708		
	Allowance for ramps at upper floor including reinforcing existing structure	**6**	loc	15,000.00	90,000		
	2hr Fireproofing to existing structure (excluding Pool, Fieldhouse, Auditorium, Tiered Lecture Hall & Modular building) approx 200,000sf	**1**	ls	500,000.00	500,000		
	Premium for building over existing	**1**	ls	1,500,000.00	1,500,000		
	SUBTOTAL					2,568,708	
	B1020 ROOF CONSTRUCTION						
	Support framing for new MEP systems	**1**	ls	500,000.00	500,000		
	SUBTOTAL					500,000	
	TOTAL - SUPERSTRUCTURE						**$3,068,708**
	B20 EXTERIOR CLOSURE						
	B2010 EXTERIOR WALLS	*62,796*	*sf*				
	Repair and repoint exterior walls- brick; assume 100%	**39,835**	sf	32.00	1,274,720		

G. COST ESTIMATE / Design Team

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Belmont High School 12-Feb-18
Design Options - GRADES 7-12
Belmont, MA

PSR Estimate **GFA** 239,354

	DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
	OPTION 2.1 RENOVATION						
54	Repairs to precast concrete panels, fins and banding	**13,058**	sf	25.00	326,450		
55	Clean all exterior walls; includes staging	**50,493**	sf	8.00	403,944		
56	Replace composite metal panels	**5,431**	sf	75.00	407,325		
57	Replace ribbon aluminum fascia panels	**5,684**	sf	80.00	454,720		
58	Replace colored aluminum fascia panels	**2,388**	sf	85.00	202,980		
59	Re-caulk existing CJ	**1,048**	lf	15.00	15,720		
60	Allowance for work at exits for ADA access to Courtyard	**1**	ls	20,000.00	20,000		
61	Seismic clips at masonry partitions				NR		
62	SUBTOTAL					3,105,859	
63							
64	**B2020 WINDOWS/CURTAINWALL**	*18,517*	*sf*		-		
65	Replace existing windows/curtainwall etc.	**11,720**	sf	110.00	1,289,200		
66	Replace existing translucent panels	**6,798**	sf	80.00	543,840		
67	Replace louvers	**700**	sf	65.00	45,500		
68	Backer rod & double sealant	**10,074**	lf	9.00	90,666		
69	Wood blocking at openings	**5,037**	lf	3.00	15,111		
70	SUBTOTAL					1,984,317	
71							
72	**B2030 EXTERIOR DOORS**						
73	Replace exterior glazed door, double	**15**	pr	8,500.00	127,500		
74	Replace exterior glazed door, single	**3**	ea	4,000.00	12,000		
75	Replace exterior single door	**3**	ea	2,100.00	6,300		
76	Replace exterior double door	**23**	pr	4,000.00	92,000		
77	Replace overhead doors; 8'x8'	**5**	ea	7,040.00	35,200		
78	Replace overhead doors; 12'x15'	**1**	ea	19,800.00	19,800		
79	Backer rod & double sealant	**1,021**	lf	9.00	9,189		
80	Wood blocking at openings	**1,021**	lf	3.00	3,063		
81	SUBTOTAL					305,052	
82							
83	***TOTAL - EXTERIOR CLOSURE***						**$5,395,228**
84							
85							
86	***B30 ROOFING***						
87							
88	**B3010 ROOF COVERINGS**						
89	Replace existing roofing systems	**156,365**	sf	28.00	4,378,220		
90	Roof equipment screen	**1**	ls	100,000.00	100,000		
91	Roof soffits	**1**	ls	1,000,000	1,000,000		
92	SUBTOTAL					5,478,220	
93							
94	**B3020 ROOF OPENINGS**						
95	New stage smoke hatches	**4**	ea	8,000.00	32,000		
96	Skylights, allow	**1**	ls	500,000.00	500,000		
97	Replace roof ladders/hatches etc.	**1**	ls	25,000.00	25,000		
98	SUBTOTAL					557,000	
99							
100	***TOTAL - ROOFING***						**$6,035,220**
101							
102							
103	***C10 INTERIOR CONSTRUCTION***						
104							
105	**C1010 PARTITIONS**						
106	Allowance to modify existing walls and add new walls	**239,354**	gsf	18.00	4,308,372		
107	Seismic upgrades	**239,354**	gsf	8.00	1,914,832		
108	Allowance to replace 20% interior borrowed lites/sidelights	**1**	ls	75,000.00	75,000		

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Belmont High School 12-Feb-18
Design Options - GRADES 7-12
Belmont, MA

PSR Estimate **GFA** 239,354

	DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
	OPTION 2.1 RENOVATION						
	SUBTOTAL					6,298,204	
C1020	**INTERIOR DOORS**						
	Adjust door openings, install new door frame to meet code requirements (door carried below)	**148**	ea	2,000.00	296,000		
	New door & hardware at demolished doors/ ADA upgraded opes	**310**	ea	1,350.00	418,500		
	Remove and replace doors	**281**	ea	500.00	140,500		
	New hardware at existing to remain doors	**281**	ea	450.00	126,450		
	Replace wire glass vision lites at stair doors - allow	**1**	ls	5,000.00	5,000		
	SUBTOTAL					986,450	
C1030	**SPECIALTIES / MILLWORK**						
	Toilet Partitions and accessories	**239,354**	gsf	0.80	191,483		
	New markerboards/tackboards	**239,354**	gsf	1.00	239,354		
	Academic lockers, full height	**1,470**	ea	190.00	279,300		
	Replace athletic/workshop/music/band lockers - allowance	**1**	ls	100,000.00	100,000		
	New guardrail at Fieldhouse bleachers	**150**	lf	200.00	30,000		
	Rails at new ramps	**840**	lf	75.00	63,000		
	Allowance for miscellaneous specialties; wall protection, fire extinguishers etc	**1**	ls	50,000.00	50,000		
055000	*MISCELLANEOUS METALS*						
	Miscellaneous metals throughout building	**239,354**	sf	2.50	598,385		
061000	*ROUGH CARPENTRY*						
	Rough blocking	**239,354**	sf	0.15	35,903		
070001	*WATERPROOFING, DAMPPROOFING AND CAULKING*						
	Miscellaneous sealants throughout building	**239,354**	sf	1.25	299,193		
101400	*SIGNAGE*						
	Code compliant signage	**239,354**	sf	0.35	83,774		
	SUBTOTAL					1,970,392	
	TOTAL - INTERIOR CONSTRUCTION						**$9,255,046**
C20	***STAIRCASES***						
C2010	**STAIR CONSTRUCTION**						
	Upgrade existing stair rails and nosings for code upgrades	**9**	flt	8,000.00	72,000		
	New stairs at Theater in Library	**2**	flts	30,000.00	60,000		
	SUBTOTAL					132,000	
C2020	**STAIR FINISHES**						
	Replace stair floor finish w/ rubber and add compliant stair nosing and tactile indicator strips	**9**	loc	10,000.00	90,000		
	SUBTOTAL					90,000	
	TOTAL - STAIRCASES						**$222,000**
C30	***INTERIOR FINISHES***						
C3010	**WALL FINISHES**						
	Allowance for wall finishes	**239,354**	gsf	6.00	1,436,124		
	SUBTOTAL					1,436,124	

G. COST ESTIMATE / Design Team

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Belmont High School 12-Feb-18
Design Options - GRADES 7-12
Belmont, MA

PSR Estimate **GFA** 239,354

	DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
	OPTION 2.1 RENOVATION						
	C3020 FLOOR FINISHES						
	Allowance for floor finishes	**239,354**	gsf	11.00	2,632,894		
	SUBTOTAL					2,632,894	
	C3030 CEILING FINISHES						
	Allowance for ceiling finishes	**239,354**	gsf	10.00	2,393,540		
	SUBTOTAL					2,393,540	
	TOTAL - INTERIOR FINISHES						**$6,462,558**
	D10 CONVEYING SYSTEMS						
	Remove existing elevator	**1**	ls	25,000.00	25,000		
	New elevator in existing shaft	**2**	stp	90,000.00	180,000		
	New lift in Auditorium	**1**	stp	35,000.00	35,000		
	SUBTOTAL					240,000	
	TOTAL - CONVEYING SYSTEMS						**$240,000**
	D20 PLUMBING						
	D20 PLUMBING, GENERALLY						
	Plumbing allowance	**239,354**	gsf	12.00	2,872,248		
	SUBTOTAL					2,872,248	
	TOTAL - PLUMBING						**$2,872,248**
	D30 HVAC						
	D30 HVAC, GENERALLY						
	HVAC allowance for Geothermal wells; based 400 wells each 400 ft deep	**1**	ls	4,000,000.00	4,000,000		
	HVAC allowance	**239,354**	gsf	45.00	10,770,930		
	SUBTOTAL					14,770,930	
	TOTAL - HVAC						**$14,770,930**
	D40 FIRE PROTECTION						
	D40 FIRE PROTECTION, GENERALLY						
	Fire pump	**1**	ls	100,000.00	100,000		
	New fire protection system	**239,354**	sf	4.70	1,124,964		
	SUBTOTAL					1,224,964	
	TOTAL - FIRE PROTECTION						**$1,224,964**
	D50 ELECTRICAL						
	D5010 ELECTRICAL WORK						
	Allowance for PV systems	**1**	ls	4,000,000.00	4,000,000		
	Complete electrical systems	**239,354**	gsf	34.00	8,138,036		
	SUBTOTAL					12,138,036	
	TOTAL - ELECTRICAL						**$12,138,036**
	E10 EQUIPMENT						

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

G. COST ESTIMATE / Design Team

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Belmont High School 12-Feb-18
Design Options - GRADES 7-12
Belmont, MA

PSR Estimate **GFA** 239,354

	DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
	OPTION 2.1 RENOVATION						
	E10 EQUIPMENT, GENERALLY						
	Gym wall pads	**1**	ls	20,000.00	20,000		
	Basketball backstops; swing up; electric operated	**6**	loc	10,000.00	60,000		
	Gymnasium dividing net; electrically operated; 60 lf	**1**	ea	30,000.00	30,000		
	Volleyball net and standards	**1**	ls	5,000.00	5,000		
	Score boards in Gym & Fieldhouse	**2**	loc	15,000.00	30,000		
	Telescoping bleachers, electronic retracting (1008 seats)	**1**	ls	131,040.00	131,040		
	Theatrical Equipment Stage curtains, rigging and controls (Auditorium & Lecture Hall)	**1**	ls	350,000.00	350,000		
	Theatrical AV allowance (Auditorium & Lecture Hall)	**1**	ls	200,000.00	200,000		
	Kitchen equipment	**1**	ls	550,000.00	550,000		
	Fume hoods	**9**	ea	15,000.00	135,000		
	Kiln	**1**	ea	5,000.00	5,000		
	Allowance for new manual operable partitions in Cafeteria & Classrooms	**356**	lf	700.00	249,200		
	Allowance for miscellaneous equipment; projection screens, residential appliances, loading dock equipment, wood workshop etc	**1**	ls	150,000.00	150,000		
	SUBTOTAL					1,915,240	
	TOTAL - EQUIPMENT						**$1,915,240**
	E20 FURNISHINGS						
	E2010 FIXED FURNISHINGS						
	Window shades	**18,517**	sf	7.00	129,619		
	Entrance mats	**1**	ls	20,000.00	20,000		
	Replace auditorium seats	**600**	seat	350.00	210,000		
	Replace lecture hall seats	**150**	seat	250.00	37,500		
123553	*CASEWORK*						
	Allowance for new casework throughout	**239,354**	gsf	10.00	2,393,540		
	SUBTOTAL					2,790,659	
	E2020 MOVABLE FURNISHINGS						
	All movable furnishings to be provided and installed by owner						
	SUBTOTAL					NIC	
	TOTAL - FURNISHINGS						**$2,790,659**
	F10 SPECIAL CONSTRUCTION						
	F10 SPECIAL CONSTRUCTION						
	Pool upgrades	**1**	ls	750,000.00	750,000		
	SUBTOTAL					750,000	
	TOTAL - SPECIAL CONSTRUCTION						**$750,000**
	F20 SELECTIVE BUILDING DEMOLITION						
	F2010 BUILDING ELEMENTS DEMOLITION						
	Remove exterior glazing	**18,517**	sf	6.00	111,102		
	Remove roofing	**156,365**	sf	2.00	312,730		
	Interior demolition	**239,354**	gsf	6.00	1,436,124		

G. COST ESTIMATE / Design Team

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Belmont High School 12-Feb-18
Design Options - GRADES 7-12
Belmont, MA

PSR Estimate **GFA** 239,354

	DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
	OPTION 2.1 RENOVATION						
280	Temporary enclosures/protection	**239,354**	sf	1.00	239,354		
281	SUBTOTAL					2,099,310	
282							
283	**F2020 HAZARDOUS COMPONENTS ABATEMENT**						
284	See summary						
285	SUBTOTAL						
286							
287	***TOTAL - SELECTIVE BUILDING DEMOLITION***						**$2,099,310**
288							

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

G. COST ESTIMATE / Design Team

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Belmont High School 12-Feb-18
Design Options - GRADES 7-12
Belmont, MA

PSR Estimate GFA 212,446

CONSTRUCTION COST SUMMARY

	BUILDING SYSTEM		*SUB-TOTAL*	*TOTAL*	*$/SF*	*%*
OPTION 2.1 NEW ADDITION						
A10	**FOUNDATIONS**					
	A1010	Standard Foundations	$1,830,752			
	A1020	Special Foundations	$5,409,040			
	A1030	Lowest Floor Construction	$1,962,546	**$9,202,338**	$43.32	13.5%
A20	**BASEMENT CONSTRUCTION**					
	A2010	Basement Excavation	$0			
	A2020	Basement Walls	$0	**$0**	$0.00	0.0%
B10	**SUPERSTRUCTURE**					
	B1010	Upper Floor Construction	$5,719,916			
	B1020	Roof Construction	$3,011,712	**$8,731,628**	$41.10	12.8%
B20	**EXTERIOR CLOSURE**					
	B2010	Exterior Walls	$5,304,788			
	B2020	Windows	$3,821,835			
	B2030	Exterior Doors	$73,680	**$9,200,303**	$43.31	13.5%
B30	**ROOFING**					
	B3010	Roof Coverings	$3,439,320			
	B3020	Roof Openings	$252,500	**$3,691,820**	$17.38	5.4%
C10	**INTERIOR CONSTRUCTION**					
	C1010	Partitions	$5,098,704			
	C1020	Interior Doors	$1,062,230			
	C1030	Specialties/Millwork	$1,779,107	**$7,940,041**	$37.37	11.7%
C20	**STAIRCASES**					
	C2010	Stair Construction	$422,000			
	C2020	Stair Finishes	$37,723	**$459,723**	$2.16	0.7%
C30	**INTERIOR FINISHES**					
	C3010	Wall Finishes	$1,274,676			
	C3020	Floor Finishes	$2,336,906			
	C3030	Ceiling Finishes	$2,124,460	**$5,736,042**	$27.00	8.4%
D10	**CONVEYING SYSTEMS**					
	D1010	Elevator	$270,000	**$270,000**	$1.27	0.4%
D20	**PLUMBING**					
	D20	Plumbing	$2,549,352	**$2,549,352**	$12.00	3.7%
D30	**HVAC**					
	D30	HVAC	$9,560,070	**$9,560,070**	$45.00	14.0%
D40	**FIRE PROTECTION**					
	D40	Fire Protection	$998,496	**$998,496**	$4.70	1.5%
D50	**ELECTRICAL**					

G. COST ESTIMATE / Design Team

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Belmont High School
Design Options - GRADES 7-12
Belmont, MA

12-Feb-18

PSR Estimate

GFA 212,446

CONSTRUCTION COST SUMMARY

	BUILDING SYSTEM		*SUB-TOTAL*	*TOTAL*	*$/SF*	*%*
OPTION 2.1 NEW ADDITION						
	D5010	Complete System	$7,223,164	**$7,223,164**	$34.00	10.6%
E10	**EQUIPMENT**					
	E10	Equipment	$35,000	**$35,000**	$0.16	0.1%
E20	**FURNISHINGS**					
	E2010	Fixed Furnishings	$2,347,575			
	E2020	Movable Furnishings	NIC	**$2,347,575**	$11.05	3.4%
F10	**SPECIAL CONSTRUCTION**					
	F10	Special Construction	$0	**$0**	$0.00	0.0%
F20	**HAZMAT REMOVALS**					
	F2010	Building Elements Demolition	$150,000			
	F2020	Hazardous Components Abatement	$0	**$150,000**	$0.71	0.2%
TOTAL DIRECT COST (Trade Costs)				***$68,095,552***	*$320.53*	*100.0%*

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Belmont High School
Design Options - GRADES 7-12
Belmont, MA

12-Feb-18

PSR Estimate

GFA 212,446

CSI CODE	DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
	OPTION 2.1 NEW ADDITION						
	GROSS FLOOR AREA CALCULATION						
	Ground Floor			83,216			
	First Floor			64,615			
	Second Floor			64,615			
	TOTAL GROSS FLOOR AREA (GFA)				**212,446**	***sf***	
	A10 FOUNDATIONS						
	A1010 STANDARD FOUNDATIONS						
	Allowance for pile caps, grade beams etc.	**83,216**	sf	22.00	1,830,752		
	SUBTOTAL					1,830,752	
	A1020 SPECIAL FOUNDATIONS						
	Driven piles; including mobilization	**83,216**	sf	65.00	5,409,040		
	SUBTOTAL					5,409,040	
	A1030 LOWEST FLOOR CONSTRUCTION						
	New Structural Slab, 12" thick	*83,216*	*sf*		-		
312000	Ordinary Fill, 6"	**1,541**	cy	16.00	24,656		
312000	Crushed stone, 6"	**1,541**	cy	35.00	53,935		
312000	Rigid insulation; 40 psi	**83,216**	sf	2.15	178,914		
033000	Vapor barrier	**83,216**	sf	0.80	66,573		
312000	Compact existing sub-grade	**83,216**	sf	0.55	45,769		
033000	Formwork	**778**	lf	12.00	9,336		
033000	Rebar, 6#/SF	**499,296**	lbs	1.20	599,155		
033000	Concrete - 12" thick; 4,000 psi	**3,236**	cy	120.00	388,320		
033000	Placing concrete	**3,236**	cy	90.00	291,240		
033000	Finishing and curing concrete	**83,216**	sf	3.00	249,648		
	Miscellaneous						
	Patch slab at foundations in existing building				W/Reno		
	New Elevator pit				W/Reno		
	New loading dock	**1**	ls	40,000.00	40,000		
	Equipment pads	**1**	ls	15,000.00	15,000		
	SUBTOTAL					1,962,546	
	TOTAL - FOUNDATIONS						**$9,202,338**
	A20 BASEMENT CONSTRUCTION						
	A2010 BASEMENT EXCAVATION						
	No Work in this section						
	SUBTOTAL					-	
	A2020 BASEMENT WALLS						
	No Work in this section						
	SUBTOTAL					-	
	TOTAL - BASEMENT CONSTRUCTION						
	B10 SUPERSTRUCTURE						
		14.61	lbs/sf		-		
	B1010 FLOOR CONSTRUCTION	1,552	tns		-		

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Belmont High School
Design Options - GRADES 7-12
Belmont, MA

12-Feb-18

PSR Estimate

GFA 212,446

CSI CODE	DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
OPTION 2.1 NEW ADDITION							
	Floor Structure - Steel:						
	Steel beams and columns to new addition; 15#/SF	**969**	tns	3,800.00	3,682,200		
	Premium for HSS	**242**	tns	300.00	72,600		
	Shear studs	**25,846**	ea	2.50	64,615		
	Floor Structure						
	2" 18 Ga. Metal galvanized floor Deck	**129,230**	sf	3.75	484,613		
	WWF reinforcement	**148,615**	sf	0.80	118,892		
	Concrete Fill to metal deck; 6" Light Weight	**3,015**	cy	160.00	482,400		
	Place and finish concrete	**129,230**	sf	2.00	258,460		
	Rebar to decks	**38,769**	lbs	1.20	46,523		
	Misc. angles	**129,230**	sf	0.50	64,615		
	Miscellaneous						
	Fire proofing to columns and beams	**129,230**	sf	2.25	290,768		
	Intumescent paint	**1**	ls	25,000.00	25,000		
	Fire stopping floors	**129,230**	sf	1.00	129,230		
	SUBTOTAL					5,719,916	
B1020	**ROOF CONSTRUCTION**						
	Roof Structure - Steel:						
	Steel beams and columns to new addition; 14#/SF	**583**	tns	3,800.00	2,215,400		
	Premium for HSS	**146**	tns	300.00	43,800		
	Exposed steel	**1**	ls	50,000.00	50,000		
	Roof Structure						
	Acoustic deck allowance	**8,000**	sf	7.00	56,000		
	3" 20 Ga. galvanized Metal Roof Deck	**75,216**	sf	4.00	300,864		
	Miscellaneous						
	Concrete under RTU's	**15,000**	sf	8.00	120,000		
	Fire proofing to columns, beams and deck	**75,216**	sf	3.00	225,648		
	SUBTOTAL					3,011,712	
	TOTAL - SUPERSTRUCTURE						**$8,731,628**
B20	***EXTERIOR CLOSURE***						
B2010	**EXTERIOR WALLS**						
	Exterior Wall Area - Solid Assume 70%	*65,205*	sf				
042000	*MASONRY*						
	Brick veneer, 3 color; 75% of solid area	**48,904**	sf	40.00	1,956,160		
	Staging to exterior wall	**65,205**	sf	4.00	260,820		
055000	*MISC. METALS*						
	Stainless steel sign at main entrance	**1**	ls	15,000.00	15,000		
070001	*WATERPROOFING, DAMPPROOFING AND CAULKING*						
	Air barrier	**65,205**	sf	6.50	423,833		
	Air barrier/flashing at windows	**16,438**	lf	6.25	102,738		
	Miscellaneous sealants to closure	**65,205**	sf	1.00	65,205		
072100	*THERMAL INSULATION*						
	Insulation	**65,205**	sf	2.25	146,711		
076400	*CLADDING*						

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Belmont High School
Design Options - GRADES 7-12
Belmont, MA

12-Feb-18

PSR Estimate

GFA 212,446

CSI CODE	DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
OPTION 2.1 NEW ADDITION							
	Metal panel; 25% of solid area	**16,301**	sf	75.00	1,222,575		
092900	*GYPSUM BOARD ASSEMBLIES*						
	6" metal stud backup	**65,205**	sf	11.00	717,255		
	Gypsum Sheathing	**65,205**	sf	2.75	179,314		
	Drywall lining to interior face of stud backup	**65,205**	sf	3.30	215,177		
	SUBTOTAL					5,304,788	
B2020	**WINDOWS**						
	Exterior Wall Area - Glazed Assume 30%	*27,945*	sf				
061000	*ROUGH CARPENTRY*						
	Wood blocking at openings	**16,438**	lf	14.00	230,132		
070001	*WATERPROOFING, DAMPPROOFING AND CAULKING*						
	Backer rod & double sealant	**16,438**	lf	8.50	139,723		
080001	*METAL WINDOWS*						
	Windows, double glazed; 20% of glazed area	**5,589**	sf	90.00	503,010		
	Curtainwall, double glazed; 80% of glazed area	**22,356**	sf	120.00	2,682,720		
	Sunshades; horizontal	**1**	ls	250,000.00	250,000		
089000	*LOUVERS*						
	Louvers	**250**	sf	65.00	16,250		
	SUBTOTAL					3,821,835	
B2030	**EXTERIOR DOORS**						
	Glazed entrance doors including frame and hardware; double door	**8**	pr	8,000.00	64,000		
	HM doors, frames and hardware- Double	**4**	pr	2,000.00	8,000		
	Backer rod & double sealant	**240**	lf	4.00	960		
	Wood blocking at openings	**240**	lf	3.00	720		
	SUBTOTAL					73,680	
	TOTAL - EXTERIOR CLOSURE						**$9,200,303**
B30	***ROOFING***						
B3010	**ROOF COVERINGS**						
	New roofing complete	**83,216**	sf	20.00	1,664,320		
	Roof equipment screen	**1**	ls	250,000.00	250,000		
	Green roof	**15,000**	sf	35.00	525,000		
	Roof soffits	**1**	ls	1,000,000	1,000,000		
	SUBTOTAL					3,439,320	
B3020	**ROOF OPENINGS**						
	Skylights, allow	**1**	ls	250,000.00	250,000		
	Roof hatch	**1**	loc	2,500.00	2,500		
	SUBTOTAL					252,500	
	TOTAL - ROOFING						**$3,691,820**
C10	***INTERIOR CONSTRUCTION***						
C1010	**PARTITIONS**						
	Miscellaneous partitions/glazed partitions/borrowed lights/blocking etc.	**212,446**	gsf	24.00	5,098,704		
	SUBTOTAL					5,098,704	

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Belmont High School
Design Options - GRADES 7-12
Belmont, MA

12-Feb-18

PSR Estimate

GFA 212,446

CSI CODE	DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
OPTION 2.1 NEW ADDITION							
C1020	**INTERIOR DOORS**						
	Interior doors, frames and hardware	**212,446**	gsf	5.00	1,062,230		
	SUBTOTAL					1,062,230	
C1030	**SPECIALTIES / MILLWORK**						
	Toilet Partitions and accessories	**212,446**	gsf	0.80	169,957		
	Backer panels in electrical closets	**1**	ls	1,000.00	1,000		
	Marker boards/tackboards in classrooms, offices, conference rooms, library and MP rooms	**212,446**	sf	1.00	212,446		
	Room Signs	**212,446**	gsf	0.40	84,978		
	Fire extinguisher cabinets	**71**	ea	350.00	24,850		
	Lockers	**212,446**	gsf	1.60	339,914		
	Janitors Work Shop Accessories	**1**	ls	1,500.00	1,500		
	Janitors Closet Accessories	**3**	rms	300.00	900		
	Media						
	Reception desks	**4**	loc	25,000	100,000		
	Railings to open to below areas	**1**	ls	100,000	100,000		
	Library shelving at perimeters 7' Tall				F,F & E		
	Library shelving at perimeters 3' Tall				F,F & E		
	Miscellaneous wood trim	**212,446**	gsf	0.50	106,223		
	Display cases	**212,446**	gsf	0.25	53,112		
	Miscellaneous metals throughout building	**212,446**	sf	1.50	318,669		
	Miscellaneous sealants throughout building	**212,446**	sf	1.25	265,558		
	SUBTOTAL					1,779,107	
	TOTAL - INTERIOR CONSTRUCTION						**$7,940,041**
C20	***STAIRCASES***						
C2010	**STAIR CONSTRUCTION**						
	Metal pan stair; egress stair	**6**	flt	25,000.00	150,000		
	Main staircase	**1**	flt	250,000.00	250,000		
	Commons steps	**2**	loc	5,000.00	10,000		
	Concrete fill to stairs	**6**	flt	2,000.00	12,000		
	SUBTOTAL					422,000	
C2020	**STAIR FINISHES**						
	High performance coating to stairs including all railings etc.	**6**	flt	3,000.00	18,000		
	Rubber tile at stairs - landings	**600**	sf	10.00	6,000		
	Rubber tile at stairs - treads & risers	**720**	lft	19.06	13,723		
	SUBTOTAL					37,723	
	TOTAL - STAIRCASES						**$459,723**
C30	***INTERIOR FINISHES***						
C3010	**WALL FINISHES**						
	Wall finishes	**212,446**	sf	6.00	1,274,676		
	SUBTOTAL					1,274,676	
C3020	**FLOOR FINISHES**						
	Floor finishes	**212,446**	sf	11.00	2,336,906		
	SUBTOTAL					2,336,906	
C3030	**CEILING FINISHES**						
	Ceiling finishes	**212,446**	sf	10.00	2,124,460		

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Belmont High School
Design Options - GRADES 7-12
Belmont, MA

12-Feb-18

PSR Estimate

GFA 212,446

CSI CODE	DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
OPTION 2.1 NEW ADDITION							
	SUBTOTAL					2,124,460	
	TOTAL - INTERIOR FINISHES						**$5,736,042**
D10	***CONVEYING SYSTEMS***						
D1010	**ELEVATOR**						
	New three stop elevator	**2**	ea	135,000.00	270,000		
	SUBTOTAL					270,000	
	TOTAL - CONVEYING SYSTEMS						**$270,000**
D20	***PLUMBING***						
D20	**PLUMBING, GENERALLY**						
	Plumbing allowance	**212,446**	gsf	12.00	2,549,352		
	SUBTOTAL					2,549,352	
	TOTAL - PLUMBING						**$2,549,352**
D30	***HVAC***						
D30	**HVAC, GENERALLY**						
	HVAC allowance	**212,446**	gsf	45.00	9,560,070		
	SUBTOTAL					9,560,070	
	TOTAL - HVAC						**$9,560,070**
D40	***FIRE PROTECTION***						
D40	**FIRE PROTECTION, GENERALLY**						
	Fire protection system	**212,446**	gsf	4.70	998,496		
	SUBTOTAL					998,496	
	TOTAL - FIRE PROTECTION						**$998,496**
D50	***ELECTRICAL***						
D5010	**ELECTRICAL WORK**						
	Complete electrical systems	**212,446**	gsf	34.00	7,223,164		
	SUBTOTAL					7,223,164	
	TOTAL - ELECTRICAL						**$7,223,164**
E10	***EQUIPMENT***						
E10	**EQUIPMENT, GENERALLY**						
	Food Service equipment				In Renovation		
	Loading dock equipment	**1**	ls	20,000.00	20,000		
	Electrically operated projection screens	**1**	loc	15,000.00	15,000		
	SUBTOTAL					35,000	
	TOTAL - EQUIPMENT						**$35,000**
E20	***FURNISHINGS***						

G. COST ESTIMATE / Design Team

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Belmont High School
Design Options - GRADES 7-12
Belmont, MA

12-Feb-18

PSR Estimate

GFA 212,446

CSI CODE	DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
OPTION 2.1 NEW ADDITION							
E2010	**FIXED FURNISHINGS**						
	Entry mats & frames - recessed with carpet/rubber strips	**500**	sf	55.00	27,500		
	Window blinds	**27,945**	sf	7.00	195,615		
	Counters, base cabinets, tall storage in classrooms and other rooms	**212,446**	gsf	10.00	2,124,460		
	SUBTOTAL					2,347,575	
E2020	**MOVABLE FURNISHINGS**						
	All movable furnishings to be provided and installed by owner						
	SUBTOTAL					NIC	
	TOTAL - FURNISHINGS						**$2,347,575**
F10	***SPECIAL CONSTRUCTION***						
F10	**SPECIAL CONSTRUCTION**						
	No items in this section						
	SUBTOTAL						
	TOTAL - SPECIAL CONSTRUCTION						
F20	***SELECTIVE BUILDING DEMOLITION***						
F2010	**BUILDING ELEMENTS DEMOLITION**						
	Demolition to make connection to existing building	**1**	ls	150,000.00	150,000		
	SUBTOTAL					150,000	
F2020	**HAZARDOUS COMPONENTS ABATEMENT**						
	See main summary for HazMat allowance				See Summary		
	SUBTOTAL						
	TOTAL - SELECTIVE BUILDING DEMOLITION						**$150,000**

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Belmont High School
Design Options - GRADES 7-12
Belmont, MA

12-Feb-18

PSR Estimate

CSI CODE	DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
SITEWORK OPTION 2.1							
	G SITEWORK						
G10	**SITE PREPARATION & DEMOLITION**						
	Site construction fence/barricades	**8,200**	lf	12.00	98,400		
	Site construction fence gates/entrance	**2**	ea	15,000.00	30,000		
	Pavement/curbing removal, crush and re-use for sub-base	**200,000**	sf	1.00	200,000		
	Walkways	**1**	ls	30,000.00	30,000		
	Miscellaneous demolition	**1**	ls	150,000.00	150,000		
	Site Earthwork						
	Strip Topsoil and remove; 6" thick	**19,889**	cy	12.00	238,668		
	Fine grading	**1,000,000**	sf	0.20	200,000		
	Cut and Fill; assumed AV 2ft; balanced site	**74,074**	cy	8.00	592,592		
	Silt fence/erosion control, wash bays, stock piles	**8,200**	lf	12.00	98,400		
	Silt fence maintenance and monitoring	**1**	ls	60,000.00	60,000		
	Hazardous Waste Remediation						
	Dispose/treat contaminated soils				NIC		
	SUBTOTAL					1,698,060	
G20	**SITE IMPROVEMENTS**						
	Asphalt Paving; parking lot and roadway	*350,000*					
	gravel base; 12" thick	**12,963**	cy	40.00	518,520		
	asphalt; 4" thick	**38,889**	sy	25.00	972,225		
	VGC	**10,000**	lf	38.00	380,000		
	Road markings/signage	**1**	ls	30,000.00	30,000		
	Pedestrian Paving						
	Concrete paving						
	gravel base; 8" thick	**744**	cy	35.00	26,040		
	4" concrete paving	**30,000**	sf	7.00	210,000		
	Concrete pavers						
	Concrete pavers						
	sand bedding; 1" thick	**148**	cy	40.00	5,920		
	Precast concrete pavers	**50,000**	sf	16.00	800,000		
	gravel base; 8" thick	**1,241**	cy	35.00	43,435		
	concrete base; 4" thick	**50,000**	sf	5.00	250,000		
	Site Improvements						
	Flag pole 50' high	**1**	ea	6,500.00	6,500		
	Concrete retaining walls				Assumed not required		
	6' chain-link fence	**8,200**	lf	50.00	410,000		
	Double gates	**1**	ea	2,500.00	2,500		
	Wood screen privacy fence 8'	**50**	lf	100.00	5,000		
	Double gates	**1**	ea	2,500.00	2,500		
	Benches	**15**	ea	2,800.00	42,000		
	Bike racks	**1**	ls	30,000.00	30,000		
	Ornamental trash/recycling receptacles	**10**	ea	800.00	8,000		
	Monumental signage	**1**	ls	40,000.00	40,000		
	Way finding signage	**1**	ls	60,000.00	60,000		
	Other site improvements; walls, fences etc.	**1**	ls	1,500,000	1,500,000		
	Multi-purpose fields						
	Crushed stone - 12" thick	**16,815**	cy	40.00	672,600		
	Sports seeding	**454,000**	sf	0.50	227,000		
	Line markings - Allowance	**1**	ls	15,000.00	15,000		
	Football goals	**2**	loc	3,000.00	6,000		
	Soccer goals (movable) - Allowance	**3**	loc	10,000.00	30,000		
	20' sports netting	**1**	ls	50,000.00	50,000		
	Baseball/softball backstop	**2**	loc	40,000.00	80,000		
	SUBTOTAL					6,423,240	
	Landscaping						
	Topsoil -modify existing topsoil	**19,889**	cy	26.00	517,114		
	Lawn - loam & seed	**546,000**	sf	0.25	136,500		
	Planting allowance	**1**	ls	500,000.00	500,000		

G. COST ESTIMATE / Design Team

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Belmont High School
Design Options - GRADES 7-12
Belmont, MA

12-Feb-18

PSR Estimate

CSI CODE	DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
SITEWORK OPTION 2.1							
	Irrigation at sports fields	**454,000**	sf	1.00	454,000		
	Allowance for new well	**1**	ls	150,000.00	150,000		
	SUBTOTAL					1,757,614	
G30	**CIVIL MECHANICAL UTILITIES**						
	Utilities - Enabling						
	Allowance for temporary utilities etc.	**1**	ls	150,000.00	150,000		
	Water supply; Pricing includes E&B and bedding						
	New DI piping; 8"	**200**	lf	100.00	20,000		
	New DI piping; 8" Fire	**3,500**	lf	100.00	350,000		
	Connect to existing	**1**	loc	10,000.00	10,000		
	FD connection	**1**	ea	2,000.00	2,000		
	Gate valves	**8**	ea	750.00	6,000		
	Fire hydrant	**12**	ea	5,000.00	60,000		
	Fire hydrant; relocate existing	**1**	ea	3,500.00	3,500		
	Sanitary; Pricing includes E&B and bedding						
	Manholes	**4**	ea	4,000.00	16,000		
	Grease trap	**1**	ea	15,000.00	15,000		
	8" PVC	**300**	lf	60.00	18,000		
	Connect to existing drain	**1**	ea	3,000.00	3,000		
	Relocate existing sewer system	**1**	ls	250,000.00	250,000		
	Storm water; Pricing includes E&B and bedding						
	Allowance to modify existing drainage systems	**350,000**	sf	7.00	2,450,000		
	Perforated pipe @ recharge systems and crushed stone base under fields	**454,000**	sf	4.00	NR		
	Gas service						
	E&B trench for new gas pipe - install by plumbing	**250**	lf	25.00	6,250		
	SUBTOTAL					3,359,750	
G40	**ELECTRICAL UTILITIES**						
	Power						
	Utility co. backcharges, allow	**1**	ls	30,000.00	30,000		
	Connections at existing manhole				Utility co.		
	Manhole	**1**	ls	8,500.00	8,500		
	Connections in manhole	**1**	ls	3,500.00	3,500		
	Primary ductbank 2-5" ductbank, empty, allow	**1100**	lf	120.00	132,000		
	Transformer by utility company				By Utility Co.		
	Transformer pad	**1**	ea	2,500.00	2,500		
	Secondary service	**60**	lf	1,100.00	66,000		
	Communications						
	Connection at riser pole, allow	**1**	ea	1,500.00	1,500		
	Telecom ductbank 4-4", allow	**1100**	lf	152.00	167,200		
	Site Lighting						
	Varsity baseball sports lighting (allow)	**1**	ls	120,000.00	120,000		
	Softball sports lighting (allow)	**1**	ls	90,000.00	90,000		
	Site Parking lighting (allow)	**1**	ls	350,000.00	350,000		
	SUBTOTAL					971,200	
	TOTAL - SITE DEVELOPMENT						***$14,209,864***

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

G. COST ESTIMATE / Design Team

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Belmont High School
Design Options - GRADES 7-12
Belmont, MA

12-Feb-18

PSR Estimate

GFA 65,050

CONSTRUCTION COST SUMMARY

	BUILDING SYSTEM		*SUB-TOTAL*	*TOTAL*	*$/SF*	*%*
OPTION 2.3 RENOVATION						
A10	**FOUNDATIONS**					
	A1010	Standard Foundations	$25,000			
	A1020	Special Foundations	$0			
	A1030	Lowest Floor Construction	$75,000	**$100,000**	$1.54	0.7%
B10	**SUPERSTRUCTURE**					
	B1010	Upper Floor Construction	$0			
	B1020	Roof Construction	$50,000	**$50,000**	$0.77	0.4%
B20	**EXTERIOR CLOSURE**					
	B2010	Exterior Walls	$822,040			
	B2020	Windows/Curtainwall	$589,164			
	B2030	Exterior Doors	$58,796	**$1,470,000**	$22.60	10.5%
B30	**ROOFING**					
	B3010	Roof Coverings	$1,821,400			
	B3020	Roof Openings	$10,000	**$1,831,400**	$28.15	13.0%
C10	**INTERIOR CONSTRUCTION**					
	C1010	Partitions	$585,450			
	C1020	Interior Doors	$195,150			
	C1030	Specialties/Millwork	$393,504	**$1,174,104**	$18.05	8.3%
C20	**STAIRCASES**					
	C2010	Stair Construction	$0			
	C2020	Stair Finishes	$0	**$0**	$0.00	0.0%
C30	**INTERIOR FINISHES**					
	C3010	Wall Finishes	$390,300			
	C3020	Floor Finishes	$715,550			
	C3030	Ceiling Finishes	$520,400	**$1,626,250**	$25.00	11.6%
D10	**CONVEYING SYSTEMS**					
	D1010	Elevator	$0	**$0**	$0.00	0.0%
D20	**PLUMBING**					
	D20	Plumbing	$780,600	**$780,600**	$12.00	5.6%
D30	**HVAC**					
	D30	HVAC	$2,927,250	**$2,927,250**	$45.00	20.8%
D40	**FIRE PROTECTION**					
	D40	Fire Protection	$305,735	**$305,735**	$4.70	2.2%
D50	**ELECTRICAL**					
	D5010	Electrical Systems	$2,211,700	**$2,211,700**	$34.00	15.7%
E10	**EQUIPMENT**					
	E10	Equipment	$276,040	**$276,040**	$4.24	2.0%

G. COST ESTIMATE / Design Team

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Belmont High School
Design Options - GRADES 7-12
Belmont, MA

12-Feb-18

PSR Estimate

GFA 65,050

CONSTRUCTION COST SUMMARY

	BUILDING SYSTEM		*SUB-TOTAL*	*TOTAL*	*$/SF*	*%*
OPTION 2.3 RENOVATION						
E20	**FURNISHINGS**					
	E2010	Fixed Furnishings	$65,050			
	E2020	Movable Furnishings	NIC	**$65,050**	$1.00	0.5%
F10	**SPECIAL CONSTRUCTION**					
	F10	Special Construction	$750,000	**$750,000**	$11.53	5.3%
F20	**SELECTIVE BUILDING DEMOLITION**					
	F2010	Building Elements Demolition	$496,138			
	F2020	Hazardous Components Abatement	$0	**$496,138**	$7.63	3.5%
TOTAL DIRECT COST (Trade Costs)				***$14,064,267***	*$216.21*	*100.0%*

G. COST ESTIMATE / Design Team

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Belmont High School 12-Feb-18
Design Options - GRADES 7-12
Belmont, MA

PSR Estimate **GFA** 65,050

	DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
	OPTION 2.3 RENOVATION						
	GROSS FLOOR AREA CALCULATION						
	First Floor				65,050		
	TOTAL GROSS FLOOR AREA (GFA)				**65,050**	***sf***	
	A10 FOUNDATIONS						
	A1010 STANDARD FOUNDATIONS						
	Repair cracks and resurface exposed concrete foundations	**1**	ls	25,000	25,000		
	SUBTOTAL					25,000	
	A1020 SPECIAL FOUNDATIONS						
	No work in this section						
	SUBTOTAL						
	A1030 LOWEST FLOOR CONSTRUCTION						
	Cutting and patching for MEP	**1**	ls	15,000.00	15,000		
	New slab at bathrooms and shower areas	**3,000**	sf	20.00	60,000		
	SUBTOTAL					75,000	
	TOTAL - FOUNDATIONS						**$100,000**
	B10 SUPERSTRUCTURE						
	B1010 FLOOR CONSTRUCTION						
	SUBTOTAL					-	
	B1020 ROOF CONSTRUCTION						
	Support framing for new MEP systems	**1**	ls	50,000.00	50,000		
	SUBTOTAL					50,000	
	TOTAL - SUPERSTRUCTURE						**$50,000**
	B20 EXTERIOR CLOSURE						
	B2010 EXTERIOR WALLS	*18,676*	*sf*				
	Repair and repoint exterior walls- brick; assume 100%	**18,676**	sf	32.00	597,632		
	Repairs to precast concrete panels, fins and banding	**1**	ls	75,000.00	75,000		
	Clean all exterior walls; includes staging	**18,676**	sf	8.00	149,408		
	SUBTOTAL					822,040	
	B2020 WINDOWS/CURTAINWALL						
	Replace existing translucent panels	**6,798**	sf	80.00	543,840		
	Backer rod & double sealant	**3,777**	lf	9.00	33,993		
	Wood blocking at openings	**3,777**	lf	3.00	11,331		
	SUBTOTAL					589,164	
	B2030 EXTERIOR DOORS						
	Replace exterior single door	**3**	ea	2,100.00	6,300		
	Replace exterior double door	**4**	pr	4,000.00	16,000		
	Replace overhead doors; 8'x8'	**2**	ea	7,040.00	14,080		
	Replace overhead doors; 12'x15'	**1**	ea	19,800.00	19,800		
	Backer rod & double sealant	**218**	lf	9.00	1,962		
	Wood blocking at openings	**218**	lf	3.00	654		

G. COST ESTIMATE / Design Team

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Belmont High School 12-Feb-18
Design Options - GRADES 7-12
Belmont, MA

PSR Estimate **GFA** 65,050

	DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
	OPTION 2.3 RENOVATION						
	SUBTOTAL					58,796	
	TOTAL - EXTERIOR CLOSURE						**$1,470,000**
	B30 ROOFING						
	B3010 ROOF COVERINGS						
	Replace existing roofing systems	**65,050**	sf	28.00	1,821,400		
	SUBTOTAL					1,821,400	
	B3020 ROOF OPENINGS						
	Replace roof ladders/hatches etc.	**1**	ls	10,000.00	10,000		
	SUBTOTAL					10,000	
	TOTAL - ROOFING						**$1,831,400**
	C10 INTERIOR CONSTRUCTION						
	C1010 PARTITIONS						
	Allowance to modify existing walls and add new walls	**65,050**	gsf	6.00	390,300		
	Seismic upgrades	**65,050**	gsf	3.00	195,150		
	SUBTOTAL					585,450	
	C1020 INTERIOR DOORS						
	Adjust door openings, install new door frame to meet code requirements (door carried below)	**65,050**	gsf	3.00	195,150		
	SUBTOTAL					195,150	
	C1030 SPECIALTIES / MILLWORK						
	Toilet Partitions and accessories	**65,050**	gsf	0.80	52,040		
	New markerboards/tackboards	**65,050**	gsf	1.00	65,050		
	Replace athletic lockers - allowance	**1**	ls	25,000.00	25,000		
	New guardrail at Fieldhouse bleachers	**150**	lf	200.00	30,000		
	Allowance for miscellaneous specialties; wall protection, fire extinguishers etc	**1**	ls	10,000.00	10,000		
055000	*MISCELLANEOUS METALS*						
	Miscellaneous metals throughout building	**65,050**	sf	1.50	97,575		
061000	*ROUGH CARPENTRY*						
	Rough blocking	**65,050**	sf	0.15	9,758		
070001	*WATERPROOFING, DAMPPROOFING AND CAULKING*						
	Miscellaneous sealants throughout building	**65,050**	sf	1.25	81,313		
101400	*SIGNAGE*						
	Code compliant signage	**65,050**	sf	0.35	22,768		
	SUBTOTAL					393,504	
	TOTAL - INTERIOR CONSTRUCTION						**$1,174,104**
	C20 STAIRCASES						
	C2010 STAIR CONSTRUCTION						
	SUBTOTAL					-	
	C2020 STAIR FINISHES						

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

G. COST ESTIMATE / Design Team

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Belmont High School 12-Feb-18
Design Options - GRADES 7-12
Belmont, MA

PSR Estimate **GFA** 65,050

	DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
	OPTION 2.3 RENOVATION						
117	SUBTOTAL					-	
118							
119	***TOTAL - STAIRCASES***						
120							
121							
122	***C30 INTERIOR FINISHES***						
123							
124	**C3010 WALL FINISHES**						
125	Allowance for wall finishes	**65,050**	gsf	6.00	390,300		
126	SUBTOTAL					390,300	
127							
128	**C3020 FLOOR FINISHES**						
129							
130	Allowance for floor finishes	**65,050**	gsf	11.00	715,550		
131	SUBTOTAL					715,550	
132							
133	**C3030 CEILING FINISHES**						
134	Allowance for ceiling finishes	**65,050**	gsf	8.00	520,400		
135	SUBTOTAL					520,400	
136							
137	***TOTAL - INTERIOR FINISHES***						**$1,626,250**
138							
139							
140	***D10 CONVEYING SYSTEMS***						
141							
142	SUBTOTAL					-	
143							
144	***TOTAL - CONVEYING SYSTEMS***						
145							
146							
147	***D20 PLUMBING***						
148							
149	**D20 PLUMBING, GENERALLY**						
150	Plumbing allowance	**65,050**	gsf	12.00	780,600		
151	SUBTOTAL					780,600	
152							
153	***TOTAL - PLUMBING***						**$780,600**
154							
155							
156	***D30 HVAC***						
157							
158	**D30 HVAC, GENERALLY**						
159	HVAC allowance	**65,050**	gsf	45.00	2,927,250		
160	SUBTOTAL					2,927,250	
161							
162	***TOTAL - HVAC***						**$2,927,250**
163							
164							
165	***D40 FIRE PROTECTION***						
166							
167	**D40 FIRE PROTECTION, GENERALLY**						
168	New fire protection system	**65,050**	sf	4.70	305,735		
169	SUBTOTAL					305,735	
170							
171	***TOTAL - FIRE PROTECTION***						**$305,735**
172							
173							
174	***D50 ELECTRICAL***						
175							
176	**D5010 ELECTRICAL WORK**						
177	Complete electrical systems	**65,050**	gsf	34.00	2,211,700		
178	SUBTOTAL					2,211,700	
179							
180	***TOTAL - ELECTRICAL***						**$2,211,700**

PM&C

Belmont High School 12-Feb-18
Design Options - GRADES 7-12
Belmont, MA

PSR Estimate **GFA** 65,050

	DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
	OPTION 2.3 RENOVATION						
	E10 EQUIPMENT						
	E10 EQUIPMENT, GENERALLY						
	Gym wall pads	**1**	ls	20,000.00	20,000		
	Basketball backstops; swing up; electric operated	**6**	loc	10,000.00	60,000		
	Gymnasium dividing net; electrically operated; 60 lf	**1**	ea	30,000.00	30,000		
	Volleyball net and standards	**1**	ls	5,000.00	5,000		
	Score boards in Gym & Fieldhouse	**2**	loc	15,000.00	30,000		
	Telescoping bleachers, electronic retracting (1008 seats)	**1**	ls	131,040.00	131,040		
	SUBTOTAL					276,040	
	TOTAL - EQUIPMENT						**$276,040**
	E20 FURNISHINGS						
	E2010 FIXED FURNISHINGS						
123553	*CASEWORK*						
	Allowance for new casework throughout	**65,050**	gsf	1.00	65,050		
	SUBTOTAL					65,050	
	E2020 MOVABLE FURNISHINGS						
	All movable furnishings to be provided and installed by owner						
	SUBTOTAL					NIC	
	TOTAL - FURNISHINGS						**$65,050**
	F10 SPECIAL CONSTRUCTION						
	F10 SPECIAL CONSTRUCTION						
	Pool upgrades	**1**	ls	750,000.00	750,000		
	SUBTOTAL					750,000	
	TOTAL - SPECIAL CONSTRUCTION						**$750,000**
	F20 SELECTIVE BUILDING DEMOLITION						
	F2010 BUILDING ELEMENTS DEMOLITION						
	Remove exterior glazing	**6,798**	sf	6.00	40,788		
	Remove roofing	**65,050**	sf	2.00	130,100		
	Interior demolition	**65,050**	gsf	4.00	260,200		
	Temporary enclosures/protection	**65,050**	sf	1.00	65,050		
	SUBTOTAL					496,138	
	F2020 HAZARDOUS COMPONENTS ABATEMENT						
	See summary						
	SUBTOTAL						
	TOTAL - SELECTIVE BUILDING DEMOLITION						**$496,138**

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

G. COST ESTIMATE / Design Team

PM&C

Belmont High School 12-Feb-18
Design Options - GRADES 7-12
Belmont, MA

PSR Estimate GFA 386,750

CONSTRUCTION COST SUMMARY

	BUILDING SYSTEM		*SUB-TOTAL*	*TOTAL*	*$/SF*	*%*
OPTION 2.3 NEW ADDITION						
A10	**FOUNDATIONS**					
	A1010	Standard Foundations	$3,222,208			
	A1020	Special Foundations	$9,520,160			
	A1030	Lowest Floor Construction	$3,405,365	**$16,147,733**	$41.75	12.3%
A20	**BASEMENT CONSTRUCTION**					
	A2010	Basement Excavation	$0			
	A2020	Basement Walls	$0	**$0**	$0.00	0.0%
B10	**SUPERSTRUCTURE**					
	B1010	Upper Floor Construction	$10,615,447			
	B1020	Roof Construction	$5,395,748	**$16,011,195**	$41.40	12.2%
B20	**EXTERIOR CLOSURE**					
	B2010	Exterior Walls	$9,770,917			
	B2020	Windows	$6,648,823			
	B2030	Exterior Doors	$73,680	**$16,493,420**	$42.65	12.5%
B30	**ROOFING**					
	B3010	Roof Coverings	$5,804,280			
	B3020	Roof Openings	$752,500	**$6,556,780**	$16.95	5.0%
C10	**INTERIOR CONSTRUCTION**					
	C1010	Partitions	$8,508,500			
	C1020	Interior Doors	$1,933,750			
	C1030	Specialties/Millwork	$3,071,826	**$13,514,076**	$34.94	10.3%
C20	**STAIRCASES**					
	C2010	Stair Construction	$584,000			
	C2020	Stair Finishes	$75,446	**$659,446**	$1.71	0.5%
C30	**INTERIOR FINISHES**					
	C3010	Wall Finishes	$2,320,500			
	C3020	Floor Finishes	$4,254,250			
	C3030	Ceiling Finishes	$3,867,500	**$10,442,250**	$27.00	7.9%
D10	**CONVEYING SYSTEMS**					
	D1010	Elevator	$360,000	**$360,000**	$0.93	0.3%
D20	**PLUMBING**					
	D20	Plumbing	$4,641,000	**$4,641,000**	$12.00	3.5%
D30	**HVAC**					
	D30	HVAC	$21,403,750	**$21,403,750**	$55.34	16.3%
D40	**FIRE PROTECTION**					
	D40	Fire Protection	$1,917,725	**$1,917,725**	$4.96	1.5%
D50	**ELECTRICAL**					

G. COST ESTIMATE / Design Team

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Belmont High School
Design Options - GRADES 7-12
Belmont, MA

12-Feb-18

PSR Estimate

GFA 386,750

CONSTRUCTION COST SUMMARY

	BUILDING SYSTEM		*SUB-TOTAL*	*TOTAL*	*$/SF*	*%*
OPTION 2.3 NEW ADDITION						
	D5010	Complete System	$17,149,500	**$17,149,500**	$44.34	13.0%
E10	**EQUIPMENT**					
	E10	Equipment	$1,674,200	**$1,674,200**	$4.33	1.3%
E20	**FURNISHINGS**					
	E2010	Fixed Furnishings	$4,503,273			
	E2020	Movable Furnishings	NIC	**$4,503,273**	$11.64	3.4%
F10	**SPECIAL CONSTRUCTION**					
	F10	Special Construction	$0	**$0**	$0.00	0.0%
F20	**HAZMAT REMOVALS**					
	F2010	Building Elements Demolition	$100,000			
	F2020	Hazardous Components Abatement	$0	**$100,000**	$0.26	0.1%
TOTAL DIRECT COST (Trade Costs)				***$131,574,348***	*$340.21*	*100.0%*

Belmont High School PSR Estimate 2.12.18 GR 7-12 Page 44 PMC - Project Management Cost

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

G. COST ESTIMATE / Design Team

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Belmont High School 12-Feb-18
Design Options - GRADES 7-12
Belmont, MA

PSR Estimate GFA 386,750

CSI CODE	DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
OPTION 2.3 NEW ADDITION							
	GROSS FLOOR AREA CALCULATION						
	Ground Floor			146,464			
	First Floor			90,452			
	Second Floor			90,452			
	Third Floor			59,382			
	TOTAL GROSS FLOOR AREA (GFA)				**386,750** ***sf***		
	A10 FOUNDATIONS						
	A1010 STANDARD FOUNDATIONS						
	Allowance for pile caps, grade beams etc.	**146,464**	sf	22.00	3,222,208		
	SUBTOTAL					3,222,208	
	A1020 SPECIAL FOUNDATIONS						
	Driven piles; including mobilization	**146,464**	sf	65.00	9,520,160		
	SUBTOTAL					9,520,160	
	A1030 LOWEST FLOOR CONSTRUCTION						
	New Structural Slab, 12" thick	*146,464*	*sf*		-		
312000	Ordinary Fill, 6"	**2,712**	cy	16.00	43,392		
312000	Crushed stone, 6"	**2,712**	cy	35.00	94,920		
312000	Rigid insulation; 40 psi	**146,464**	sf	2.15	314,898		
033000	Vapor barrier	**146,464**	sf	0.80	117,171		
312000	Compact existing sub-grade	**146,464**	sf	0.55	80,555		
033000	Formwork	**778**	lf	12.00	9,336		
033000	Rebar, 6#/SF	**878,784**	lbs	1.20	1,054,541		
033000	Concrete - 12" thick; 4,000 psi	**5,696**	cy	120.00	683,520		
033000	Placing concrete	**5,696**	cy	90.00	512,640		
033000	Finishing and curing concrete	**146,464**	sf	3.00	439,392		
	Miscellaneous						
	Patch slab at foundations in existing building				W/Reno		
	New Elevator pit				W/Reno		
	New loading dock	**1**	ls	40,000.00	40,000		
	Equipment pads	**1**	ls	15,000.00	15,000		
	SUBTOTAL					3,405,365	
	TOTAL - FOUNDATIONS						**$16,147,733**
	A20 BASEMENT CONSTRUCTION						
	A2010 BASEMENT EXCAVATION						
	No Work in this section						
	SUBTOTAL					-	
	A2020 BASEMENT WALLS						
	No Work in this section						
	SUBTOTAL					-	
	TOTAL - BASEMENT CONSTRUCTION						
	B10 SUPERSTRUCTURE						
		14.92	lbs/sf		-		