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July 31, 2020

MILLIS MIDDLE HIGH SCHOOL
Roof and HVAC Feasibility Study
Millis, MA

Prepared For:
Millis Public Schools
245 Plain Street
Millis, Massachusetts 02054

CBI Consulting LLC.
250 Dorchester Avenue
Boston, Massachusetts 02127
CBI Project No. CB192030

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Section 1 Preface

This roof and HVAC feasibility study report was prepared for the Millis Public Schools of Millis, Massachusetts. The Feasibility Study includes an evaluation of the school's existing roof and HVAC systems, along with recommendation for replacements and probable estimated costs.

The project is to be managed by the Millis Public Schools administration acting on behalf of the Millis School Committee and will be coordinated with other appropriate town departments as needed. The Millis School Committee has issued a charge to evaluate the current condition of all aspects of the Middle High School Roof as well as the Middle High School building's heating, ventilation, air conditioning, and mechanical systems with the results of said evaluation to be a suggested scope and sequence for the two projects, preliminary cost estimates, and technical information to be used to generate bidding documents.

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Section 2 Acknowledgements

The following individuals and firms contributed to this report:

Millis Public Schools

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Section 3 Executive Summary

CBI Consulting, LLC (CBI) of Boston, Massachusetts was retained by the Millis Public Schools to perform a Feasibility Study for Roofing and HVAC.

The existing Millis Middle High School is a one (1) and two (2)-story public educational facility comprised of grades 9-12. It includes classrooms, school administration offices, gymnasium, locker rooms, auditorium, cafeteria, boiler room and maintenance. Built in the 1960's and additions in the 1970's, and renovations in 1998, the school is constructed of cast-in-place concrete foundations and floor slabs, structural steel framing and concrete masonry unit walls. The roof deck is comprised of lightweight concrete gypsum panels. The exterior elevations are clad with brick veneer masonry and aluminum glazed commercial walls and storefront entrances.

CBI and its consultants BLW Engineers Inc (MEP Engineers), by Fuss & O'Neill, Inc. (Environmental Consultants) Inc visited the subject building between June 2 and June 5, 2020 to review the existing roofing, building and mechanical systems.

During these visits CBI and its consultants performed visual review of the exterior roofing conditions and interior review of the roof structure and mechanical equipment, as well as review of the existing building materials that may be affected by any roofing or mechanical equipment replacement. With the assistance of Gibson Roofing of Hanover, MA, roofing test cuts (97 total) were taken in all single membrane roof areas.

Existing Roofing

There are ten (10) roof areas ranging from approximately 10 feet to 25 feet in height that are all covered with a fully adhered unreinforced EPDM single-ply membrane roofing system with rigid polyisocyanurate insulation of varying thickness. There is an entrance canopy leading to the main entrance of the school that is a hip roof canopy structure covered with pre-finished standing seam metal roofing. There is a maintenance shed that is covered fiberglass asphalt shingles.

The age of the EPDM membrane roof covering varies amongst the different roof areas. It appears that during the 1998 renovations, Roof Areas A, B, C, part of D, E, F and G were replaced. The EPDM membrane in these areas appeared to be newer than at Roof Areas A1, a portion of D, D1 and H, as the seaming technique of the membrane sheets were made with a butyl tape as opposed to glued seam technology. In addition, the roofing test cuts revealed that an older gravel surface 5-ply built-up roofing system (BUR) was left in place at Roof Areas A1, D, D1 and H rather than be removed when the EPDM membrane Roofing System at the time was installed. Most of the test cuts were found to be damp and wet in these roof areas. Despite damp to wet conditions found in the roofing test cuts both where the BUR does and does not exist, overall, the lightweight gypsum concrete was found to be in fair condition. However, some deterioration of the material is expected in areas where the roof was not cut open.

It is CBI's understanding that there are roof leaks that appear on regular basis and on all roof areas. The leaks can be attributable to cuts, punctures, open lap seams in the field membrane sheets and flashings. There were repair patches that were evident throughout all roof areas.

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In general, CBI observed the following, at each roof area:

- The existing brick masonry on large boiler chimney is exhibiting mortar deterioration, as it appears debonded, cracked and eroded.
- The roof deck general slopes 1/8" per foot, and greater at walls and roof sumps. There is evidence of ponding due the appearance of dirt deposits along drainage valleys and behind penetrations.
- The existing roofing insulation installed over the existing BUR roofing system, were found to damp to wet, and as, result there are areas of buckled and warped insulation
- The existing insulations thermal R-Values range between an R-11 and R-15, well below the current building code minimum R-value of R-30.
- There are open membrane lap seams and flashing seams, as noted previously and are failing where they are glued together with adhesive.
- The copper through wall flashings are weathered and in poor condition. They appear to have been damaged from past roofing replacement work. The sealant at the top of the flashings are deteriorated and beyond their serviceable useful life expectancy. The flashings heights are low and will need to be raised to accommodate new roofing.
- All existing sealants at penetrations, flashings, windows, louvers, and existing at other dissimilar materials are deteriorated and beyond their serviceable useful life expectancy.
- The existing skylights aged and weathered have repaired with sealant, mastic and flashings tapes, in what appears to be attempts to stop leaks. The polycarbonate domes are etched and crazed. At Roof D was broken and covered with membrane flashing tape.
- Plumbing vent stacks are rust corroded.
- The roof drains are rust corroded.

CBI recommends complete replacement of all roofing on all roof areas with a new 20 year warranted EPDM reinforced single-ply membrane roofing system, fully adhered, to a mechanically attached and adhered 1/4" per foot tapered polyisocyanurate insulation system having a minimum LTTR-value of 30 and 30mil self-adhered vapor barrier.

Other associated work would include, select gypsum deck repairs, raising of through-wall flashings at higher brick masonry walls, restoration of the large brick masonry chimney, all new perimeter wood blocking and edge metal systems, replacement of sealants at windows, doors and louvers directly above roof areas, unit skylight replacement, roof access hatch replacement and roof drain replacement. We also suggest painting of corroded vent plumbing stacks and access doors.

Structural Review

CBI's analysis was based on the current building code Building 780 CMR - Massachusetts State Building Code 9th Edition, which is based on modified versions of the 2015 International Building Code (IBC) and in consideration of the building code of the time the building(s) were

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construed. To perform the analysis, we used estimated weights of the roofs and attached finishes. Our analysis showed the steel beams supporting the deck and roof decking are adequate for the current code loading, but have limited reserve capacity, if any. For areas where the structure was not visible, CBI has interpolated these conditions as similar construction, thus having similar limited reserve capacity. Due to limited reserve capacity, and without substantive upgrades to the existing roof structure and decking, installation of Green Roofing as part of a roofing replacement project is not feasible

Building Materials Review

The investigation and testing of building materials revealed that asbestos containing materials were found in the existing built-up roofing, as well as in the cement used to seal ductwork. Lead base paints were also assumed. These hazardous materials will need to be removed as part of the roofing replacement project.

Mechanical and Electrical

The existing fire protection system is over 20 years old, but is fair condition and does not require replacement.

The existing mechanical systems are in excess of 20 years old and at the end of their useful life expectancy. Replacement of these systems is recommended. These include but may not be limited to hot water boiler, pumps, water specialties, controls, unit ventilators, exhaust blowers, cabinet unit heaters, rooftop units, air handling and exhaust fans. These replacements shall be considered MEP Option 1.

MEP Option 2, includes replacement of these system with packaged roof top units, new supply and return ductwork terminating with air outlets, constant volume air equipment for the large spaces including cafeteria, gymnasium and auditorium and variable air volume (VAV) boxes with hot water reheat coils and zone controls for smaller spaces such as classrooms and offices. Replacement of boilers with high efficiency natural gas unit, with primary and secondary piping systems. The equipment would be controlled with a new building management system (BMS), which can be integrated with the BMS system recently constructed Elementary School.

Total Construction Cost Summary

Total Construction Cost	
Roofing	$2,899,500
With MEP Option 1	$5,400,000
Total	**$8,299,500**
Total Construction Cost with Option 2	
Roofing	$2,899,500
With MEP Option 2	$9,300,000
Total	**$ 12,199,500**

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Section 4 Existing Conditions Observations

The existing Millis Middle High School is a one (1) and two (2)-story public educational facility comprised of grades 9-12. It includes classrooms, school administration offices, gymnasium, locker rooms, auditorium, cafeteria, boiler room and maintenance. Built in the 1960's and additions in the 1970's, and renovations in 1998, the school is constructed of cast-in-place concrete foundations and floor slabs, structural steel framing and concrete masonry unit walls. The roof deck is comprised of lightweight concrete gypsum panels. The exterior elevations are clad with brick veneer masonry and aluminum glazed commercial walls and storefront entrances.

CBI and its consultants visited the subject building between June 2 and June 5, 2020 to review the existing roofing, building and mechanical systems. For the mechanical systems, please refer to Appendix A- MEPFP Evaluation as prepared by BLW Engineers, Inc. For Hazardous Building Materials, please refer to Appendix B – Limited Hazardous Materials Inspection Report as prepared by Fuss & O'Neill, Inc.

CBI was provided with limited existing documentation regarding the existing building and roofing conditions. This was limited to the construction documents from the 1998 Renovation.

During these visits CBI and its consultants performed visual review of the exterior roofing conditions and interior review of the roof structure and mechanical equipment, as well as review of the existing building materials that may be affected by any roofing or mechanical equipment replacement. With the assistance of Gibson Roofing of Hanover, MA, roofing test cuts (97 total) were taken in all single membrane roof areas.

1. Roofing

There are ten (10) roof areas ranging from approximately 10 feet to 25 feet in height that are all covered with a fully adhered unreinforced EPDM single-ply membrane roofing system with rigid polyisocyanurate insulation of varying thickness. There is an entrance canopy leading to the main entrance of the school that is a hip roof canopy structure covered with pre-finished standing seam metal roofing. There is a maintenance shed that is covered fiberglass asphalt shingles.

The age of the EPDM membrane roof covering varies amongst the different roof areas. It appears that during the 1998 renovations, Roof Areas A, B, C, part of D, E, F and G were replaced. The EPDM membrane in these areas appeared to be newer than at Roof Areas A1, a portion of D, D1 and H, as the seaming technique of the membrane sheets were made with a butyl tape as opposed to glued seam technology. In addition, the roofing test cuts revealed that an older gravel surface 5-ply built-up roofing system (BUR) was left in place at Roof Areas A1, D, D1 and H rather than be removed when the EPDM membrane Roofing System at the time was installed. Most of the test cuts were found to be damp and wet in these roof areas. Despite damp to wet conditions found in the roofing test cuts both where the BUR does and does not exist, overall, the lightweight gypsum concrete was found to be in fair condition. However, some deterioration of the material is expected in areas where the roof was not cut open.

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It is CBI's understanding that there are roof leaks that appear on a regular basis and on all roof areas. The leaks can be attributable to cuts, punctures, open lap seams in the field membrane sheets and flashings. There were repair patches that were evident throughout all roof areas.

In general, CBI observed the following, at each roof area:

Roof A

The roofing assembly consists of EPDM membrane and 2.5 inches of polyisocyanurate insulation over the existing lightweight gypsum concrete roof deck. The roofing was also partially covered with Photovoltaic Solar Panels.

- A building expansion joint dissects Roof Areas A and A-1 and is constructed with a foam rod and EPDM membrane cover.
- The existing standing seam metal canopy roof partially intersects with this roof.
- This roof abuts a higher masonry wall and includes copper through- wall flashing.
- The perimeter edge condition includes a pre-finished, pre-manufactured edge metal anchor bar system.
- Roof penetrations include Rooftop HVAC Unit, Exhaust Fans, Skylights, plumbing vent stacks, and two (2) roof drains.
- There is an existing access door in the brick veneer masonry wall that is rust corroded.

Roof A.1

The roofing assembly consists of EPDM membrane, 2.25 inches of polyisocyanurate insulation, BUR roofing over the existing lightweight gypsum concrete roof deck. The insulation was found to damp and moist.

- A building expansion joint dissects Roof Areas A and A-1 and is constructed with a foam rod and EPDM membrane cover.
- The perimeter edge condition includes a pre-finished, pre-manufactured edge metal anchor bar system.
- Roof penetrations include Exhaust Fans and three (3) roof drains.

Roof B

The roofing assembly consists of EPDM membrane and 2.5 inches of polyisocyanurate insulation over the existing lightweight gypsum concrete roof deck.

- A building expansion joint dissects Roof Areas A and A-1 and is constructed with a foam rod and EPDM membrane cover.
- This roof abuts a higher masonry wall and includes copper through- wall flashing
- The perimeter edge condition includes a pre-finished, pre-manufactured edge metal anchor bar system.
- Roof penetrations include Rooftop HVAC Units, Exhaust Fans, covered abandoned curb, plumbing vent stacks, and two (2) roof drains.

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Roof C

The roofing assembly consists of EPDM membrane and 2.75 inches of polyisocyanurate insulation over the existing lightweight gypsum concrete roof deck. This roof covers both the gymnasium and auditorium.

- The perimeter edge condition includes a pre-finished, pre-manufactured edge metal anchor bar system.
- Roof penetrations include large exhaust fans and ventilators, exhaust Fans, smoke exhaust hatches covered abandoned curb, plumbing vent stacks, and two (2) roof drains.

Roof D

- The small portion of the roof consists of EPDM membrane, 2.25 inches of polyisocyanurate insulation, BUR roofing over existing lightweight gypsum concrete roof deck. The insulation was wet, and water saturated, with some evidence of deterioration of the decking. The insulation was severely buckled.
- A larger portion of the consists of EPDM membrane and 2.75 inches of polyisocyanurate insulation over the existing lightweight gypsum concrete roof deck . The insulation was found to damp and moist.
- This roof abuts a higher masonry wall and includes copper through- wall flashing.
- The perimeter edge condition includes a pre-finished, pre-manufactured edge metal anchor bar system.
- Roof penetrations include Exhaust Fans and skylights three (3) roof drains.
- The roof also includes an elevator override. The cladding appears to be stucco over concrete masonry unit blocks. The stucco is severely cracked and deteriorated.

Roof D.1

- The roofing assembly consists of EPDM membrane, 2.25 inches of polyisocyanurate insulation, BUR roofing over existing lightweight gypsum concrete roof deck. The insulation was wet and water saturated, with some evidence of deterioration of the decking. The insulation was severely buckled.
- This roof abuts a slightly higher masonry wall and includes copper through- wall flashing.
- The perimeter edge condition includes a pre-finished, pre-manufactured edge metal anchor bar system.
- Roof penetrations include Rooftop HVAC Unit, skylight, abandoned curbs covered with EPDM membrane and three (3) roof drains.

Roof E

The roofing assembly consists of EPDM membrane and 2.5 inches of polyisocyanurate insulation over the existing lightweight gypsum concrete roof deck.

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- This roof abuts a higher masonry wall and includes copper through- wall flashing.
- The perimeter edge condition includes a pre-finished, pre-manufactured edge metal anchor bar system.
- Roof penetrations include Rooftop HVAC, exhaust fans and ventilators, covered abandoned curbs, gas flue vents, plumbing vent stacks, and two (2) roof drains. Note that one drain was noticeably clogged.
- A large brick masonry chimney also exists at this roof.

Roof F

The roofing assembly consists of EPDM membrane and 2.75 inches of polyisocyanurate insulation over the existing lightweight gypsum concrete roof deck.

- This roof abuts a slightly higher masonry wall and includes copper through- wall flashing. The brick masonry wall is covered with electrical conduit.
- The perimeter edge condition includes a pre-finished, pre-manufactured edge metal anchor bar system.
- Roof penetrations include exhaust fans, plumbing vent stacks, and one (1) roof drain.

Roof G

The roofing assembly consists of EPDM membrane and 2.75 inches of polyisocyanurate insulation over the existing lightweight gypsum concrete roof deck. The roofing was fully covered with Photovoltaic Solar Panels.

- A building expansion joint dissects Roof Areas G from H and is constructed with wood blocking and covered with an aluminum preformed expansion joint cover.
- This roof abuts a higher masonry wall and includes copper through- wall flashing. The brick masonry wall is covered with electrical conduit.
- The perimeter edge condition includes a pre-finished, pre-manufactured edge metal anchor bar system.
- Roof penetrations include Rooftop HVAC Unit, A-C Condensers, Exhaust Fans, plumbing vent stacks, and six (6) roof drains.
- This roof also includes a roof access hatch and elevator override, and Photovoltaic Solar electrical equipment.

Roof H

The roofing assembly consists of EPDM membrane, 2.25 inches of polyisocyanurate insulation, BUR roofing over the existing lightweight gypsum concrete roof deck. The insulation was severely buckled.

- The perimeter edge condition includes a pre-finished, pre-manufactured edge metal anchor bar system.

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- Roof penetrations include Rooftop HVAC Unit, A-C Condensers, Exhaust Fans, plumbing vent stacks, include Exhaust Fans and four (4) roof drains.

Common Roof and Building Component Deficiencies

- The existing brick masonry on large boiler chimney is exhibiting mortar deterioration, as it appears debonded, cracked and eroded.
- The roof deck general slopes 1/8" per foot, and greater at walls and roof sumps. There is evidence of ponding due the appearance of dirt deposits along drainage valleys and behind penetrations.
- The existing insulations thermal R-Values range between an R-11 and R-15, well below the current building code minimum R-value of R-30.
- There are open membrane lap seams and flashing seams, as noted previously and are failing particular where they are glued.
- The copper through wall flashings are weathered and in poor condition. They appear to have been damaged from past roofing replacement work. The sealant at the top of the flashings are deteriorated and beyond their serviceable useful life expectancy. The flashings heights are low and will need to be raised to accommodate new roofing.
- All existing sealants at penetrations, flashings, windows, louvers, and existing at other dissimilar materials are deteriorated and beyond their serviceable useful life expectancy.
- The existing skylights aged and weathered have repaired with sealant, mastic and flashings tapes, in what appears to be attempts to stop leaks. The polycarbonate domes are etched and crazed. At Roof D was broken and covered with membrane flashing tape.
- Plumbing vent stacks are rust corroded.
- The roof drains are rust corroded.

Structural Review: CBI reviewed existing documents and visited site to review the existing structure Documentation was limited to the 1998 Renovation drawings provided to CBI by the Millis Schools.

The building structure is primarily steel framed with masonry walls, concrete foundations, and concrete 1st and 2nd floor slabs. The roof structure varies framing type, but all roof decking appears to be 3" lightweight gypsum concrete.

Since the availability of the original structural drawings were limited, CBI was only able to analysis the existing where the structure was accessible view the structure where removable. Following our site visit and review of available documentation calculations of representative members were made to determine the reserve capacity of the roof structure. Our analysis was based on the current building code Building 780 CMR - Massachusetts State Building Code 9th Edition, which is based on modified versions of the 2015 International Building Code (IBC) and in consideration of the building code of the time the building(s) were construed. To perform the analysis, we used estimated weights of the roofs and attached finishes. Our analysis

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showed the steel beams supporting the deck and roof decking are adequate for the current code loading, but have limited reserve capacity, if any. For areas where the structure was not visible, CBI has interpolated these conditions as similar construction, thus having similar limited reserve capacity. Refer to Appendix F.

2. Mechanical and Electrical Systems

a. **Refer to Appendix A –** MEPFP Evaluation as prepared by BLW Engineers, Inc.

3. Hazardous Building Materials Inspection

a. Appendix B – Limited Hazardous Materials Inspection Report as prepared by Fuss & O'Neill, Inc.

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Section 5 Assessment and Recommendations

The existing EPDM Roofing Systems are aged and weathered, with indications of failure, particularly the EPDM membrane with the glued adhesive seams that was installed over the gravel surface built-up roofing. This roofing has existed for at least twenty-five (25) years or longer and is well beyond its serviceable life expectancy. The EPDM membrane roofing installed in 1998 has existed more than twenty (20) years and has also reached its life expectancy.

These membrane field and flashing lap seams will continue fail and will require constant maintenance and repair if the roofing systems are left in place. The most critical roofs are Roof Areas A.1, partial D, D.1 and H, as the insulation is buckled, and insulation facers are delaminated. These conditions could lead to catastrophic failure of the roof covering if exposed to heavy sustained. Although CBI recommends full replacement of all roof areas, these roofs should be a priority, if funding is limited.

It should also be considered that he thermal resistance of the existing insulation is well below the current building code minimum R-value of R-30. The thermal effectiveness of the insulation is further reduced as it is damp and wet.

CBI recommends that all roof areas be fully removed down to the existing roof deck and replaced with a new code compliant insulated roofing system, with a total system No-Dollar Limit, 20 year roofing manufacturer warranty. We believe that the warranty length and wind speed coverage of the warranty would be limited due to the existing lightweight gypsum concrete deck.

We further recommend that the insulation be tapered to a minimum ¼" per foot to increase the slope and drainage of all the roofs. The attachment of the new insulation and roofing system to the existing lightweight gypsum concrete deck may be dependent on the selected roof covering, as different manufacturers may have different requirements. We believe that a base layer of 2-inch rigid polyisocyanurate insulation would need to be fastened with lightweight deck fasteners.

There are a number of roofing system options to consider and are as follows:

1. **SBS Modified Bitumen Roofing:** One of the more durable systems would include installing a 3-ply SBS modified bitumen roofing system, cold adhesive applied, over a minimum R-30 rigid polyisocyanurate insulation and cover board assembly. The system may be capped with a granulated sheet or a smooth colored cap for UV protection, along with acrylic coating to lock in the granules.
2. **PVC KEE Single-ply Membrane Roofing:** Another option would include installing a fully adhered .060 (or of greater thickness) PVC KEE reinforced single-ply membrane roofing system over the insulation assembly as previously described. PVC membranes are slightly less durable than an SBS modified roofing system. However, they are easily repairable and have expected service life of 25 years or more. PVC membranes are typically white or grey in color but are also available in a variety of other colors.

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3. **Thermal Plastic Olefin (TPO) Membrane Roofing,** an alternative to PVC would include single-A fourth option would include installing a Thermal Plastic Olefin (TPO) single-ply roofing system over the insulation assembly as previously described. This system is like PVC but has less of a historical track record. However, changes in the industry standards for producing TPO roof membranes in the last 10 years make it a viable option. The advantages of TPO membranes include; hot air welded seam technology and chemical resistance.
4. **EPDM Reinforced Membrane Roofing,** is the ***preferred option*** as it is a dependable product, durable if reinforced and cost effective. This would include installing a fully adhered .060 (or of greater thickness) reinforced EPDM single-ply membrane roofing system over the insulation assembly as previously described. EPDM membrane is also less durable than the SBS systems but is still durable provided it is reinforced EPDM membrane systems are slightly less expensive than PVC membrane roofing systems and have similar serviceable life expectancy as PVC. The seaming technology of EPDM systems have improved since the development of butyl seam tape rather than the less dependable glued seam technology that was previously used. It should be noted that the reinforced EPDM membrane has greater puncture resistance than unreinforced but is a premium in cost. White EPDM membranes are available, but also at a premium cost.

Other recommended work includes:

1. The temporary removal and storage of all Photovoltaic Solar Panels, ballast and equipment in its complete entirety to be performed by others responsible for the system.
2. Remove and fill in all abandoned roof curbs with steel decking.
3. Include unit costs to patch any deteriorated decking.
4. Remove and replace all perimeter wood blocking.
5. All through-wall flashing will need to be raised and should be replaced with zinc coated copper flashings. Considering the amount masonry work involved to raise these flashings, the project would require a File Sub-bid Masonry Contractor to perform the work.
6. Perform brick masonry restoration work on the large boiler chimney by cutting and pointing all joints, and selectively replacing any cracked brickwork.
7. Replace all sealants above each roof level at windows, access doors and louvers with silicone sealant.
8. Replace all skylights with new polycarbonate dome skylights and prefabricated curbs with minimum R-5 insulation
9. Abrade and paint all access doors and frames in the existing brick masonry walls.
10. Abrade and paint all plumbing vent stacks prior to apply roof flashing.
11. Replace all roof drains with hot dipped galvanized roof drains.

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12. Following completion of the work route all roof drains to nearest catch basin.

With respect to considering the installation of a new intensive or extensive green roofing system, it's the analysis and opinion of CBI that due the lack reserve capacity of the structure, the weight of a green roofing system would overstress the structure as it exists and would not be permissible without wholesale and costly changes to roof structure and decking.

This report is based upon observations of the visible and apparent condition of the existing slate roofs and the building. While care has been taken in the performance of this inspection, the observations contained in this report are, by necessity, limited. Subject to your approval, CBI is prepared to conduct further review of the buildings, if needed, and to make additional recommendations in accordance herewith. However, no warranty, guarantee, opinion, recommendation, or representation is expressed or implied in this report with respect to the components of the buildings, and no representation of the buildings or latent or concealed conditions that may exist. Therefore, unless and until a more detailed study of the buildings occurs, the client must and should not rely on this report as an expressed or implied opinion or verification of the integrity of the building or its component parts.

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Section 6 Proposed Scope of Work

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CONTRACT DOCUMENTS

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DIVISION 02 00 00 SUBSURFACE INVESTIGATION & DEMOLITION

02 07 00 - SELECTIVE DEMOLITION
02 90 10 - LANDSCAPE REPAIRS
02 82 13 - HAZARDOUS BUILDING MATERIALS

DIVISION 03 00 00 CONCRETE

03 31 00 - LIGHTWEIGHT GYPSUM CONCRETE DECK REPAIR

DIVISION 04 00 00 MASONRY

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DIVISION 06 00 00 WOOD AND PLASTIC

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07 62 00 - SHEET METAL FLASHING AND TRIM
07 92 00 - JOINT SEALANTS

DIVISION 08 00 00 OPENINGS

08 62 00 – UNIT SKYLIGHTS

DIVISION 09 00 00 FINISHES

09 90 00 – PAINTING AND COATINGS

DIVISION 22 00 00 PLUMBING

22 15 44 - ROOF DRAINS

DIVISION 23 00 00 HEATING, VENTILATING AND AIR CONDITIONING

23 00 00 - HEATING, VENTILATING AND AIR CONDITIONING

DIVISION 26 00 00 ELECTRICAL

26 00 00 - ELECTRICAL

DIVISION 28 00 00 FIRE DETECTION

28 31 00 – FIRE DETECTION AND ALARM

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Section 7 Probable Estimated Costs

DIVISION 01 00 00	GENERAL REQUIREMENTS	$55,000.00
DIVISION 02 00 00	SUBSURFACE INVESTIGATION & DEMOLITION	
	02 07 00 - SELECTIVE DEMOLITION	$275,000.00
	02 90 10 - LANDSCAPE REPAIRS	$50,000.00
DIVISION 03 00 00	CONCRETE	
	03 31 00 - LIGHTWEIGHT GYPSUM CONCRETE DECK REPAIR	$200,000.00
	02 82 13 - HAZARDOUS BUILDING MATERIALS	$164,500.00
DIVISION 04 00 00	MASONRY	
	04 52 00 - MASONRY RESTORATION	$130,000.00
DIVISION 06 00 00	WOOD AND PLASTIC	
	06100 - ROUGH CARPENTRY	$150,000.00
DIVISION 07 00 00	THERMAL AND MOISTURE PROTECTION	
	07 53 23 - REINFORCED EPDM MEMBRANE ROOFING	$1,500,000.00
	07 62 00 - SHEET METAL FLASHING AND TRIM	$250,000.00
	07 92 00 - JOINT SEALANTS	$15,000.00
DIVISION 08 00 00	OPENINGS	
	08 62 00 – UNIT SKYLIGHTS	$50,000.00
DIVISION 09 00 00	FINISHES	
	09 90 00 – PAINTING AND COATINGS	$10,000.00
DIVISION 22 00 00	PLUMBING	
	22 15 44 - ROOF DRAINS	$50,000.00
	Total Roofing Cost	*$2,899,500.00*

MEP OPTION 1

DIVISION 23 00 00	HEATING, VENTILATING AND AIR CONDITIONING	
	23 00 00 - HEATING, VENTILATING AND AIR CONDITIONING	$5,400,000.00
DIVISION 26 00 00	ELECTRICAL	
	26 00 00 - ELECTRICAL	
DIVISION 28 00 00	FIRE DETECTION	
	28 31 00 – FIRE DETECTION AND ALARM	$204,000.00
	Total Option 1 MEP Cost	*$5,604,000.00*

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MEP OPTION 2 - ADD

DIVISION 23 00 00	HEATING, VENTILATING AND AIR CONDITIONING	
23 00 00 - HEATING, VENTILATING AND AIR CONDITIONING		$9,100,000.00
DIVISION 26 00 00	ELECTRICAL	
26 00 00 - ELECTRICAL		$200,000.00
DIVISION 28 00 00	FIRE DETECTION	
	Total Option 2 MEP Add Cost	*$9,300,000.00*

TOTAL CONSTRUCTION SUMMARY

Total Construction Cost	
Roofing	$2,899,500
With MEP Option 1	$5,400,000
Total	**$8,299,500**

Total Construction Cost with Option 2	
Roofing	$2,899,500
With MEP Option 2	$9,300,000
Total	**$ 12,199,500**

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Section 8 Proposed Schedule of Work

Phase	Date
Receipt of Signed Contract/Release to Start Project	09/01/2020
Start Schematic Design and Bid/Construction Documents	09/08/2020
Schematic Design Document	10/08/2020
60% Design Document	11/23/2020
100% Bid/Construction	01/08/2021
Bid Documents Out-To-Bid	01/27/2021
Pre-Bid Meeting	02/03/2021
File-Sub Bids Due	02/17/2021
General Bids Due	02/24/2021
Contract Award	03/10/2021
Preconstruction Meeting	03/17/2021
Submittal Review Complete	05/05/2021
Mobilize / Start Construction	06/01/2021
Punch List / Construction Complete	08/27/2021
Close-out Documents Issued / Project Complete	09/27/2021

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Section 9 Appendices

Appendix A - Mechanical Engineering Report

Appendix B – Hazardous Building Material Testing Report

Appendix C – Photographs of Existing Conditions

Appendix D – Photographs of Roofing Test Cuts

Appendix E – Roof Plan of Roofing Test Cut Locations

Appendix F – Plan of Existing Structural Review and Reserve Capacity

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Appendix A – Mechanical and Electrical Engineering Report

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BLW ENGINEERS

Millis Middle/High School
245 Plain Street
Millis, MA

MEPFP Evaluation

Prepared For:

Arno Skalski, LEED AP, Associate A.I.A
CBI Consulting, LLC
250 Dorchester Ave.
Boston, Massachusetts 02127

June 12, 2020

FIRE PROTECTION

Fire Protection Existing Conditions

There is currently a sprinkler system and sprinkler coverage throughout the building. The sprinkler system appears to have been installed in 1996 and more than 20 years old. The sprinkler enters the water room via 4" services and is provided with a double check valve and (2) 4" wet alarm check valves to separate the building into (2) zones. Piping was predominately black steel with IPS threaded type fittings. Piping appeared in fair condition. Sprinkler heads where a combination of concealed pendant, pendant and upright type fittings.

Alarm Check Valves

Fire Protection Gong and Hose Connection

Fire Protection Recommendations

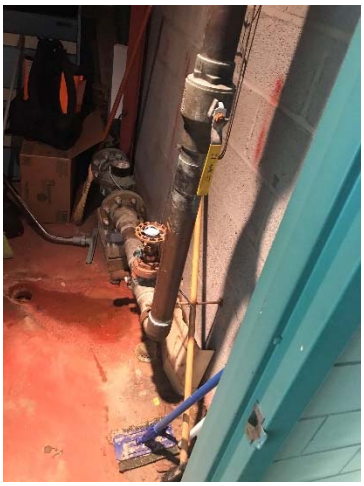
Existing Fire Protection system appears in fair condition, BLW would recommend type routine maintenance and flushing in accordance with NFPA-13 standards.

End of Fire Protection Section

PLUMBING

Plumbing Existing Conditions

The building water service and water meter appears to be 4”. Domestic hot water is generated through an indirect hot water heater. Hot water is supplied to the indirect heating coil from the building hot water heating system. Supplemental domestic hot water is also provided through a gas fired domestic hot water heater. This heater appears to operate during the summer months when the building hot water heating system is non-operational.



Water Entrance and Water Meter

Indirect Hot Water Heater and Storage

Supplemental Domestic Hot Water Heater

Plumbing fixtures throughout the building were various types and states of condition. Waste piping throughout the building is both gravity and pumped. The pumped waste is through a duplex waste pump system located in the boiler room. It was noted that soap dispensers at janitor's sinks did not appear to be equipped with backflow prevention.

Lab waste pipe appears to be acid waste type with compression gaskets. The lab waste extends to an acid neutralizing tank and then extend to normal waste. Domestic hot water was protected to the laboratory supply via backflow preventers. It was noted emergency showers were provided in the science classroom.

Duplex Waste Pump

Typical Fixtures

Typical Fixtures

Lab Sink

Natural gas is utilized within the school for hot water heating, kitchen cooking appliances and science labs. The gas piping was steel pipe with threaded fittings. It was noted that the gas line under the hood did not appear to have the latest CO interlock safety devices.

Natural Gas Meters

Natural Gas Pipe to Kitchen Appliances

Kitchen grease interceptor is located within the kitchen below the kitchen pot sink.

Grease Interceptor

Kitchen Pot Sink

Plumbing Recommendations

The existing domestic hot water heating system shall be replaced. The large hot water storage tank shall be removed. The new existing gas fired domestic hot water heater shall be reused. Additional gas fired hot water heaters shall be provided as required. The new heaters shall be piped to a new hot water mixing valve and piping extended to the existing piping system.

The existing plumbing fixtures shall be replaced with low flow/water conservation type fixtures. Point of use mixing valves shall be provided for all hand washing and lavatory sinks.

The duplex pump systems shall be replaced in-kind. New controls shall also be provided as required to verify operation and provide alarms.

Gas piping shall be disconnected and reconnected as needed for equipment replacement. BLW would recommend a CO interlock safety valve be provided at the kitchen cookline.

Backflow preventers are recommended to be installed at all hard piped soap dispensers

Acid neutralizing tanks shall be replaced in-kind.

End of Plumbing Section

MECHANICAL

Mechanical Existing Conditions

The building is heater with (3) hot water boilers (Smith model # MB99032) with a heating capacity of 5,856 MBH each. The boilers operating efficiency is approximately 80%. The boiler burners are dual fuel type and can operate with natural gas and fuel oil. Fuel oil is provided from an exterior fuel oil tank, fuel oil pumps and fuel oi piping. The boilers and fuel oil systems appears to have been installed in 1996 and more than 20 years old.

Typical Hot Water Boiler

Fuel Oil Pump

Hot water is circulated throughout the building with a hot water supply and return piping distribution system and hot water system specialties including air separator and expansion tanks. Water is pumped through the piping systems with (3) base mounted pumps each rated for 420 GPM @ 90 feet of head pressure. The pumps, water specialties and piping appear to have been installed in 1996 and more than 20 years old.

Typical Hot Water Pumps

Expansion Tank

Classrooms are heated and ventilated with wall mounted unit ventilators with hot water heating coils. Exhaust is provided in each classroom through a wall mounted exhaust fan. Ventilation air and exhaust air is provided through a side wall louver and a ducted wall sleeve extends from the exterior wall to each until ventilator or exhaust fan. The unit ventilators and exhaust fans appear to have been installed in 1996 and more than 20 years old.

Typical Unit Ventilator

Typical Wall Louvers – Fresh Air and Exhaust Air

Common space and office areas are heated with finned tube radiation and cover. Each piece of finned tube is controller with a pneumatic hot water control valve and space thermostat. Ventilation air is provided through a roof mounted ventilation air unit with gas fired furnace. Ventilation ais is distributed throughout the common areas and office areas with a supply air duct systems and air outlets. The finned tube radiation and ventilation systems appear to have been installed in 1996 and more than 20 years old.

Typical Finned Tube Radiation

Typical Ventilation Roof Top Unit

Bathroom and locker room exhaust is through roof mounted exhaust fans. Exhaust ductwork extends from the roof fan and extends to each bathroom and locker rooms and terminates with an exhaust register. Kitchen hood exhaust is through a roof mounted up-blast exhaust fan. Grease exhaust ductwork extends from the fan and extends down to hood.

Typical Exhaust Fan

Kitchen Exhaust

The building controls are pneumatic with the air compressor located within the mechanical room. Pneumatic tubing extends from the mechanical room to controllers throughout the building.

Air Compressor

Typical Wall Thermostat

Mechanical Recommendations

Hot water boiler, pumps, water specialties, controls, unit ventilators, cabinet unit heaters, roof top units, air handling units and exhaust fans are more than 20 years old and at the end of their useful life expectancy and should be replaced.

Below are recommended system options:

- Option #1

  The existing Hot water boiler, pumps, water specialties, controls, unit ventilators, exhaust blowers, cabinet unit heaters, roof top units, air handling units and exhaust fans shall be removed.

The new hot water boilers shall be natural gas high efficiency type. The new pumps shall be variable flow type and shall be provided with variable frequency drives. The boiler pumps and building pumps shall be piped for primary and secondary piping systems. The building hot water piping shall remain and be reused.

The unit ventilators and exhaust blower cabinets shall be replaced in-kind. The outdoor air louvers shall be replaced.

Roof top units shall be replaced in-kind. Airflow and ventilation rates shall be verified to meet code requirements. The existing ductwork would remain and be cleaned.

Exhaust fans shall be replaced in-kind. Airflow and exhaust rates shall be verified to meet code requirements. The existing ductwork would remain and be cleaned.

Controls shall be new. A new building management system shall be provided to allow for HVAC system management. All equipment controls shall be DDC and shall interface and communicate with new building management system.

If cooling throughout the building is required, a new chill water system shall be provided which would include air cooled chiller, chill water pump, building chill water pumps, and water specialties. Chill water pipe shall extend from the chiller and pumps throughout the building to chill water coils in all air handling units and terminal devices (unit ventilators and fan coils).

- Option #2

The existing hot water boiler, pumps, water specialties, controls, unit ventilators, cabinet unit heaters, roof top units, air handling units and exhaust fans shall be removed.

Heating, cooling and ventilation would be provided through packaged roof top units with electrical cooling and natural gas heating. Supply and return air ductwork shall extend throughout the building and terminate with air outlets. Large spaces typical of gymnasium, auditorium, cafeteria, etc. shall be constant volume type roof top units. Smaller spaces typical of offices and classrooms shall be provided with variable flow roof top units and shall be provided with variable air volume (VAV) boxes with hot water reheat coils to provide zone control.

Hot water shall be provided through new hot water boilers that shall be natural gas high efficiency type. The new pumps shall be variable flow type and shall be provided with variable frequency drives. The boiler pumps and building pumps shall be piped for primary and secondary piping systems. Where possible, the building hot water piping shall remain and be reused. Hot water piping shall extend to each hot water coil.

Exhaust fans shall be replaced in-kind. Airflow and exhaust rates shall be verified to meet code requirements. The existing ductwork would remain and be cleaned.

Controls shall be new. A new building management system shall be provided to allow for HVAC system management. All equipment controls shall be DDC and shall interface and communicate with new building management system.

End of Mechanical Section

ELECTRICAL

Electrical Service Existing Conditions

The building's service originates from a below-grade Eversource transformer. The service size is 1600 amps at 120/208 volt 3-phase 4-wire. The secondary service conductors terminate in the switchboard that is located in the building's main electric room at the basement level.

The switchgear was manufactured by Federal Pacific Electric. The gear consists of a 1600 amp, 208 volt 3-pole main circuit breaker and a distribution section. The distribution section contains 3-pole breakers which provide overcurrent protection and feed various panels throughout the school. The main switchgear appears to be from the original building construction.

The electrical room that houses the switchboard, although meeting the National Electrical Code at time of installation, does not currently meet the spacing requirements and proper door exits, required by the latest edition of the National Electrical Code (Art.110.26).

The manufacturer of the gear, Federal Pacific Electric, has not been in business for over 30 years. Spare or replacement parts for F.P.E. gear is virtually non-existent or very expensive to purchase.

Past utility records (from the previous 12 months) indicate that the largest demand on the electric service is 140.4 KVA, which equates to 390 amps at 120/208 volt 3-phase. Therefore, theoretically there is a spare amount of 890 amps on the existing electric service that could be utilized for the proposed added HVAC equipment (details in other section of this report). (1600 amps X 80% Rated Breaker -390 AMPS = 890 amps). If Option #2 is to be considered, that would add an approximate 1,263 amps of mechanical load. The existing electrical service would not be able to support that added load.


FPE
FEDERAL
PACIFIC


WARNING

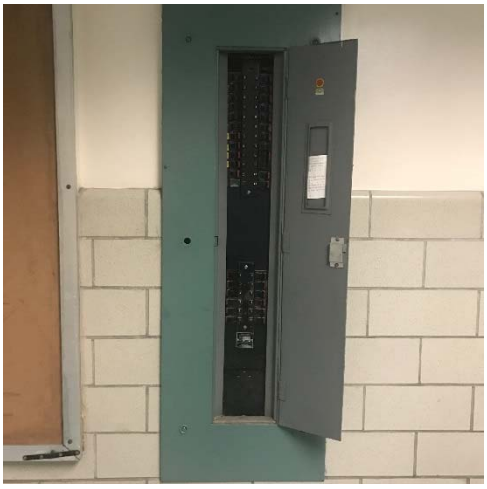
Existing Electrical Distribution

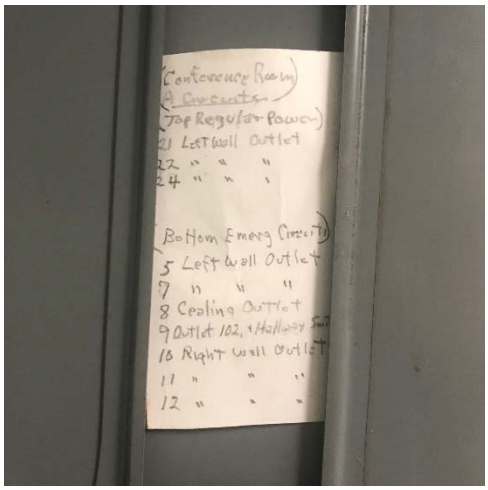
There are local panelboards distributed around the building which feed lighting, receptacles and HVAC loads. The majority of the panels are also from the original construction. Below, is a list of panels, by location, general condition and approximate age:

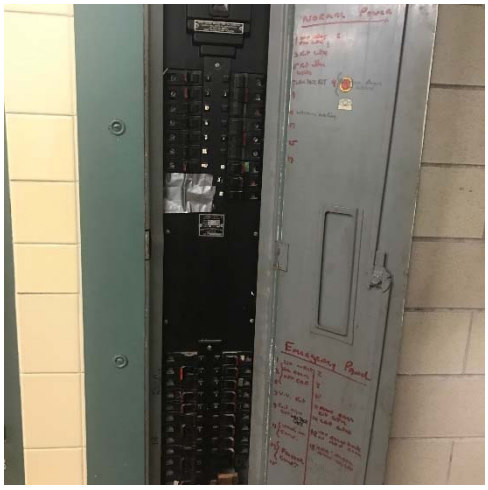
Location	Manufacturer	General Condition	Approximate Age
Band 101	F.P.E.	Beyond expected life	+ 50 years
Chorus 105	F.P.E.	Beyond expected life	+ 50 years
Stage Left	Square D	New, good condition	15 years
Off Stage/Closet	F.P.E.	Beyond expected life	+ 50 years
1st Floor Corridor	F.P.E.	Beyond expected life	+ 50 years
Kitchen	F.P.E.	Beyond expected life	+ 50 years
2nd Floor Corridor	F.P.E.	Beyond expected life	+ 50 years
Janitor Closets	F.P.E.	Beyond expected life	+ 50 years

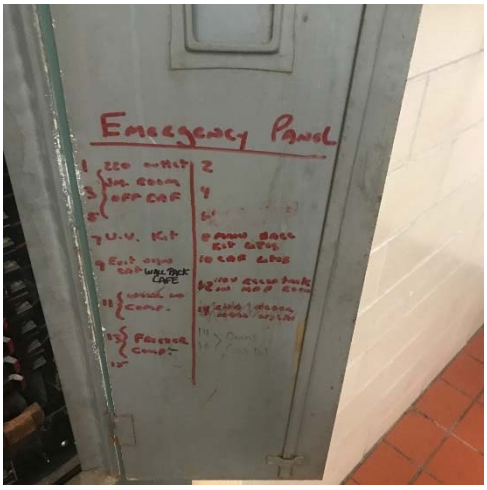
The janitor panels are within 6' of the existing slop/ janitor sink. The installation would not meet the latest NEC for clearances around sinks.

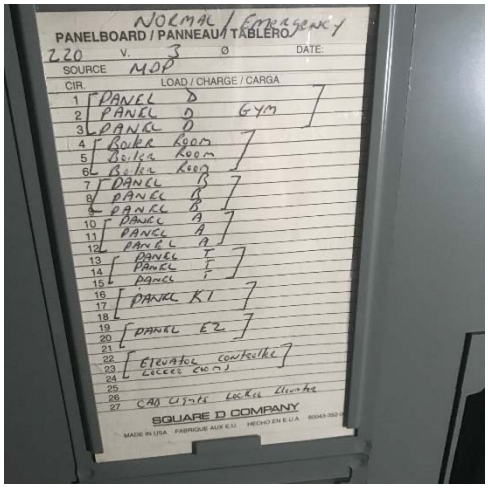
The corridor panels contain split busses. They are fed from both a normal circuit and also from an emergency circuit. The top one half of the circuit breakers feed normal power loads. The bottom half feed emergency lighting and exit signs. This type of panel is no longer allowable by the latest version of the NEC.




Conference Room
Top Regular Power
21 Left Wall Outlet
22 " " "
24 " " "
Bottom Emerg Circuit
5 Left Wall Outlet
7 " " "
8 Ceiling Outlet
9 Outlet 102, + Hallway
10 Right Wall Outlet
11 " " "
12 " " "


Normal Power
Emergency Panel


Emergency Panel
U.V. Kit



Existing Fire Alarm

The building has an existing fire alarm system that consists of a conventional zoned voice evacuation Catalog No. 4002, control panel. The building's notification appliances consist of speaker/strobe devices throughout the building. The system appears to be in excess of 25 years old, and therefore has reached or exceeded its expected life span. If the proposed HVAC systems included rooftop units that require duct-smoke detectors, the existing fire alarm system would not be able to support the new devices.

Electrical Recommendations

Electrical Service

For Option #1 of the HVAC section, the majority of the mechanical equipment would be called for to be replaced in kind. If this Option was pursued, the existing service size would be adequate to handle the loads. Panelboards that are beyond their life expectancy, that are feeding mechanical equipment, should be replaced at the time of the HVAC replacement.

In order to provide the necessary power required for the proposed HVAC systems described as Option #2, the electrical service would need to be increased from a 1600 amp 120/208 volt service to an approximate 2,000 amp 120/208 volt service. This report also recommends installing the new service switchgear in a new electrical room that has all the proper required work clearances. The new switchgear would consist of a 2,000 amp main breaker/current transformer cabinet and a distribution section with circuit breakers to re-feed existing panelboards and new panelboards.

New feeders and panelboards would be provided to power all the new HVAC equipment.

The fire alarm control panel should be replaced with a new addressable voice evacuation system. All existing notification circuits (speaker/strobes) would be reconnected to the proposed FACP; the activation circuits (pull stations, smoke and heat detectors, sprinkler devices) would be reconnected to the new FACP via addressable modules. This would allow the town to replace those aged devices at a later time. The new duct-smoke detectors required for the proposed HVAC equipment, would be connected to the new FACP.

End of Electrical Section

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Appendix B – Hazardous Buildings Materials Report

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Limited Hazardous Building Materials Inspection Report

Millis Middle & High School Roof & HVAC Project
245 Plain Street
Millis, Massachusetts

CBI Consulting, LLC
Boston, Massachusetts

July 2020

Fuss & O'Neill, Inc.
108 Myrtle Street, Suite 502
Quincy, MA 02171

Project No. 20200048.A10

FUSS & O'NEILL

July 29, 2020

Mr. Arno Skalski, LEED AP, Associate AIA
Principal
CBI Consulting, LLC
250 Dorchester Avenue
Boston, MA 02127

RE: Limited Hazardous Building Materials Inspection Report
Millis Middle & High School Roof & HVAC Project
245 Plain Street, Millis, Massachusetts
Fuss & O'Neill Project No. 20200048.A10

Dear Mr. Skalski:

Enclosed is the Limited Hazardous Building Materials Inspection Report prepared for the Millis Middle & High School Roof & HVAC Project.

On June 2 and 3, 2020, a Fuss & O'Neill, Inc. state-certified Asbestos Inspector performed a limited asbestos inspection, a lead-based paint screening, a presumed polychlorinated biphenyl (PCB)-containing source building materials inventory, and a fluorescent light ballast and mercury-containing equipment inventory prior to proposed renovation acitivities.

The information summarized in this report is solely for the abovementioned materials only. The work was performed in accordance with our written scope of services dated March 30, 2020.

If you should have any questions regarding the contents of the enclosed report, please do not hesitate to contact me at 617-282-4675, extension 4703. Thank you for this opportunity to have served your environmental needs.

Sincerely,

Dustin A. Diedricksen
Associate/Department Manager

DD/rs

Enclosure

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Table of Contents

Limited Hazardous Building Materials Inspection Report Millis Middle & High School Roof & HVAC Project CBI Consulting, LLC

1 Introduction

On June 2 and 3, 2020, Fuss & O'Neill, Inc. (Fuss & O'Neill) representative, Mr. Robert Mallett, performed a limited hazardous building materials inspection prior to proposed renovation activities to occur at the Millis Middle & High School located at 245 Plain Street in Millis, Massachusetts (the "Site").

1.1 Scope of Work

The work was performed for CBI Consulting, LLC (the "Client") in accordance with our written scope of services dated March 30, 2020. This report is subject to the limitations presented in *Appendix A*. The scope of work included the following:

- Limited Asbestos-Containing Materials (ACM) Inspection;
- Lead-Based Paint (LBP) Screening;
- Polychlorinated Biphenyl (PCB)-Source Building Materials Inventory (visual only); and
- Fluorescent Light Ballast and Mercury-Containing Equipment Inventory.

The Client contracted with a professional roofing contractor to perform roof test cuts at the Site.

Fuss & O'Neill did not conduct subsurface investigations to identify concealed suspect materials throughout the subject property.

We excluded collection and analysis of suspect materials for polychlorinated biphenyls (PCBs) during this inspection. Sampling for PCBs is presently not mandated by the United States Environmental Protection Agency (EPA); however, significant liability risk for disposing of PCB-containing wastes exists. Recent knowledge of PCBs within these matrices has become more prevalent, especially with remediation contractors, waste haulers, and disposal facilities. Many property owners have become subject to large changes in schedule, scope, and costs as a result of failure to identify PCBs prior to renovation or demolition activities. For the purpose of this inspection, potential PCB-containing source building materials (as recommended by the EPA) have been presumed to contain regulated concentrations of PCBs.

2 Limited Asbestos Inspection

A property owner or operator must ensure that a thorough asbestos inspection is performed prior to possible disturbance of suspect ACM during renovation or demolition activities. This is a requirement of the United States Environmental Protection Agency (EPA) National Emission Standards for Hazardous Air Pollutants (NESHAP) regulation located at Title 40 CFR, Part 61, Subpart M.

On June 2 and 3, 2020, Mr. Mallett of Fuss & O'Neill conducted the limited inspection of visible and accessible areas. Mr. Mallett is a Commonwealth of Massachusetts Department of Labor Standards (MADLS)-certified Asbestos Inspector. Refer to *Appendix B* for copies of the Asbestos Inspector's state certification and EPA accreditation.

2.1 Methodology

The inspection was conducted by visually inspecting for suspect ACM and touching each of the suspect ACM. The suspect ACM were grouped into three EPA NESHAP categories: Friable; Category I Non-Friable, and Category II Non-Friable.

- Friable is defined as material that contains greater than one percent (> 1%) asbestos that, when dry, **can** be crumbled, pulverized, or reduced to powder by hand pressure.
- Category I Non-Friable refers to material that contains > 1% asbestos (i.e., packings, gaskets, resilient floor coverings, and asphalt roofing products) that when dry **cannot** be crumbled, pulverized, or reduced to powder by hand pressure.
- Category II Non-Friable refers to any non-friable material excluding Category I materials that contain > 1% asbestos that when dry **cannot** be crumbled, pulverized, or reduced to powder by hand pressure.

The suspect ACM were also categorized into their applications including: Thermal System Insulation (TSI), Surfacing ACM, and Miscellaneous ACM. TSI includes those materials used to prevent heat loss/gain or water condensation on mechanical systems. Examples of TSI include, but are not limited to, pipe insulation, boiler insulation, duct insulation, mudded pipe-fitting insulation, etc. Surfacing ACM includes those ACM that are sprayed-on, troweled-on, or otherwise applied to an existing surface. Surfacing ACM is commonly used for fireproofing, decorative, and acoustical applications. Miscellaneous ACM include those not listed as TSI or Surfacing ACM, such as sheet flooring, floor tiles, ceiling tiles, caulking, mastics, construction adhesives, etc.

The EPA recommends collecting suspect ACM samples in a manner sufficient to determine asbestos content, and separating suspect ACM into homogenous material types (similar in color, texture, and date of application). The EPA NESHAP regulation does not specifically identify a minimum number of samples to be collected for each homogeneous material, but the NESHAP regulation does recommend the use of sampling protocols included in EPA Title 40 CFR, Part 763, Subpart E: Asbestos Hazard Emergency Response Act (AHERA).

The EPA AHERA regulation requires a specific number of samples be collected based on the material type and quantity present. This regulation includes the following protocol:

1. Surfacing Materials (e.g., plaster, spray-applied fireproofing, etc.) shall be collected in a randomly-distributed manner representing each homogenous area based on the overall quantity as follows:

    a. At least three (3) bulk samples collected from each homogenous area that is less than or equal to 1,000 square feet.
    b. At least five (5) bulk samples collected from each homogenous area that is greater than 1,000 square feet but less than or equal to 5,000 square feet.
    c. At least seven (7) bulk samples collected from each homogenous area that is greater than 5,000 square feet.

2. Thermal System Insulation (e.g., pipe insulation, tank insulation, etc.) shall be collected in a randomly distributed manner representing each homogenous area. At least three (3) bulk samples shall be collected of each homogenous material type. Also, at least one (1) bulk sample of any patching material applied to TSI, presuming the patched area is less than six linear or square feet, shall be collected.

3. Miscellaneous Materials (e.g., floor tile, mastic, cement board, caulking, glazing, etc.) should have at least two (2) bulk samples collected of each homogenous material type. Sample collection shall be conducted in a manner sufficient to determine the asbestos content of the homogenous material type as determined by the inspector.

Suspect ACM samples were collected, and proper chain-of-custody forms were prepared for transmission of collected samples to EMSL Analytical, Inc. (EMSL), for analysis. EMSL is a Commonwealth of Massachusetts-licensed and American Industrial Hygiene Association (AIHA)-accredited Asbestos Analytical Laboratory. Initial asbestos sample analysis was conducted using the EPA Interim Method for the Determination of Asbestos in Bulk Building Materials (EPA/600/R-93/116) via Polarized Light Microscopy with Dispersion Staining (PLM/DS).

The EPA recommends that non-friable, organically-bound (NOB) materials (e.g., asphaltic-based materials, adhesives, caulking, etc.) undergo further confirmatory analysis utilizing Transmission Electron Microscopy (TEM). Three (3) of the collected NOB samples were analyzed by TEM.

2.2 Results

The EPA, the Occupational Safety and Health Administration (OSHA), and the MADLS define a material that contains > 1% asbestos (by PLM/DS analysis) as an ACM. The Massachusetts Department of Environmental Protection (MassDEP) further defines ACM as materials containing greater than or equal to (≥) 1% asbestos. MassDEP also defines an asbestos-containing waste material (ACWM) as:

- ACM removed during renovation or demolition activities;
- Materials contaminated by an ACM during renovation or demolition activities; or
- ACM on and/or in facility components that are inoperable or have been taken out of service.

The MassDEP further defines waste material containing any amount of asbestos as an ACWM, which must be managed and disposed of as such. Materials that are identified as "none detected" are specified as not containing asbestos.

Refer to **Table 1**, attached, for the complete list of ACM and non-ACM identified by sample identification, material type, sample location, and asbestos content as part of this inspection. Refer to **Table 2**, attached hereto, for the identified ACM inventory.

Refer to *Appendix C* for the asbestos laboratory analytical reports and chain-of-custody form.

2.3 Conclusions & Recommendations

Based on visual observations, sample collection, and laboratory analysis, ACM were identified at the Site.

Prior to disturbance, ACM/ACWM that would likely be impacted by the proposed renovation activities must first be abated by a MADLS-licensed Asbestos Contractor. This is a requirement of MADLS, MassDEP, and EPA NESHAP regulations governing asbestos abatement.

Due to the inability to effectively separate some types of multi-layered ACM from non-ACM, these materials are considered asbestos-contaminated and must be managed as ACWM for removal and disposal purposes.

If suspect materials are encountered during renovation activities that are not identified in this report as being non-ACM, they shall be assumed to be ACM until laboratory analysis indicates otherwise.

If ACM are to remain at the Site following renovation/demolition activities, Fuss & O'Neill recommends the development of a written Operations and Maintenance Program (to manage ACM in place) in accordance with OSHA regulations.

3 Lead-Based Paint Screening

Fuss & O'Neill used an X-ray fluorescence (XRF) spectrum analyzer to perform the LBP screening. The screening was conducted in accordance with generally accepted industry standards for non-residential (i.e., not child-occupied) buildings.

3.1 Methodology

A Radiation Monitoring Device Model LPA-1 (Serial Number 1395) was utilized for the LBP screening. The instrument was calibrated according to the manufacturer's Performance Characteristic Sheet (PCS) prior to each use.

For the purpose of this LBP screening, representative, coated building components were tested for LBP. Individual repainting efforts are not always discernable in such a limited program. LBP issues involving properties that are not residential are only regulated to a limited degree for worker protection relating to LBP-disturbing work activities and waste disposal.

Worker protection is regulated by OSHA regulations, as well as MADLS regulations. These regulations include air monitoring of workers to determine exposure levels when disturbing lead-containing paint. A LBP screening cannot determine a safe level of lead, but is intended to provide guidance for implementing industry standards for lead in paint at identified locations. Contractors may better determine worker exposure to airborne lead by understanding the different concentrations of LBP on representative components and surfaces. Air monitoring can then be performed during activities that disturb paint on representative surfaces.

The EPA Resource Conservation and Recovery Act (RCRA) and MassDEP regulate lead-containing waste disposal. If lead is determined to be present, representative composite samples of the anticipated waste stream must be collected and analyzed using the Toxicity Characteristic Leaching Procedure (TCLP). The results are compared to a threshold value of 5.0 milligrams per liter (mg/L). If TCLP sample analytical results exceed this value, the waste is characterized as hazardous lead waste. If the result is below the threshold value, the waste material is not considered hazardous and may be disposed as construction and demolition debris.

A level of paint exceeding 1.0 milligram of lead per square centimeter (mg/cm^2) of surface area is considered toxic or dangerous by EPA and the Massachusetts Department of Public Health (MADPH) child-occupied residential standards. For the purpose of this screening, the level of 1.0 mg/cm^2 has been utilized as a guide to segregate coated building materials from general demolition debris for disposal purposes.

3.2 XRF Screening Results

The LBP screening indicated consistent painting trends associated with representative building components that may be impacted by potential renovation activities. No building components tested were determined to contain levels of lead ≥ 1.0 mg/cm^2.

Refer to *Appendix D* for a copy of the XRF Lead-Based Paint Screening Field Data Sheet.

3.3 Discussion

OSHA published a Lead in Construction Standard (OSHA Lead Standard) Title 29 CFR, Part 1926.62 in May of 1993. This Standard sets no limit for the content of lead in paint below which the OSHA standards do not apply. The OSHA Lead Standards are task-based and are also based on airborne exposures and blood lead levels.

The results of this LBP screening are intended to provide guidance to contractors for occupational lead exposure controls. Building components coated with lead levels above industry standards may cause exposures to lead above OSHA standards during proposed demolition/renovation activities. The results of this screening are also intended to provide insight into waste disposal requirements, in accordance with EPA RCRA regulations. At the Client's request, a TCLP sample to characterize the expected waste that may result from possible selective demolition/renovation activities was not collected as part of this inspection.

3.4 Conclusions & Recommendations

Based on our LBP screening results, LBP was not identified on coated building components located at the Site.

Contractors must be made aware that OSHA has not established a level of lead in a material below which OSHA Title 29 CFR, Part 1926.62 does not apply. Contractors shall comply with exposure assessment criteria, interim worker protection, and other requirements of the regulation as necessary to protect workers during any renovation and/or demolition activities that will impact LBP.

If disturbed by renovation activities, LBP-coated building components should be segregated from the general demolition waste stream for sample collection and analysis by TCLP to determine proper off-site waste disposal. If disturbed and managed off-site, non-porous LBP-coated building materials (i.e., metals) may be segregated and recycled as scrap metal. Metal LBP-coated building components cannot be subject to grinding, sawing, drilling, sanding, or torch cutting.

The building is presently characterized as a "non-child-occupied facility", which is not subject to the MADPH Childhood Lead Poisoning Prevention Program (CLPPP) Regulation 105 CMR 460.000. The Site may be renovated using procedures required in accordance with OSHA Title 29 CFR, Part 1926.62 and MADLS Regulation 454 CMR 22.11. In addition, the building is not considered a "child-occupied facility" and therefore, it is not subject to lead safe renovation requirements.

Note that the information contained in this report concerning the presence or absence of lead in paint, does not constitute a comprehensive lead inspection in accordance with MADPH CLPPP regulations. The screened painted surfaces represent only a portion of those surfaces that would be screened to determine whether the premises are in compliance with the aforementioned regulations, which are specific to a child-occupied residence only, and not applicable to buildings of this type and current use.

4 Presumed Polychlorinated Biphenyl (PCB)-Containing Source Building Materials

4.1 Background

Sample collection and analysis of building materials for PCBs is presently not mandated by the EPA. However, significant liability risk exists for improperly disposing of PCB-containing waste materials. Recent knowledge and awareness of PCBs within matrices such as caulking, glazing compounds, paints, adhesives and ceiling tiles has become more prevalent, especially among remediation contractors, waste haulers, and disposal facilities. The EPA recommends sample collection and analysis of caulking and glazing compounds installed between 1950 and 1980 to determine PCB concentration.

The EPA requirements apply and require removal of PCBs once identified, regardless of project intent as an unauthorized use of PCBs. Once it is determined that PCBs are present and a building is to remain for re-use, the EPA still requires PCB-containing material removal. If PCBs are present at certain concentrations, additional sampling and analysis of adjacent surfaces in contact with PCB sources, or which may have been contaminated from a source of PCBs (e.g., masonry, soil), must also be performed or remediated.

EPA requirements apply only if PCBs are present in concentrations above a specified level. Presently, PCB-containing materials at concentrations equal to or greater than (≥) 50 part per million (ppm), or equivalent units of milligrams per kilogram (mg/kg), are regulated. Note materials containing ≥ 1, ppm but less than (<) 50 ppm may also be regulated unless proven to be an "Excluded PCB Product". The definition of an Excluded PCB Product includes those products, or source of the products, containing < 50 ppm concentration PCBs that were legally manufactured, processed, distributed in commerce, or used before October 1, 1984.

4.2 Results

Utilizing the EPA guidelines, no suspect PCB-containing source building materials were observed during this limited inspection.

4.3 Conclusions & Recommendations

The window systems were reportedly replaced at some point during the 1990s. This is after the EPA recommended sampling cutoff date of 1980. Therefore, no suspect PCB-containing source building materials will be impacted by the proposed roof replacement project.

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5 Fluorescent Light Ballasts & Mercury-Containing Equipment

5.1 Fluorescent Light Ballasts

Fluorescent light ballasts manufactured prior to 1979 may contain capacitors that contain PCBs. Light ballasts installed as late as 1985 may contain PCB capacitors. Fluorescent light ballasts that are not labeled as "No PCBs" must be assumed to contain PCBs unless proven otherwise by quantitative analysis. Capacitors in fluorescent light ballasts labeled as non-PCB-containing may contain diethylhexyl phthalate (DEHP). DEHP was the primary substitute to replace PCBs for small capacitors in fluorescent lighting ballasts in use until 1991. DEHP is a toxic substance, a suspected carcinogen, and is listed under RCRA and the Superfund Law as a hazardous waste. Therefore, Superfund liability exists for landfilling both PCB- and DEHP-containing light ballasts. These listed materials are considered hazardous waste under RCRA and require special handling and disposal considerations.

5.2 Mercury-Containing Equipment

Fluorescent lamps/tubes are presumed to contain mercury vapor, which is a hazardous substance to both human health and the environment. Thermostatic controls and electrical switch gear may contain a vial or bulb of liquid mercury associated with the control. Mercury-containing equipment is regulated for proper disposal by EPA RCRA regulations.

5.3 Results

The inspection involved visually inspecting labels on representative light ballasts to identify manufacture dates and labels indicating "No PCBs". Ballasts manufactured after 1991 were not listed as PCB- or DEHP-containing ballasts and were not quantified for disposal. An in-place inventory of the fluorescent lamps/tubes and other mercury-containing equipment was completed concurrently.

During this limited inspection, no DEHP-containing fluorescent light ballasts or mercury-containing light tubes were identified.

5.4 Conclusions & Recommendations

PCB and DEHP-containing fluorescent light ballasts and mercury-containing equipment were not identified during this limited inspection.

This report is not intended to be utilized as a bidding or a project specification document. This report is designed to aid the Client in locating hazardous building materials.

Report prepared by Environmental Analyst, Madelyn Sampson.

Reviewed by:

Dustin A. Diedricksen
Associate/Department Manager

Tables

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Table 1
Suspect Asbestos-Containing Materials Laboratory Analytical Data Summary

Millis Middle & High School
Millis, Massachusetts

CBI Consulting, LLC
July 2020
Fuss & O'Neill Reference No. 20200048.A10

Sample Number	Material Type	NESHAP Category	Sample Location	Result	Comments
01A-RCM-0603	Gray Duct-Seam Sealant	Non-ACM	Southeast Roof	ND	
01B-RCM-0603	Gray Duct-Seam Sealant	Non-ACM	Southeast Roof	ND	
02A-RCM-0603	Black Lap-Seam Sealant	Non-ACM	Southeast Roof	ND	TEM
02B-RCM-0603	Black Lap-Seam Sealant	Non-ACM	Southeast Roof	ND	
03A-RCM-0603	Black Built-Up Roofing - Asphalt	Non-ACM	Southeast Roof	ND	TEM
03B-RCM-0603	Black Built-Up Roofing - Asphalt	Non-ACM	Southeast Roof	ND	
03C-RCM-0603	Black Built-Up Roofing - Asphalt	Non-ACM	Southeast Roof	ND	
04A-RCM-0603	Black Built-Up Roofing - Felt	Non-ACM	Southeast Roof	ND	
04B-RCM-0603	Black Built-Up Roofing - Felt	Non-ACM	Southeast Roof	ND	
04C-RCM-0603	Black Built-Up Roofing - Felt	Non-ACM	Southeast Roof	ND	
05A-RCM-0603	Black Felt Layer on Deck	Non-ACM	Southeast Roof	ND	
05B-RCM-0603	Black Felt Layer on Deck	Non-ACM	Southeast Roof	ND	
06A-RCM-0603	Gray Gypsum Roof Deck	Non-ACM	Southeast Roof	ND	
06B-RCM-0603	Gray Gypsum Roof Deck	Non-ACM	Southeast Roof	ND	
07A-RCM-0603	Black Curbing at Fan Curbing	Non-ACM	Southeast Roof	ND	
07B-RCM-0603	Black Curbing at Fan Curbing	Non-ACM	Southeast Roof	ND	
08A-RCM-0603	Black Built-Up Roofing - Asphalt	Non-ACM	Beneath Copper Flashing at Vent Penetration	ND	
08B-RCM-0603	Black Built-Up Roofing - Asphalt	Non-ACM	Beneath Copper Flashing at Vent Penetration	ND	
09A-RCM-0603	Black Built-Up Roofing - Felt	Non-ACM	Beneath Copper Flashing at Vent Penetration	ND	
09B-RCM-0603	Black Built-Up Roofing - Felt	Non-ACM	Beneath Copper Flashing at Vent Penetration	ND	
10A-RCM-0603	Black Built-Up Roofing - Asphalt	Non-ACM	Over Copper Flashing at Vent Penetration	ND	
10B-RCM-0603	Black Built-Up Roofing - Asphalt	Non-ACM	Over Copper Flashing at Vent Penetration	ND	
11A-RCM-0603	**Black Built-Up Roofing - Felt**	**Cat 1 NF**	**Over Copper Flashing at Vent Penetration**	**70% Chrysotile**	
11B-RCM-0603	**Black Built-Up Roofing - Felt**	**Cat 1 NF**	**Over Copper Flashing at Vent Penetration**	**Pos Stop**	
12A-RCM-0603	**Black Built-Up Roofing - Asphalt**	**Cat 1 NF**	**at Cut 9**	**15% Chrysotile**	
12B-RCM-0603	**Black Built-Up Roofing - Asphalt**	**Cat 1 NF**	**at Cut 9**	**Pos Stop**	
13A-RCM-0603	**Black Built-Up Roofing - Felt**	**Cat 1 NF**	**at Cut 9**	**18% Chrysotile**	
13B-RCM-0603	**Black Built-Up Roofing - Felt**	**Cat 1 NF**	**at Cut 9**	**Pos Stop**	
14A-RCM-0603	Gray Roof-Top Fan Sealant	Non-ACM	Southeast Roof	ND	
14B-RCM-0603	Gray Roof-Top Fan Sealant	Non-ACM	Southeast Roof	ND	

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Table 1
Suspect Asbestos-Containing Materials Laboratory Analytical Data Summary

Sample Number	Material Type	NESHAP Category	Sample Location	Result	Comments
15A-RCM-0603	Gray Duct-Seam Sealant	Non-ACM	2nd Floor Ceiling Plenum	ND	
15B-RCM-0603	Gray Duct-Seam Sealant	Non-ACM	2nd Floor Ceiling Plenum	ND	
16A-RCM-0603	White Skim Coat Cementitious Plaster	Non-ACM	2nd Floor Ceiling Plenum	ND	
16B-RCM-0603	White Skim Coat Cementitious Plaster	Non-ACM	2nd Floor Ceiling Plenum	ND	
17A-RCM-0603	Gray Rough Coat Cementitious Plaster	Non-ACM	2nd Floor Ceiling Plenum	ND	
17B-RCM-0603	Gray Rough Coat Cementitious Plaster	Non-ACM	2nd Floor Ceiling Plenum	ND	
18A-RCM-0603	2' x 2' White Sand Textured Suspended Ceiling Tile	Non-ACM	Throughout 2nd Floor	ND	
18B-RCM-0603	2' x 2' White Sand Textured Suspended Ceiling Tile	Non-ACM	Throughout 2nd Floor	ND	
19A-RCM-0603	2' x 4' White Fissure & Dot Suspended Ceiling Tile	Non-ACM	Throughout 2nd Floor	ND	
19B-RCM-0603	2' x 4' White Fissure & Dot Suspended Ceiling Tile	Non-ACM	Throughout 2nd Floor	ND	
20A-RCM-0603	Black Vibration Isolator	Non-ACM	Catwalk above Auditorium	ND	
20B-RCM-0603	Black Vibration Isolator	Non-ACM	Catwalk above Auditorium	ND	
21A-RCM-0603	White Joint Compound	Non-ACM	2nd Floor	ND	
21B-RCM-0603	White Joint Compound	Non-ACM	2nd Floor	ND	
22A-RCM-0603	Gray Gypsum Roof Deck	Non-ACM	Gymnasium Roof	ND	
22B-RCM-0603	Gray Gypsum Roof Deck	Non-ACM	Low Roof Adjacent to Gymnasium Roof	ND	
23A-RCM-0603	Gray Duct-Seam Sealant	Non-ACM	Boiler Room Roof	ND	
23B-RCM-0603	Gray Duct-Seam Sealant	Non-ACM	Boiler Room Roof	ND	
24A-RCM-0603	Gray "Newer" Duct-Seam Sealant	Non-ACM	Boiler Room Roof	ND	
24B-RCM-0603	Gray "Newer" Duct-Seam Sealant	Non-ACM	Boiler Room Roof	ND	
25A-RCM-0603	Black Skylight Sealant	Non-ACM	Boiler Room Roof	ND	
25B-RCM-0603	Black Skylight Sealant	Non-ACM	Boiler Room Roof	ND	
26A-RCM-0603	Black Chimney Flashing Sealant	Non-ACM	Boiler Room Roof	ND	
26B-RCM-0603	Black Chimney Flashing Sealant	Non-ACM	Boiler Room Roof	ND	
27A-RCM-0603	Gray Kalwall Caulking	Non-ACM	Boiler Room Roof	ND	
27B-RCM-0603	Gray Kalwall Caulking	Non-ACM	Boiler Room Roof	ND	
28A-RCM-0603	Gray Kalwall Flashing Caulking	Non-ACM	Boiler Room Roof	ND	
28B-RCM-0603	Gray Kalwall Flashing Caulking	Non-ACM	Boiler Room Roof	ND	
29A-RCM-0603	Black Built-Up Roofing - Asphalt	Non-ACM	Roof Adjacent to Elevator Penthouse toward rear of Building	ND	TEM
29B-RCM-0603	Black Built-Up Roofing - Asphalt	Non-ACM	Roof Adjacent to Elevator Penthouse toward rear of Building	ND	
30A-RCM-0603	**Black Built-Up Roofing - Felt**	**Cat 1 NF**	**Roof Adjacent to Elevator Penthouse toward rear of Building**	**10% Chrysotile**	
30B-RCM-0603	**Black Built-Up Roofing - Felt**	**Cat 1 NF**	**Roof Adjacent to Elevator Penthouse toward rear of Building**	**Pos Stop**	
31A-RCM-0603	Tan Cementitious Coat on Cmu	Non-ACM	Elevator Penthouse	ND	
31B-RCM-0603	Tan Cementitious Coat on Cmu	Non-ACM	Elevator Penthouse	ND	

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Table 1
Suspect Asbestos-Containing Materials Laboratory Analytical Data Summary

Sample Number	Material Type	NESHAP Category	Sample Location	Result	Comments
32A-RCM-0603	White Throughwall Flashing Caulking	Non-ACM	Throughwall Flashing at Low Roof	ND	
32B-RCM-0603	White Throughwall Flashing Caulking	Non-ACM	Throughwall Flashing at Low Roof	ND	
33A-RCM-0603	Black Throughwall Flashing Caulking	Non-ACM	Throughwall Flashing at Low Roof	ND	
33B-RCM-0603	Black Throughwall Flashing Caulking	Non-ACM	Throughwall Flashing at Low Roof	ND	
34A-RCM-0603	Tan Window Caulking	Non-ACM	Low Roof	ND	
34B-RCM-0603	Tan Window Caulking	Non-ACM	Low Roof	ND	
35A-RCM-0603	Gray Louver Caulking	Non-ACM	Low Roof	ND	
35B-RCM-0603	Gray Louver Caulking	Non-ACM	Low Roof	ND	
36A-RCM-0603	Black Built-Up Roofing - Asphalt	Non-ACM	Low Roof	ND	
36B-RCM-0603	Black Built-Up Roofing - Asphalt	Non-ACM	Low Roof	ND	
37A-RCM-0603	**Black Built-Up Roofing - Felt**	**Cat 1 NF**	**Low Roof**	**65% Chrysotile**	
37B-RCM-0603	**Black Built-Up Roofing - Felt**	**Cat 1 NF**	**Low Roof**	**Pos Stop**	
38A-RCM-0603	Black Base Layer Felt	Non-ACM	Low Roof	ND	
38B-RCM-0603	Black Base Layer Felt	Non-ACM	Low Roof	ND	
39A-RCM-0603	Residual Base Sheet	Non-ACM	Roof above Custodian's Office	ND	
39B-RCM-0603	Residual Base Sheet	Non-ACM	Roof above Custodian's Office	ND	
40A-RCM-0603	Tan Pipe-Thread Sealant	Non-ACM	Boiler Room Roof	ND	
40B-RCM-0603	Tan Pipe-Thread Sealant	Non-ACM	Boiler Room Roof	ND	
41A-RCM-0603	**Black Built-Up Roofing - Asphalt**	**Cat 1 NF**	**Roof A.1 Cut 75**	**5% Chrysotile**	
41B-RCM-0603	**Black Built-Up Roofing - Asphalt**	**Cat 1 NF**	**Roof A.1 Cut 76**	**4% Chrysotile**	
41C-RCM-0603	**Black Built-Up Roofing - Asphalt**	**Cat 1 NF**	**Roof A.1 Cut 77**	**ND**	**Asbestos identified in homogenous sample set**
41D-RCM-0603	**Black Built-Up Roofing - Asphalt**	**Cat 1 NF**	**Roof A.1 Cut 78**	**18% Chrysotile**	
41E-RCM-0603	**Black Built-Up Roofing - Asphalt**	**Cat 1 NF**	**Roof A.1 Cut 79**	**ND**	**Asbestos identified in homogenous sample set**
41F-RCM-0603	**Black Built-Up Roofing - Asphalt**	**Cat 1 NF**	**Roof A.1 Cut 90**	**5% Chrysotile**	
42A-RCM-0603	**Black Built-Up Roofing - Felt**	**Cat 1 NF**	**Roof A.1 Cut 75**	**20% Chrysotile**	
42B-RCM-0603	**Black Built-Up Roofing - Felt**	**Cat 1 NF**	**Roof A.1 Cut 76**	**18% Chrysotile**	
42C-RCM-0603	**Black Built-Up Roofing - Felt**	**Cat 1 NF**	**Roof A.1 Cut 77**	**ND**	**Asbestos identified in homogenous sample set**
42D-RCM-0603	**Black Built-Up Roofing - Felt**	**Cat 1 NF**	**Roof A.1 Cut 78**	**4% Chrysotile**	
42E-RCM-0603	**Black Built-Up Roofing - Felt**	**Cat 1 NF**	**Roof A.1 Cut 79**	**ND**	**Asbestos identified in homogenous sample set**
42F-RCM-0603	**Black Built-Up Roofing - Felt**	**Cat 1 NF**	**Roof A.1 Cut 90**	**20% Chrysotile**	

Cat 1 NF = Category I Non-Friable Material
Pos Stop = Positive Stop
ND = None Detected
ACM = Asbestos-Containing Material
TEM = Transmission Electron Microscopy

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Table 2
Asbestos-Containing Materials Summary

Millis Middle & High School
Millis, Massachusetts

CBI Consulting, LLC
July 2020
Fuss & O'Neill Reference No. 20200048.A10

Asbestos-Containing Material Type	Locations(s)	Asbestos Content	Estimated Total Quantity	Comments
Black Built-Up Roofing - Asphalt & Felt	Roof H	15 - 70% Chrysotile	13,250 SF	
Black Built-Up Roofing - Felt	Southwest Section of Roof D	10% Chrysotile	600 SF	
Black Built-Up Roofing - Felt	Roof D.1	65% Chrysotile	3,150 SF	
Black Built-Up Roofing - Asphalt & Felt	Roof A.1	5 - 20% Chrysotile	4,000 SF	
Gray Reinforced-Cement Ductwork	Ceiling Plenum at Limited Locations Throughout 2nd Floor	Assumed	150 SF	May not be impacted by Scope of Work

SF = Square Feet
ACM = Asbestos-Containing Material

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Appendix A

Limitations

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APPENDIX A

Millis Middle & High School
Millis, Massachusetts

1. This environmental report has been prepared for the exclusive use of the Client, and is subject to, and is issued in connection with, the general terms and conditions of the original Agreement (March 30, 2020) and all of its provisions. Any use or reliance upon information provided in this report, without the specific written authorization of the Client and Fuss & O'Neill, shall be at the User's individual risk. This report should not be used as an abatement specification. All quantities of materials identified during this inspection are approximate.
2. Fuss & O'Neill has obtained and relied upon laboratory analytical results in conducting the inspection. This information was used to form conclusions regarding the types and quantities of ACM materials that must be managed prior to renovation or demolition activities that may disturb these materials at the subject property(ies). Fuss & O'Neill has not performed an independent review of the reliability of this laboratory data.
3. Unless otherwise noted, only suspect hazardous materials associated within or located on the building (aboveground) were included in this inspection. Suspect hazardous materials may exist below the ground surfaces that were not included in the scope of work of this inspection. Fuss & O'Neill cannot guarantee all asbestos or suspect hazardous materials were identified within the areas included in the scope of work.
4. The findings, observations, and conclusions presented in this report are limited by the scope of services outlined in our original Agreement, which reflects schedule and budgetary constraints imposed by the Client. Furthermore, the assessment has been conducted in accordance with generally accepted environmental practices. No other warranty, expressed or implied, is made.
5. The conclusions presented in this report are based solely upon information gathered by Fuss & O'Neill to date. Should further environmental or other relevant information be discovered at a later date, the Client should immediately bring the information to Fuss & O'Neill's attention. Based upon an evaluation and assessment of relevant information, Fuss & O'Neill may modify the report and its conclusions.

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Appendix B

Asbestos Inspector State Certification & EPA Accreditation

THE COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF LABOR AND WORKFORCE DEVELOPMENT
DEPARTMENT OF LABOR STANDARDS

Michael Flanagan
Director

Asbestos Inspector

ROBERT C. MALLETT

Eff. Date 06/01/20
Exp. Date 06/01/21
AI900557
Member of C.O.N.E.S.
bosrnew **BOS-renew**

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This is to certify that

Robert C Mallett

has completed the requisite training, and has passed an examination for reaccreditation as:

Asbestos Inspector Refresher

pursuant to Title II of the Toxic Substance Control Act, 15 U.S.C. 2646

Course Location

Institute for Environmental Education
16 Upton Drive Wilmington, MA 01887

January 6, 2020
Course Dates

20-2958-106-402379
Certificate Number

January 06, 2020
Examination Date

January 06, 2021
Expiration Date

Training Director

16 Upton Drive, Wilmington, MA 01887 Telephone 978.658.5272 www.ieetrains.com

INSTITUTE FOR ENVIRONMENTAL EDUCATION

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Appendix C

Asbestos Laboratory Analytical Reports & Chain-of-Custody Form

EMSL Analytical, Inc.

5 Constitution Way, Unit A Woburn, MA 01801

Tel/Fax: (781) 933-8411 / (781) 933-8412

http://www.EMSL.com / bostonlab@emsl.com

EMSL Order:	132003745
Customer ID:	ENVI54
Customer PO:	20200048.A10T15
Project ID:	

Attention:	Dustin Diedricksen	**Phone:**	(617) 778-3750
	Fuss & O'Neill, Inc.	**Fax:**	
	146 Hartford Road	**Received Date:**	06/08/2020 9:05 AM
	Manchester, CT 06040	**Analysis Date:**	06/14/2020 - 06/15/2020
		Collected Date:	06/03/2020

Project: 20200048.A10 Task 15 / Millis MS/HS Roof Replacement & HVAC Replacement Study, 245 Plain Street, Millis, MA

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	**Description**	**Appearance**	**% Fibrous**	**% Non-Fibrous**	**% Type**
01A-RCM-0603 *132003745-0001*	Southeast Roof - Gray Duct Seam Sealant	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
01B-RCM-0603 *132003745-0002*	Southeast Roof - Gray Duct Seam Sealant	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
02A-RCM-0603 *132003745-0003*	Southeast Roof - Black Lap Seam Sealant	Black Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
02B-RCM-0603 *132003745-0004*	Southeast Roof - Black Lap Seam Sealant	Black Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
03A-RCM-0603 *132003745-0005*	Southeast Roof - Black Built-Up Roofing - Asphalt	Black Fibrous Homogeneous	12% Cellulose	88% Non-fibrous (Other)	None Detected
03B-RCM-0603 *132003745-0006*	Southeast Roof - Black Built-Up Roofing - Asphalt	Black Fibrous Homogeneous	15% Cellulose	85% Non-fibrous (Other)	None Detected
03C-RCM-0603 *132003745-0007*	Southeast Roof - Black Built-Up Roofing - Asphalt	Black Fibrous Homogeneous	15% Cellulose	85% Non-fibrous (Other)	None Detected
04A-RCM-0603 *132003745-0008*	Southeast Roof - Black Built-Up Roofing - Felt	Black Fibrous Homogeneous	55% Cellulose	45% Non-fibrous (Other)	None Detected
04B-RCM-0603 *132003745-0009*	Southeast Roof - Black Built-Up Roofing - Felt	Black Fibrous Homogeneous	50% Cellulose	50% Non-fibrous (Other)	None Detected
04C-RCM-0603 *132003745-0010*	Southeast Roof - Black Built-Up Roofing - Felt	Black Fibrous Homogeneous	50% Cellulose	50% Non-fibrous (Other)	None Detected
05A-RCM-0603 *132003745-0011*	Southeast Roof - Black Felt Layer on Deck	Black Fibrous Homogeneous	65% Cellulose	35% Non-fibrous (Other)	None Detected
05B-RCM-0603 *132003745-0012*	Southeast Roof - Black Felt Layer on Deck	Black Fibrous Homogeneous	65% Cellulose	35% Non-fibrous (Other)	None Detected
06A-RCM-0603 *132003745-0013*	Southeast Roof - Gray Gypsum Roof Deck	Gray/White Fibrous Homogeneous	2% Cellulose	98% Non-fibrous (Other)	None Detected
06B-RCM-0603 *132003745-0014*	Southeast Roof - Gray Gypsum Roof Deck	Gray/White Fibrous Homogeneous	2% Cellulose	98% Non-fibrous (Other)	None Detected
07A-RCM-0603 *132003745-0015*	Southeast Roof - Black Curbing at Fan Curbing	Black Fibrous Homogeneous	70% Cellulose	30% Non-fibrous (Other)	None Detected
07B-RCM-0603 *132003745-0016*	Southeast Roof - Black Curbing at Fan Curbing	Black Fibrous Homogeneous	70% Cellulose	30% Non-fibrous (Other)	None Detected

Initial report from: 06/15/2020 08:59:46

EMSL Analytical, Inc.
5 Constitution Way, Unit A Woburn, MA 01801
Tel/Fax: (781) 933-8411 / (781) 933-8412
http://www.EMSL.com / bostonlab@emsl.com

EMSL Order: 132003745
Customer ID: ENVI54
Customer PO: 20200048.A10T15
Project ID:

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	**Description**	**Appearance**	**% Fibrous**	**% Non-Fibrous**	**% Type**
08A-RCM-0603 *132003745-0017*	Beneath Copper Flashing @ Vent Penetration - Black Built-Up Roofing - Asphalt	Black Fibrous Homogeneous	15% Cellulose	85% Non-fibrous (Other)	None Detected
08B-RCM-0603 *132003745-0018*	Beneath Copper Flashing @ Vent Penetration - Black Built-Up Roofing - Asphalt	Black Fibrous Homogeneous	13% Cellulose	87% Non-fibrous (Other)	None Detected
09A-RCM-0603 *132003745-0019*	Beneath Copper Flashing @ Vent Penetration - Black Built-Up Roofing - Felt	Black Fibrous Homogeneous	65% Cellulose	35% Non-fibrous (Other)	None Detected
09B-RCM-0603 *132003745-0020*	Beneath Copper Flashing @ Vent Penetration - Black Built-Up Roofing - Felt	Black Fibrous Homogeneous	65% Cellulose	35% Non-fibrous (Other)	None Detected
10A-RCM-0603 *132003745-0021*	Over Copper Flashing @ Vent Penetration - Black Built-Up Roofing - Asphalt	Black Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
10B-RCM-0603 *132003745-0022*	Over Copper Flashing @ Vent Penetration - Black Built-Up Roofing - Asphalt	Black Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
11A-RCM-0603 *132003745-0023*	Over Copper Flashing @ Vent Penetration - Black Built-Up Roofing - Felt	Black Fibrous Homogeneous		30% Non-fibrous (Other)	70% Chrysotile
11B-RCM-0603 *132003745-0024*	Over Copper Flashing @ Vent Penetration - Black Built-Up Roofing - Felt				Positive Stop (Not Analyzed)
12A-RCM-0603 *132003745-0025*	@ Cut 9 - Black Built-Up Roofing - Asphalt	Black Fibrous Homogeneous		85% Non-fibrous (Other)	15% Chrysotile
12B-RCM-0603 *132003745-0026*	@ Cut 9 - Black Built-Up Roofing - Asphalt				Positive Stop (Not Analyzed)
13A-RCM-0603 *132003745-0027*	@ Cut 9 - Black Built-Up Roofing - Felt	Black Fibrous Homogeneous	15% Synthetic	67% Non-fibrous (Other)	18% Chrysotile
13B-RCM-0603 *132003745-0028*	@ Cut 9 - Black Built-Up Roofing - Felt				Positive Stop (Not Analyzed)
14A-RCM-0603 *132003745-0029*	Southeast Roof - Gray Roof-Top Fan Sealant	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
14B-RCM-0603 *132003745-0030*	Southeast Roof - Gray Roof-Top Fan Sealant	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
15A-RCM-0603 *132003745-0031*	2nd Floor Ceiling Plenum - Gray Duct Seam Sealant	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
15B-RCM-0603 *132003745-0032*	2nd Floor Ceiling Plenum - Gray Duct Seam Sealant	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected

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Project ID:

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	**Description**	**Appearance**	**% Fibrous**	**% Non-Fibrous**	**% Type**
16A-RCM-0603 *132003745-0033*	2nd Floor Ceiling Plenum - White Skim Coat Cementitious Plaster	White Fibrous Homogeneous	<1% Cellulose	100% Non-fibrous (Other)	None Detected
16B-RCM-0603 *132003745-0034*	2nd Floor Ceiling Plenum - White Skim Coat Cementitious Plaster	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
17A-RCM-0603 *132003745-0035*	2nd Floor Ceiling Plenum - Gray Rough Coat Cementitious Plaster	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
17B-RCM-0603 *132003745-0036*	2nd Floor Ceiling Plenum - Gray Rough Coat Cementitious Plaster	Gray Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
18A-RCM-0603 *132003745-0037*	Throughout 2nd Floor - 2'x2' White Sand Textured Suspended Ceiling Tile	Gray/White Fibrous Homogeneous	40% Cellulose 45% Min. Wool	15% Non-fibrous (Other)	None Detected
18B-RCM-0603 *132003745-0038*	Throughout 2nd Floor - 2'x2' White Sand Textured Suspended Ceiling Tile	Gray/White Fibrous Homogeneous	40% Cellulose 45% Min. Wool	15% Non-fibrous (Other)	None Detected
19A-RCM-0603 *132003745-0039*	Throughout 2nd Floor - 2'x4' White Fissure & Dot Suspended Ceiling Tile	Gray/White Fibrous Homogeneous	50% Cellulose 30% Min. Wool	20% Non-fibrous (Other)	None Detected
19B-RCM-0603 *132003745-0040*	Throughout 2nd Floor - 2'x4' White Fissure & Dot Suspended Ceiling Tile	Gray/White Fibrous Homogeneous	30% Cellulose 45% Min. Wool	25% Non-fibrous (Other)	None Detected
20A-RCM-0603 *132003745-0041*	Catwalk Above Auditorium - Black Vibration Isolator	Black Fibrous Homogeneous	35% Glass	65% Non-fibrous (Other)	None Detected
20B-RCM-0603 *132003745-0042*	Catwalk Above Auditorium - Black Vibration Isolator	Black Fibrous Homogeneous	35% Glass	65% Non-fibrous (Other)	None Detected
21A-RCM-0603 *132003745-0043*	2nd Floor - White Joint Compound	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
21B-RCM-0603 *132003745-0044*	2nd Floor - White Joint Compound	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
22A-RCM-0603 *132003745-0045*	Gymnasium Roof - Gray Gypsum Roof Deck	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
22B-RCM-0603 *132003745-0046*	Low Roof Adjacent to Gymnasium Roof - Gray Gypsum Roof Deck	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
23A-RCM-0603 *132003745-0047*	Boiler Room Roof - Gray Duct Seam Sealant	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
23B-RCM-0603 *132003745-0048*	Boiler Room Roof - Gray Duct Seam Sealant	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected

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Project ID:

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	**Description**	**Appearance**	**% Fibrous**	**% Non-Fibrous**	**% Type**
24A-RCM-0603 *132003745-0049*	Boiler Room Roof - Gray "Newer" Duct Seam Sealant	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
24B-RCM-0603 *132003745-0050*	Boiler Room Roof - Gray "Newer" Duct Seam Sealant	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
25A-RCM-0603 *132003745-0051*	Boiler Room Roof - Black Skylight Sealant	Black Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
25B-RCM-0603 *132003745-0052*	Boiler Room Roof - Black Skylight Sealant	Black Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
26A-RCM-0603 *132003745-0053*	Boiler Room Roof - Black Chimney Flashing Sealant	Black Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
26B-RCM-0603 *132003745-0054*	Boiler Room Roof - Black Chimney Flashing Sealant	Black Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
27A-RCM-0603 *132003745-0055*	Boiler Room Roof - Gray Kalwall Caulking	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
27B-RCM-0603 *132003745-0056*	Boiler Room Roof - Gray Kalwall Caulking	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
28A-RCM-0603 *132003745-0057*	Boiler Room Roof - Gray Kalwall Flashing Caulking	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
28B-RCM-0603 *132003745-0058*	Boiler Room Roof - Gray Kalwall Flashing Caulking	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
29A-RCM-0603 *132003745-0059*	Roof Adjacent to Elevator Penthouse Towards the Rear of the Building - Black Built-Up Roofing - Asphalt	Black Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
29B-RCM-0603 *132003745-0060*	Roof Adjacent to Elevator Penthouse Towards the Rear of the Building - Black Built-Up Roofing - Asphalt	Black Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
30A-RCM-0603 *132003745-0061*	Roof Adjacent to Elevator Penthouse Towards the Rear of the Building - Black Built-Up Roofing - Felt	Black Fibrous Homogeneous	18% Glass	72% Non-fibrous (Other)	10% Chrysotile
30B-RCM-0603 *132003745-0062*	Roof Adjacent to Elevator Penthouse Towards the Rear of the Building - Black Built-Up Roofing - Felt				Positive Stop (Not Analyzed)
31A-RCM-0603 *132003745-0063*	Elevator Penthouse - Tan Cementitious Coat on CMU	Gray/Tan Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
31B-RCM-0603 *132003745-0064*	Elevator Penthouse - Tan Cementitious Coat on CMU	Gray/Tan Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected

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Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	**Description**	**Appearance**	**% Fibrous**	**% Non-Fibrous**	**% Type**
32A-RCM-0603 *132003745-0065*	Throughwall Flashing @ Low Roof - White Throughwall Flashing Caulking	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
32B-RCM-0603 *132003745-0066*	Throughwall Flashing @ Low Roof - White Throughwall Flashing Caulking	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
33A-RCM-0603 *132003745-0067*	Throughwall Flashing @ Low Roof - Black Throughwall Flashing Caulking	Black Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
33B-RCM-0603 *132003745-0068*	Throughwall Flashing @ Low Roof - Black Throughwall Flashing Caulking	Black Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
34A-RCM-0603 *132003745-0069*	Low Roof - Tan Window Caulking	Green Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
34B-RCM-0603 *132003745-0070*	Low Roof - Tan Window Caulking	Green Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
35A-RCM-0603 *132003745-0071*	Low Roof - Gray Louver Caulking	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
35B-RCM-0603 *132003745-0072*	Low Roof - Gray Louver Caulking	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
36A-RCM-0603 *132003745-0073*	Low Roof - Black Built-Up Roofing - Asphalt	Black Fibrous Homogeneous	35% Cellulose	65% Non-fibrous (Other)	None Detected
36B-RCM-0603 *132003745-0074*	Low Roof - Black Built-Up Roofing - Asphalt	Black Fibrous Homogeneous	35% Cellulose	65% Non-fibrous (Other)	None Detected
37A-RCM-0603 *132003745-0075*	Low Roof - Black Built-Up Roofing - Felt	Black Fibrous Homogeneous		35% Non-fibrous (Other)	65% Chrysotile
37B-RCM-0603 *132003745-0076*	Low Roof - Black Built-Up Roofing - Felt				Positive Stop (Not Analyzed)
38A-RCM-0603 *132003745-0077*	Low Roof - Black Base Layer Felt	Black Fibrous Homogeneous	65% Cellulose	35% Non-fibrous (Other)	None Detected
38B-RCM-0603 *132003745-0078*	Low Roof - Black Base Layer Felt	Black Fibrous Homogeneous	65% Cellulose	35% Non-fibrous (Other)	None Detected
39A-RCM-0603 *132003745-0079*	Roof Above Custodian's Office - Residual Base Sheet	Black Fibrous Homogeneous	25% Glass	75% Non-fibrous (Other)	None Detected
39B-RCM-0603 *132003745-0080*	Roof Above Custodian's Office - Residual Base Sheet	Black Fibrous Homogeneous	25% Glass	75% Non-fibrous (Other)	None Detected
40A-RCM-0603 *132003745-0081*	Boiler Room Roof - Tan Pipe Thread Sealant	Tan Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
40B-RCM-0603 *132003745-0082*	Boiler Room Roof - Tan Pipe Thread Sealant	Tan Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected

Initial report from: 06/15/2020 08:59:46

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EMSL Order:	132003745
Customer ID:	ENVI54
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Project ID:	

Analyst(s)

Ramon Buenaventura (77)

Steve Grise, Laboratory Manager
or Other Approved Signatory

Initial report from: 06/15/2020 08:59:46

EMSL Analytical, Inc.
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EMSL Order: 132003745
Customer ID: ENVI54
Customer PO: 20200048.A10T15
Project ID:

Attention: Dustin Diedricksen
Fuss & O'Neill, Inc.
146 Hartford Road
Manchester, CT 06040

Phone: (617) 778-3750
Fax:
Received Date: 06/08/2020 9:05 AM
Analysis Date: 06/22/2020
Collected Date: 06/03/2020

Project: 20200048.A10 Task 15 / Millis MS/HS Roof Replacement & HVAC Replacement Study, 245 Plain Street, Millis, MA

Test Report: Asbestos Analysis of Non-Friable Organically Bound Materials by TEM via EPA/600/R-93/116 Section 2.5.5.1

Sample ID	Description	Appearance	% Matrix Material	% Non-Asbestos Fibers	Asbestos Types
02A-RCM-0603 *132003745-0003*	Southeast Roof - Black Lap Seam Sealant	Black Non-Fibrous Homogeneous	100.0 Other	None	No Asbestos Detected
03A-RCM-0603 *132003745-0005*	Southeast Roof - Black Built-Up Roofing - Asphalt	Black Non-Fibrous Homogeneous	100.0 Other	None	No Asbestos Detected
29A-RCM-0603 *132003745-0059*	Roof Adjacent to Elevator Penthouse Towards the Rear of the Building - Black Built-Up Roofing - Asphalt	Black Non-Fibrous Homogeneous	100.0 Other	None	No Asbestos Detected

Analyst(s)

Matthew Conley (3)

Steve Grise, Laboratory Manager
or other approved signatory

Samples analyzed by EMSL Analytical, Inc. Woburn, MA

Initial report from: 06/22/2020 10:21:21

OrderID: 132003745

FUSS & O'NEILL

132003745

EMSL Customer No. ENVI54

www.fando.com

108 Myrtle Street, Suite 502, Quincy, MA 02171 Phone (617) 282-4675 Fax (617) 282-8253

Asbestos Bulk Sample Chain-of-Custody Form

Sheet ___ of ___

Project Name: Millis MS / HS Roof Replacement & HVAC Replacement Study **Project No.:**20200048.A10 **Task:** 15

Building Name/Number: Millis MS/HS **Project Manager:** Diedricksen

Site Address: 245 Plain Street, Millis, MA **Total # of Samples:** 82

Sample ID (#-Initials-Date)	Material Type (Size, Color, Description, Material)	Sample Location	Comments/ Quantities
01A-RCM-0603	Gray Duct Seam Sealant	Southeast Roof	
01B-RCM-0603	Gray Duct Seam Sealant	Southeast Roof	
02A-RCM-0603	Black Lap Seam Sealant	Southeast Roof	*2
02B-RCM-0603	Black Lap Seam Sealant	Southeast Roof	
03A-RCM-0603	Black Built-Up Roofing - Asphalt	Southeast Roof	*1
03B-RCM-0603	Black Built-Up Roofing - Asphalt	Southeast Roof	
03C-RCM-0603	Black Built-Up Roofing - Asphalt	Southeast Roof	
04A-RCM-0603	Black Built-Up Roofing - Felt	Southeast Roof	
04B-RCM-0603	Black Built-Up Roofing - Felt	Southeast Roof	
04C-RCM-0603	Black Built-Up Roofing - Felt	Southeast Roof	
05A-RCM-0603	Black Felt Layer on Deck	Southeast Roof	
05B-RCM-0603	Black Felt Layer on Deck	Southeast Roof	
06A-RCM-0603	Gray Gypsum Roof Deck	Southeast Roof REC'D MC EMSL-BOSTON JUN 08 2020	9'05
06B-RCM-0603	Gray Gypsum Roof Deck	Southeast Roof	
07A-RCM-0603	Black Curbing at Fan Curbing	Southeast Roof EFx: 7958 5258 4472	
07B-RCM-0603	Black Curbing at Fan Curbing	Southeast Roof	
08A-RCM-0603	Black Built-Up Roofing – Asphalt	Beneath Copper Flasing @ Vent Penetration	
08B-RCM-0603	Black Built-Up Roofing – Asphalt	Beneath Copper Flasing @ Vent Penetration	
09A-RCM-0603	Black Built-Up Roofing - Felt	Beneath Copper Flasing @ Vent Penetration	
09B-RCM-0603	Black Built-Up Roofing - Felt	Beneath Copper Flasing @ Vent Penetration	
10A-RCM-0603	Black Built-Up Roofing – Asphalt	Over Copper Flasing @ Vent Penetration	
10B-RCM-0603	Black Built-Up Roofing – Asphalt	Over Copper Flasing @ Vent Penetration	
11A-RCM-0603	Black Built-Up Roofing - Felt	Over Copper Flasing @ Vent Penetration	
11B-RCM-0603	Black Built-Up Roofing - Felt	Over Copper Flasing @ Vent Penetration	

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12A-RCM-0603	Black Built-Up Roofing – Asphalt	@ Cut 9	
12B-RCM-0603	Black Built-Up Roofing – Asphalt	@ Cut 9	
13A-RCM-0603	Black Built-Up Roofing - Felt	@ Cut 9	
13B-RCM-0603	Black Built-Up Roofing - Felt	@ Cut 9	
14A-RCM-0603	Gray Roof-Top Fan Sealant	Southeast Roof	
14B-RCM-0603	Gray Roof-Top Fan Sealant	Southeast Roof	
15A-RCM-0603	Gray Duct Seam Sealant	2nd Floor Ceiling Plenum	
15B-RCM-0603	Gray Duct Seam Sealant	2nd Floor Ceiling Plenum	
16A-RCM-0603	White Skim Coat Cementitious Plaster	2nd Floor Ceiling Plenum	
16B-RCM-0603	White Skim Coat Cementitious Plaster	2nd Floor Ceiling Plenum	
17A-RCM-0603	Gray Rough Coat Cementitious Plaster	2nd Floor Ceiling Plenum	
17B-RCM-0603	Gray Rough Coat Cementitious Plaster	2nd Floor Ceiling Plenum	
18A-RCM-0603	2' x 2' White Sand Textured Suspended Ceiling Tile	Throughout 2nd Floor	
18B-RCM-0603	2' x 2' White Sand Textured Suspended Ceiling Tile	Throughout 2nd Floor	
19A-RCM-0603	2' x 4' White Fissure & Dot Suspended Ceiling Tile	Throughout 2nd Floor	
19B-RCM-0603	2' x 4' White Fissure & Dot Suspended Ceiling Tile	Throughout 2nd Floor	
20A-RCM-0603	Black Vibration Isolator	Catwalk above Auditorium	
20B-RCM-0603	Black Vibration Isolator	Catwalk above Auditorium	
21A-RCM-0603	White Joint Compound	2nd Floor	
21B-RCM-0603	White Joint Compound	2nd Floor	
22A-RCM-0603	Gray Gypsum Roof Deck	Gymnasiam Roof	
22B-RCM-0603	Gray Gypsum Roof Deck	Low Roof Adjacent to Gymnasium Roof	
23A-RCM-0603	Gray Duct Seam Sealant	Boiler Room Roof	
23B-RCM-0603	Gray Duct Seam Sealant	Boiler Room Roof	
24A-RCM-0603	Gray "Newer" Duct Seam Sealant	Boiler Room Roof	
24B-RCM-0603	Gray "Newer" Duct Seam Sealant	Boiler Room Roof	
25A-RCM-0603	Black Skylight Sealant	Boiler Room Roof	
25B-RCM-0603	Black Skylight Sealant	Boiler Room Roof	
26A-RCM-0603	Black Chimney Flashing Sealant	Boiler Room Roof	

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26B-RCM-0603	Black Chimney Flashing Sealant	Boiler Room Roof	
27A-RCM-0603	Gray Kalwall Caulking	Boiler Room Roof	
27B-RCM-0603	Gray Kalwall Caulking	Boiler Room Roof	
28A-RCM-0603	Gray Kalwall Flashing Caulking	Boiler Room Roof	
28B-RCM-0603	Gray Kalwall Flashing Caulking	Boiler Room Roof	
29A-RCM-0603	Black Built-Up Roofing - Asphalt	Roof Adjacent to Elevator Penthouse Towards the Rear of the Building	*3
29B-RCM-0603	Black Built-Up Roofing - Asphalt	Roof Adjacent to Elevator Penthouse Towards the Rear of the Building	
30A-RCM-0603	Black Built-Up Roofing - Felt	Roof Adjacent to Elevator Penthouse Towards the Rear of the Building	*4
30B-RCM-0603	Black Built-Up Roofing - Felt	Roof Adjacent to Elevator Penthouse Towards the Rear of the Building	
31A-RCM-0603	Tan Cementitious Coat on CMU	Elevator Penthouse	
31B-RCM-0603	Tan Cementitious Coat on CMU	Elevator Penthouse	
32A-RCM-0603	White Throughwall Flashing Caulking	Throughwall Flashing @ Low Roof	
32B-RCM-0603	White Throughwall Flashing Caulking	Throughwall Flashing @ Low Roof	
33A-RCM-0603	Black Throughwall Flashing Caulking	Throughwall Flashing @ Low Roof	
33B-RCM-0603	Black Throughwall Flashing Caulking	Throughwall Flashing @ Low Roof	
34A-RCM-0603	Tan Window Caulking	Low Roof	
34B-RCM-0603	Tan Window Caulking	Low Roof	
35A-RCM-0603	Gray Louver Caulking	Low Roof	
35B-RCM-0603	Gray Louver Caulking	Low Roof	
36A-RCM-0603	Black Built-Up Roofing - Asphalt	Low Roof	*5
36B-RCM-0603	Black Built-Up Roofing - Asphalt	Low Roof	
37A-RCM-0603	Black Built-Up Roofing - Felt	Low Roof	*6
37B-RCM-0603	Black Built-Up Roofing - Felt	Low Roof	
38A-RCM-0603	Black Base Layer Felt	Low Roof	
38B-RCM-0603	Black Base Layer Felt	Low Roof	
39A-RCM-0603	Residual Base Sheet	Roof above Custodian's Office	
39B-RCM-0603	Residual Base Sheet	Roof above Custodian's Office	
40A-RCM-0603	Tan Pipe Thread Sealant	Boiler Room Roof	
40B-RCM-0603	Tan Pipe Thread Sealant	Boiler Room Roof	

OrderID: 132003745

FUSS & O'NEILL

132003745

EMSL Customer No. ENVI54

www.fando.com

108 Myrtle Street, Suite 502, Quincy, MA 02171 Phone (617) 282-4675 Fax (617) 282-8253

Analysis Method: ☒ PLM ☐ TEM ☐ Other _____ Turnaround Time: 1-week

Please call Fuss & O'Neill at (617) 282-4675 if analyses will not be completed for requested turnaround time listed above.

Email Results to: ddiedricksen **@fando.com** **Do Not Mail Hard Copy Report** **FAX Results to: 888-838-1160.**

Special Instructions: Analyze ALL samples, do NOT stop positive. Do not layer samples unless indicated. Do not point count. If NOB group samples are **ALL** negative by PLM, analyze the sample denoted with a star (★) by **TEM NOB** on a **1-week** turnaround time. Analyze a **MAXIMUM** of **3** samples by **TEM in noted order.**

Samples Collected by: _____ **Date:** ~~6/5/2020~~ 6/13 + 6/14/2020

Samples Sent by: PM **Date:** 6/5/2020 **Time:** PM

Shipped To: ☒ EMSL ☐ Other _____

Method of Shipment: ☒ Fed Ex ~~☒ Lab Drop Off~~ ☐ Other _____

REC'D MC
EMSL-BOSTON JUN 08 2020

EMSL Analytical, Inc.

5 Constitution Way, Unit A Woburn, MA 01801

Tel/Fax: (781) 933-8411 / (781) 933-8412

http://www.EMSL.com / bostonlab@emsl.com

EMSL Order:	132003927
Customer ID:	ENVI54
Customer PO:	20200048.A10T15
Project ID:	

Attention:	Dustin Diedricksen	**Phone:**	(617) 778-3750
	Fuss & O'Neill, Inc.	**Fax:**	
	146 Hartford Road	**Received Date:**	06/15/2020 8:30 AM
	Manchester, CT 06040	**Analysis Date:**	06/22/2020
		Collected Date:	06/03/2020

Project: 20200048.A10 Task 15 / Millis MS/HS Roof Replacement & HVAC Replacement Study

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	**Description**	**Appearance**	**% Fibrous**	**% Non-Fibrous**	**% Type**
41A-RCM-0603 *132003927-0001*	Roof A-1 Cut 75 - Black Built-Up Roofing - Asphalt	Black Fibrous Homogeneous	35% Cellulose	60% Non-fibrous (Other)	5% Chrysotile
41B-RCM-0603 *132003927-0002*	Roof A-1 Cut 76 - Black Built-Up Roofing - Asphalt	Black Fibrous Homogeneous	60% Cellulose	36% Non-fibrous (Other)	4% Chrysotile
41C-RCM-0603 *132003927-0003*	Roof A-1 Cut 77 - Black Built-Up Roofing - Asphalt	Black Fibrous Homogeneous	20% Cellulose	80% Non-fibrous (Other)	None Detected
41D-RCM-0603 *132003927-0004*	Roof A-1 Cut 78 - Black Built-Up Roofing - Asphalt	Black/Silver Fibrous Homogeneous	30% Glass	52% Non-fibrous (Other)	18% Chrysotile
41E-RCM-0603 *132003927-0005*	Roof A-1 Cut 79 - Black Built-Up Roofing - Asphalt	Black Fibrous Homogeneous	30% Cellulose	70% Non-fibrous (Other)	None Detected
41F-RCM-0603 *132003927-0006*	Roof A-1 Cut 90 - Black Built-Up Roofing - Asphalt	Black Fibrous Homogeneous	20% Cellulose	75% Non-fibrous (Other)	5% Chrysotile
42A-RCM-0603 *132003927-0007*	Roof A-1 Cut 75 - Black Built-Up Roofing - Felt	Black Fibrous Homogeneous	65% Cellulose	15% Non-fibrous (Other)	20% Chrysotile
42B-RCM-0603 *132003927-0008*	Roof A-1 Cut 76 - Black Built-Up Roofing - Felt	Black Fibrous Homogeneous	65% Cellulose	17% Non-fibrous (Other)	18% Chrysotile
42C-RCM-0603 *132003927-0009*	Roof A-1 Cut 77 - Black Built-Up Roofing - Felt	Black Fibrous Homogeneous	60% Cellulose	40% Non-fibrous (Other)	None Detected
42D-RCM-0603 *132003927-0010*	Roof A-1 Cut 78 - Black Built-Up Roofing - Felt	Black Fibrous Homogeneous	65% Cellulose	31% Non-fibrous (Other)	4% Chrysotile
42E-RCM-0603 *132003927-0011*	Roof A-1 Cut 79 - Black Built-Up Roofing - Felt	Black Fibrous Homogeneous	60% Cellulose	40% Non-fibrous (Other)	None Detected
42F-RCM-0603 *132003927-0012*	Roof A-1 Cut 90 - Black Built-Up Roofing - Felt	Black/Silver Fibrous Homogeneous	25% Synthetic	55% Non-fibrous (Other)	20% Chrysotile

Initial report from: 06/22/2020 08:20:15

EMSL Analytical, Inc.
5 Constitution Way, Unit A Woburn, MA 01801
Tel/Fax: (781) 933-8411 / (781) 933-8412
http://www.EMSL.com / bostonlab@emsl.com

EMSL Order:	132003927
Customer ID:	ENVI54
Customer PO:	20200048.A10T15
Project ID:	

Analyst(s)

Ramon Buenaventura (12)

Steve Grise, Laboratory Manager
or Other Approved Signatory

Initial report from: 06/22/2020 08:20:15

OrderID: 132003927

132003927

FUSS & O'NEILL

EMSL Customer No. ENVI54

www.fando.com

108 Myrtle Street, Suite 502, Quincy, MA 02171 Phone (617) 282-4675 Fax (617) 282-8253

Asbestos Bulk Sample Chain-of-Custody Form

Sheet ___ of ___

Project Name: Millis MS / HS Roof Replacement & HVAC Replacement Study **Project No.:**20200048.A10 **Task:** 15

Building Name/Number: Millis MS/HS **Project Manager:** Diedricksen

Site Address: 245 Plain Street, Millis, MA **Total # of Samples:** 12

Sample ID (#-Initials-Date)	Material Type (Size, Color, Description, Material)	Sample Location	Comments/ Quantities
41A-RCM-0603	Black Built-Up Roofing - Asphalt	Roof A-1 Cut 75	
41B-RCM-0603	Black Built-Up Roofing - Asphalt	Roof A-1 Cut 76	
41C-RCM-0603	Black Built-Up Roofing - Asphalt	Roof A-1 Cut 77	
41D-RCM-0603	Black Built-Up Roofing - Asphalt	Roof A-1 Cut 78	
41E-RCM-0603	Black Built-Up Roofing - Asphalt	Roof A-1 Cut 79	
41F-RCM-0603	Black Built-Up Roofing - Asphalt	Roof A-1 Cut 90	
42A-RCM-0603	Black Built-Up Roofing - Felt	Roof A-1 Cut 75	
42B-RCM-0603	Black Built-Up Roofing - Felt	Roof A-1 Cut 76	
42C-RCM-0603	Black Built-Up Roofing - Felt	Roof A-1 Cut 77	
42D-RCM-0603	Black Built-Up Roofing - Felt	Roof A-1 Cut 78	
42E-RCM-0603	Black Built-Up Roofing - Felt	Roof A-1 Cut 79	
42F-RCM-0603	Black Built-Up Roofing - Felt	Roof A-1 Cut 90	

Analysis Method: ☒ PLM ☐ TEM ☐ Other _____ Turnaround Time: 1-week

Please call Fuss & O'Neill at (617) 282-4675 if analyses will not be completed for requested turnaround time listed above.

Email Results to: ddiedricksen @fando.com **Do Not Mail Hard Copy Report** **FAX Results to: 888-838-1160.**

Special Instructions: Analyze ALL samples, do NOT stop positive. Do not layer samples unless indicated. Do not point count. ~~If NOB group samples are **ALL** negative by PLM, analyze the sample denoted with a star (★) by **TEM NOB** on a 1-week turnaround time. Analyze a **MAXIMUM** of 3 samples by **TEM in noted order.**~~

Samples Collected by: _____ **Date:** 6/3/2020

Samples Sent by: _____ **Date:** 6/12/20 **Time:** PM

Shipped To: ☒ EMSL ☐ Other _____

Method of Shipment: ☐ Fed Ex ☒ Lab Drop Off ☐ Other _____

REC'D RMS 0830
EMSL-BOSTON JUN 15 2020
Fed Ex 7958 5058 4494

Appendix D

XRF Lead-Based Paint Screening Field Data Sheet

FUSS & O'NEILL

www.fando.com

108 Myrtle Street, Suite 502, Quincy, MA 02171 (617) 282-4675

XRF Lead-Based Paint Screening Field Data Sheet

Inspector: Mallett XRF Model: RMD – LPA-1 Serial: 1395

Project Name: Millis High School Roof & HVAC Project Date: 6/3/2020

Building Name/Number: Millis High & Middle School Project Number: 20200048.A10

Site Address: 245 Plain Street, Millis, MA Project Manager: Dustin Diedricksen

XRF Calibration Check - RMD (0.7 to 1.3 mg/cm^2 inclusive)

	First Reading	Second Reading	Third Reading	Average
Start Check	1.0	1.0	1.0	1.0
Finish Check	1.0	1.0	1.0	1.0

Room	Side	Surface/Component	Color	Substrate*	XRF Reading	Positive
2nd Floor Corridor	B	Wall (above ceiling tiles)	Beige	Plaster	0.0	
2nd Floor Corridor	C	Wall (above ceiling tiles)	N/C	GWB	0.0	

* Substrate Type: M = Metal, W = Wood, P = Plaster, D = Drywall, C = Concrete, B = Brick, CMU = Concrete Masonry Unit, A = Aluminum, CT = Ceramic Tile
N/A = Not Accessible, N/C = Not Coated, COV = Covered, VR = Vinyl Replacement, POS = Positive

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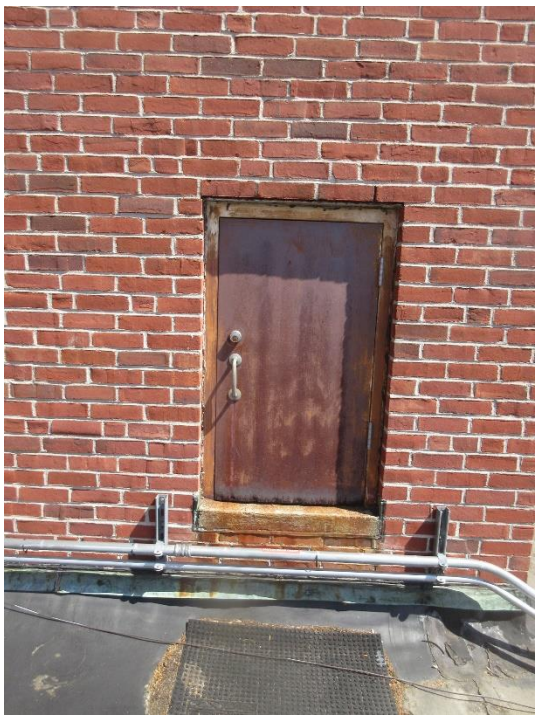
Appendix C – Photo Index of Existing Conditions

T 617 • 268.8977
F 617 • 464.2971
cbiconsultingllc.com
vidaris.com

Millis Middle Shool
Photo Index – Roof Areas A & A.1
CBI Job No.:CB192030
Date: 7/31/2020

Photo No.		Description
1		Partial view of Roof Areas A & A.1. Notice Photovoltaic (PV) Solar Panels located on Roof Area A.
2		Partial view of Roof Area A, covered with PV panels and adjoining brick masonry wall
3		Typical view of rooftop mechanical equipment, skylights and rust corroded vent stack piping.

4		View of existing copper through-wall flashing. Notice the low height of the flashing and damaged conditions, and deteriorated sealant. This condition typical on all roof areas that include through-wall flashing.
5		View of rust corroded access door.

BK/as
Photos A

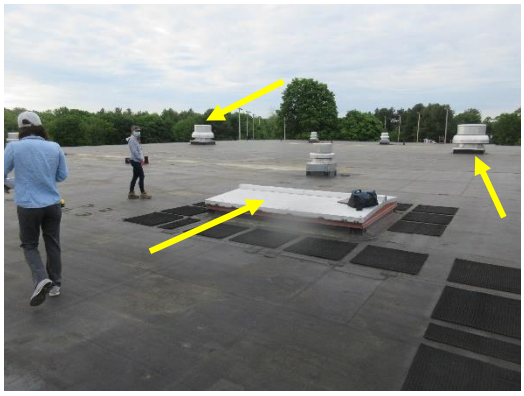
Millis Middle School
Photo Index – Roof Area B
CBI Job No.: CB192030
Date: 7/31/2020

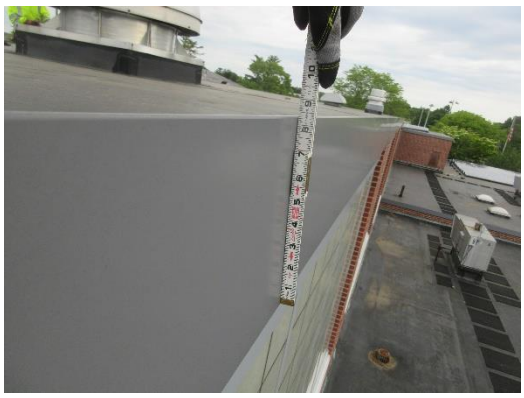
Photo No.		Description
1		Overall view of Roof Area B.
2		Another view of Roof Area B, toward Roof Area A/A.1. Notice rooftop equipment and ponding water.
3		Partial view of Roof Area B, along higher brick masonry wall and copper through-wall counterflashing.

4		View of rooftop HVAC unit.
5		Open laps at HVAC unit curb flashing.
6		Open lap at pitch pocket flashing, adjacent RTU.

BK/as
Photos B

Millis Middle School
Photo Index – Roof Area C
CBI Job No.: CB192030
Date: 7/31/2020

Photo No.		Description
1		Overall view of Roof Area C, which includes large exhaust fans.
2		Partial view of Roof Area C, which includes smoke hatch and exhaust fans.
3		Partial view of Roof Area with exhaust vents and vent pipes. Notice the remanence of ponding water with dirt residue.

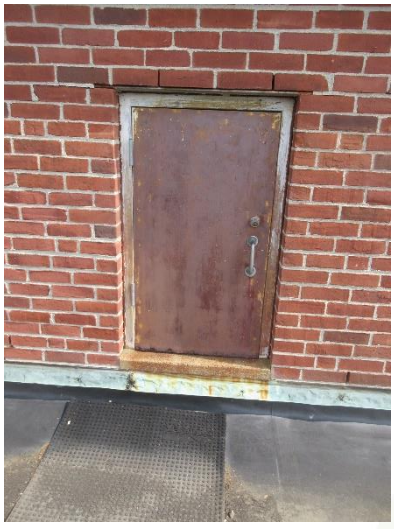
4		Typical perimeter edge metal fascia.
5		View a gap between roofing membrane and edge metal flashing.
6		Roofing test cut in progress, notice rust corroded vent pipe and roof drain.

BK/as
Photos C

Millis Middle School
Photo Index – Roof Area D
CBI Job No.: CB192030
Date: 7/31/2020

Photo No.		Description
1		Overall view of Roof Area D.
2		Another view of Roof Area D, containing skylights, roof drain and exhaust fan. Notice the broken skylight dome sealed with membrane flashing.

2		View of open membrane lap seam at expansion joint.
3		View of open membrane flashing lap seam at exhaust fan curb.
4		View of cracked and deteriorated stucco on Elevator override.

5		View of existing copper through-wall flashing. Notice the low height of the flashing and damaged conditions, and deteriorated sealant. This condition typical on all roof areas that include through-wall flashing.
6		View of existing copper through-wall flashing. Notice the low height of the flashing and damaged conditions, and deteriorated sealant. This condition typical on all roof areas that include through-wall flashing.
7		View of rust corroded access door.

BK/as
Photos D

Millis Middle School
Photo Index – Roof Area D.1
CBI Job No.: CB192030
Date: 7/31/2020

Photo No.		Description
1		Overall view of Roof Area D.1, including RTU and skylight
2		View of skylight. The polycarbonate dome is checked, an cracked, with condensation on the interior surface.
3		Overall view of Roof Area D.1, including skylights, exhaust fan, covered abandoned curb, and rust corroded roof drain. Notice the broken skylight dome sealed with membrane flashing.

4		View of severely buckled roofing insulation below the membrane surface.
5		View of existing copper through-wall flashing. Notice the low height of the flashing and damaged conditions, and deteriorated sealant. This condition typical on all roof areas that include through-wall flashing.
6		View of sealant at adjoining brick masonry wall. The sealant was deteriorated, and included cohesive and adhesive failures.

BK/as
Photos D.1

Millis Middle School
Photo Index – Roof Area E
CBI Job No.: CB192030
Date: 7/10/2020

Photo No.		Description
1		Overall view of Roof Area E, with covered abandoned curbs, RTU unit and exhaust fans.
2		View of clogged roof drain, and sump.
3		View of translucent insulated wall panels of the Gymnasium, and counterflashing detail below.

4		Partial view of Roof Area E, with covered abandoned curbs, RTU unit and skylights.
5		View of brick masonry chimney.
6		The brick masonry chimney includes, cracked, debonded and eroded mortar joints, and random cracked brick.

BK/as
Photos E

Millis Middle School
Photo Index – Roof Area F
CBI Job No.: CB192030
Date: 7/31/2020

Photo No.		Description
1		Overall view of Roof Area F.
2		Partial view of Roof Area F. Notice the remanence of ponding water with dirt residue.
3		Another partial view of Roof Area F. Notice the remanence of ponding water with dirt residue and repair patches.

BK/as
Photos F

Millis Middle School
Photo Index – Roof Area G
CBI Job No.: CB192030
Date: 7/31/2020

Photo No.		Description
1		Partial view of Roof Area G, covered with PV solar panels
2		Another partial view of Roof Area G, covered with PV solar panels.
3		View of elevator override, PV power panels and A/C condenser unit.

4		View of roof access hatch and condiut apply to existing brick masonry wall.
5		View of existing copper through-wall flashing. Notice the low height of the flashing and damaged conditions, and deteriorated sealant. This condition typical on all roof areas that include through-wall flashing.
6		View of repair patch, which includes curled and open lap seams.

7		View of open seam lap adjacent to roof edge.
8		View of repair patches, which includes curled and open lap seams.
9		View of building expansion joint between Roof Area G and H. Notice the joints are covered EPDM membrane seam tape. The joint is also been damaged likely through the years from roof foot traffic on the roof and other activity.

BK/as
Photos G

Millis Middle School
Photo Index – Roof Area H
CBI Job No.: CB192030
Date: 7/31/2020

Photo No.		Description
1		Partial view of Roof Area H.
2		Another partial view of Roof Area H. Notice prior patches and buckled insulation below the membrane surface, and the remanence of ponding water with dirt residue.
3		View are between RTU and exhaust fan, where prior repairs were evident. Also, notice the EPDM membrane field seam, which was adhered with adhesive glue and sealant.

4		Exhaust fan unit curb. Notice the flashing is curled and open.
5		Close view of a typical EPDM membrane field seam, which was adhered with adhesive glue and sealant.
6		This photo was taken during a rain event. Notice the ponding throughout the roof, particularly toward the center of the roof.

BK/as
Photos H

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Appendix D - Photo Index of Roofing Test Cuts

T 617 • 268.8977
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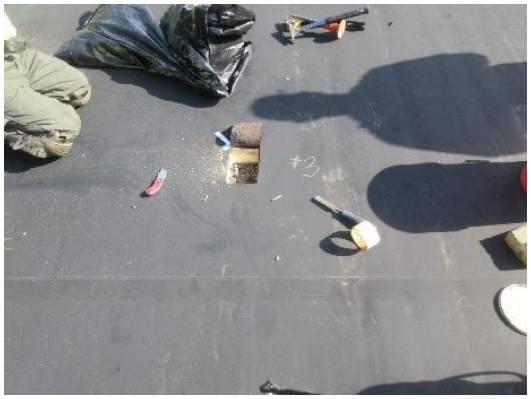
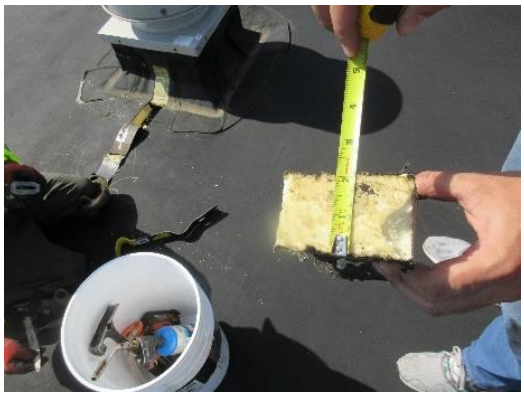
cbiconsultingllc.com
vidaris.com

Millis Middle School
Photo Index
CBI Job No.: CB192030
Date: 7/31/2020

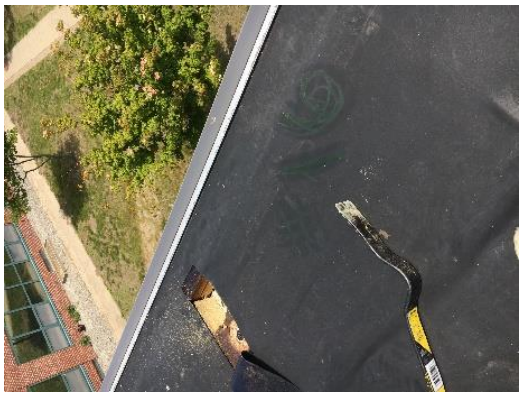
Photo No.		Description
1		Test Cut #1-Roof H - EPDM Membrane - 2.25''Polyisocyanurate - 5-Ply Gravel Surface BUR
2		Test Cut #2 -Roof H - EPDM Membrane - 2.25''Polyisocyanurate - 5-Ply Gravel Surface BUR
3		Test Cut #3 -Roof H - EPDM Membrane - 2.25''Polyisocyanurate - 5-Ply Gravel Surface BUR

4		Test Cut #4 -Roof H - EPDM Membrane - 2.25''Polyisocyanurate - 5-Ply Gravel Surface BUR
5		Test Cut #5 -Roof H - EPDM Membrane - 2.25''Polyisocyanurate - 5-Ply Gravel Surface BUR
6		Test Cut #6 -Roof H - EPDM Membrane - 2.25''Polyisocyanurate - 5-Ply Gravel Surface BUR

7		Test Cut #7 -Roof H - EPDM Membrane - 2.25''Polyisocyanurate - 5-Ply Gravel Surface BUR
8		Test Cut #8 -Roof H - EPDM Membrane - 2.25''Polyisocyanurate - 5-Ply Gravel Surface BUR
9		Test Cut #9 -Roof H - EPDM Membrane - 2.25''Polyisocyanurate - 5-Ply Gravel Surface BUR

10		Test Cut #10 -Roof H - EPDM Membrane - 2.25''Polyisocyanurate - 5-Ply Gravel Surface BUR
11		Test Cut #11 -Roof H - EPDM Membrane - 2.25''Polyisocyanurate - 5-Ply Gravel Surface BUR
12		Test Cut #12 -Roof H - EPDM Membrane - 2.25''Polyisocyanurate - 5-Ply Gravel Surface BUR

13		Test Cut #13 -Roof H - EPDM Membrane - 2.25''Polyisocyanurate - 5-Ply Gravel Surface BUR
14		Test Cut #14 -Roof G - EPDM Membrane - Tapered Edge Wood Fiberboard - 2.75''Polyisocyanurate
15		Test Cut #15 -Roof G - EPDM Membrane - 2.75''Polyisocyanurate

16		Test Cut #16 -Roof G - EPDM Membrane - 2.75''Polyisocyanurate
17		Test Cut #17 -Roof G - EPDM Membrane - 2.75''Polyisocyanurate
18		Test Cut #18 -Roof G - EPDM Membrane - 2.75''Polyisocyanurate

19		Test Cut #19 -Roof G - EPDM Membrane - 2.75''Polyisocyanurate
20		Test Cut #20 -Roof G - EPDM Membrane - 2.75''Polyisocyanurate
21		Test Cut #21 -Roof G - EPDM Membrane - 2.75''Polyisocyanurate

22		Test Cut #22 -Roof G - EPDM Membrane - 2.75''Polyisocyanurate
23		Test Cut #23 -Roof G - EPDM Membrane - 2.75''Polyisocyanurate
24		Test Cut #24 -Roof G - EPDM Membrane - 2.75''Polyisocyanurate

25		Test Cut #25 -Roof G - EPDM Membrane - 2.75''Polyisocyanurate
26		Test Cut #26 -Roof G - EPDM Membrane - 2.75''Polyisocyanurate
27		Test Cut #27 -Roof G - EPDM Membrane - 2.75''Polyisocyanurate

28		Test Cut #28 -Roof G - EPDM Membrane - 2.75''Polyisocyanurate
29		Test Cut #29 -Roof G - EPDM Membrane - 2.75''Polyisocyanurate
30		Test Cut #30 -Roof G - EPDM Membrane - 2.75''Polyisocyanurate

31		Test Cut #31 -Roof G - EPDM Membrane - 2.75''Polyisocyanurate
32		Test Cut #32 -Roof C - EPDM Membrane - 2.75''Polyisocyanurate
33		Test Cut #33 -Roof C - EPDM Membrane - 2.75''Polyisocyanurate

34		Test Cut #34 -Roof C - EPDM Membrane - 2.75''Polyisocyanurate
35		Test Cut #35 -Roof C - EPDM Membrane - 2.75''Polyisocyanurate
36		Test Cut #36 -Roof C - EPDM Membrane - 2.75''Polyisocyanurate

37		Test Cut #37 -Roof C - EPDM Membrane - 2.75''Polyisocyanurate
38		Test Cut #38 -Roof C - EPDM Membrane - 2.75''Polyisocyanurate
39		Test Cut #39 -Roof C - EPDM Membrane - 2.75''Polyisocyanurate

40		Test Cut #40 -Roof C - EPDM Membrane - 2.75''Polyisocyanurate
41		Test Cut #41 -Roof C - EPDM Membrane - 2.75''Polyisocyanurate
42		Test Cut #42 -Roof C - EPDM Membrane - 2.75''Polyisocyanurate

43		Test Cut #43 -Roof D - EPDM Membrane - 2.75''Polyisocyanurate
44		Test Cut #44 -Roof D - EPDM Membrane - 2.25''Polyisocyanurate - 5-Ply Gravel Surface BUR
45		Test Cut #45 -Roof D - EPDM Membrane - 2.25''Polyisocyanurate - 5-Ply Gravel Surface BUR

46		Test Cut #46 -Roof D - EPDM Membrane - 2.25''Polyisocyanurate - 5-Ply Gravel Surface BUR
47		Test Cut #47 -Roof D - EPDM Membrane - 2.25''Polyisocyanurate - 5-Ply Gravel Surface BUR
48		Test Cut #48 -Roof D - EPDM Membrane - 2.25''Polyisocyanurate - 5-Ply Gravel Surface BUR

49		Test Cut #49 -Roof D - EPDM Membrane - 2.75''Polyisocyanurate - 5-Ply Gravel Surface BUR
50		Test Cut #50 -Roof D - EPDM Membrane - 2.75''Polyisocyanurate - 5-Ply Gravel Surface BUR
51		Test Cut #51 -Roof D - EPDM Membrane - 2.75''Polyisocyanurate - 5-Ply Gravel Surface BUR

52		Test Cut #52 -Roof D - EPDM Membrane - 2.75''Polyisocyanurate - 5-Ply Gravel Surface BUR
53		Test Cut #53 -Roof D.1 - EPDM Membrane - 2.25''Polyisocyanurate - 5-Ply Gravel Surface BUR
54		Test Cut #54 -Roof D.1 - EPDM Membrane - 2.25''Polyisocyanurate - 5-Ply Gravel Surface BUR

55		Test Cut #55 -Roof D.1 - EPDM Membrane - 2.25''Polyisocyanurate - 5-Ply Gravel Surface BUR
56		Test Cut #56 -Roof D.1 - EPDM Membrane - 2.25''Polyisocyanurate - 5-Ply Gravel Surface BUR
57		Test Cut #57 -Roof D.1 - EPDM Membrane - 2.25''Polyisocyanurate - 5-Ply Gravel Surface BUR

58		Test Cut #58 -Roof D.1 - EPDM Membrane - 2.25''Polyisocyanurate - 5-Ply Gravel Surface BUR
59		Test Cut #59 -Roof D.1 - EPDM Membrane - 2.25''Polyisocyanurate - 5-Ply Gravel Surface BUR
60		Test Cut #60 -Roof D.1 - EPDM Membrane - 2.5''Polyisocyanurate - 5-Ply Gravel Surface BUR

61		Test Cut #61 -Roof D.1 - EPDM Membrane - 2.25''Polyisocyanurate - 5-Ply Gravel Surface BUR
62		Test Cut #62 -Roof E - EPDM Membrane - 2.75''Polyisocyanurate - 5-Ply Gravel Surface BUR
63		Test Cut #63 -Roof E - EPDM Membrane - 2.75''Polyisocyanurate - 5-Ply Gravel Surface BUR

64		Test Cut #64 -Roof E - EPDM Membrane - 2.75''Polyisocyanurate - 5-Ply Gravel Surface BUR
65		Test Cut #65 -Roof E - EPDM Membrane - 2.75''Polyisocyanurate - 5-Ply Gravel Surface BUR
66		Test Cut #66 -Roof E - EPDM Membrane - 2.75''Polyisocyanurate - 5-Ply Gravel Surface BUR

67		Test Cut #67 -Roof E - EPDM Membrane - 2.75''Polyisocyanurate - 5-Ply Gravel Surface BUR
68		Test Cut #68 -Roof E - EPDM Membrane - 2.75''Polyisocyanurate - 5-Ply Gravel Surface BUR
69		Test Cut #69 -Roof E - EPDM Membrane - 2.75''Polyisocyanurate - 5-Ply Gravel Surface BUR

70		Test Cut #70 -Roof E - EPDM Membrane - 2.75''Polyisocyanurate - 5-Ply Gravel Surface BUR
71		Test Cut #71 -Roof F - EPDM Membrane - 2.75''Polyisocyanurate - 5-Ply Gravel Surface BUR
72		Test Cut #72 -Roof F - EPDM Membrane - 2.75''Polyisocyanurate - 5-Ply Gravel Surface BUR

73		Test Cut #73 -Roof F - EPDM Membrane - 2.75''Polyisocyanurate - 5-Ply Gravel Surface BUR
74		Test Cut #74 -Roof F - EPDM Membrane - 2.75''Polyisocyanurate - 5-Ply Gravel Surface BUR
75		Test Cut #75 -Roof A.1 - EPDM Membrane - 2.75''Polyisocyanurate - 5-Ply Gravel Surface BUR

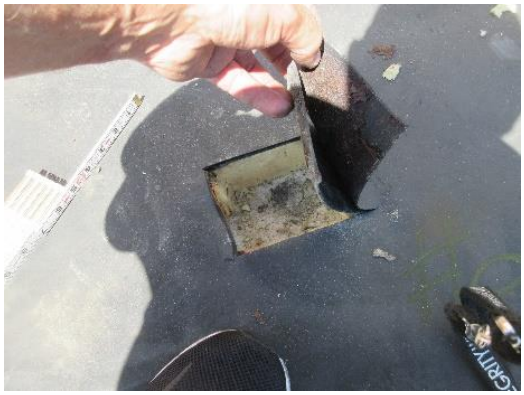
76		Test Cut #76 -Roof A - EPDM Membrane - 2.75''Polyisocyanurate - 5-Ply Gravel Surface BUR
77		Test Cut #77 -Roof A.1 - EPDM Membrane - 2.75''Polyisocyanurate - 5-Ply Gravel Surface BUR
78		Test Cut #78 -Roof A.1 - EPDM Membrane - 2.75''Polyisocyanurate - 5-Ply Gravel Surface BUR

79		Test Cut #79 -Roof A.1 - EPDM Membrane - 2.25''Polyisocyanurate - SBS Modified Membrane
80		Test Cut #80 -Roof A - EPDM Membrane - 2.75''Polyisocyanurate
81		Test Cut #81 -Roof A - EPDM Membrane - 2.75''Polyisocyanurate

82		Test Cut #82 -Roof A - EPDM Membrane - 2.75''Polyisocyanurate
83		Test Cut #83 -Roof A - EPDM Membrane - 2.75''Polyisocyanurate
84		Test Cut #84 -Roof A - EPDM Membrane - 2.75''Polyisocyanurate

85		Test Cut #85 -Roof A - EPDM Membrane - 2.75''Polyisocyanurate
86		Test Cut #86 -Roof A - EPDM Membrane - 2.75''Polyisocyanurate
87		Test Cut #87 -Roof A - EPDM Membrane - 2.75''Polyisocyanurate

88		Test Cut #88 -Roof B - EPDM Membrane - 2.75''Polyisocyanurate
89		Test Cut #89 -Roof B - EPDM Membrane - 2.75''Polyisocyanurate
90		Test Cut #90 -Roof B - EPDM Membrane - 2.75''Polyisocyanurate

91		Test Cut #91 -Roof B - EPDM Membrane - 2.75’’Polyisocyanurate
92		Test Cut #92 -Roof B - EPDM Membrane - 2.75’’Polyisocyanurate
93		Test Cut #93 -Roof B - EPDM Membrane - 2.75’’Polyisocyanurate

94		Test Cut #94 -Roof B - EPDM Membrane - 2.75’’Polyisocyanurate

BK/as
Appendix D - Millis Test Cuts

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Appendix E – Roofing Test Cut Location Plan

T 617 • 268.8977
F 617 • 464.2971
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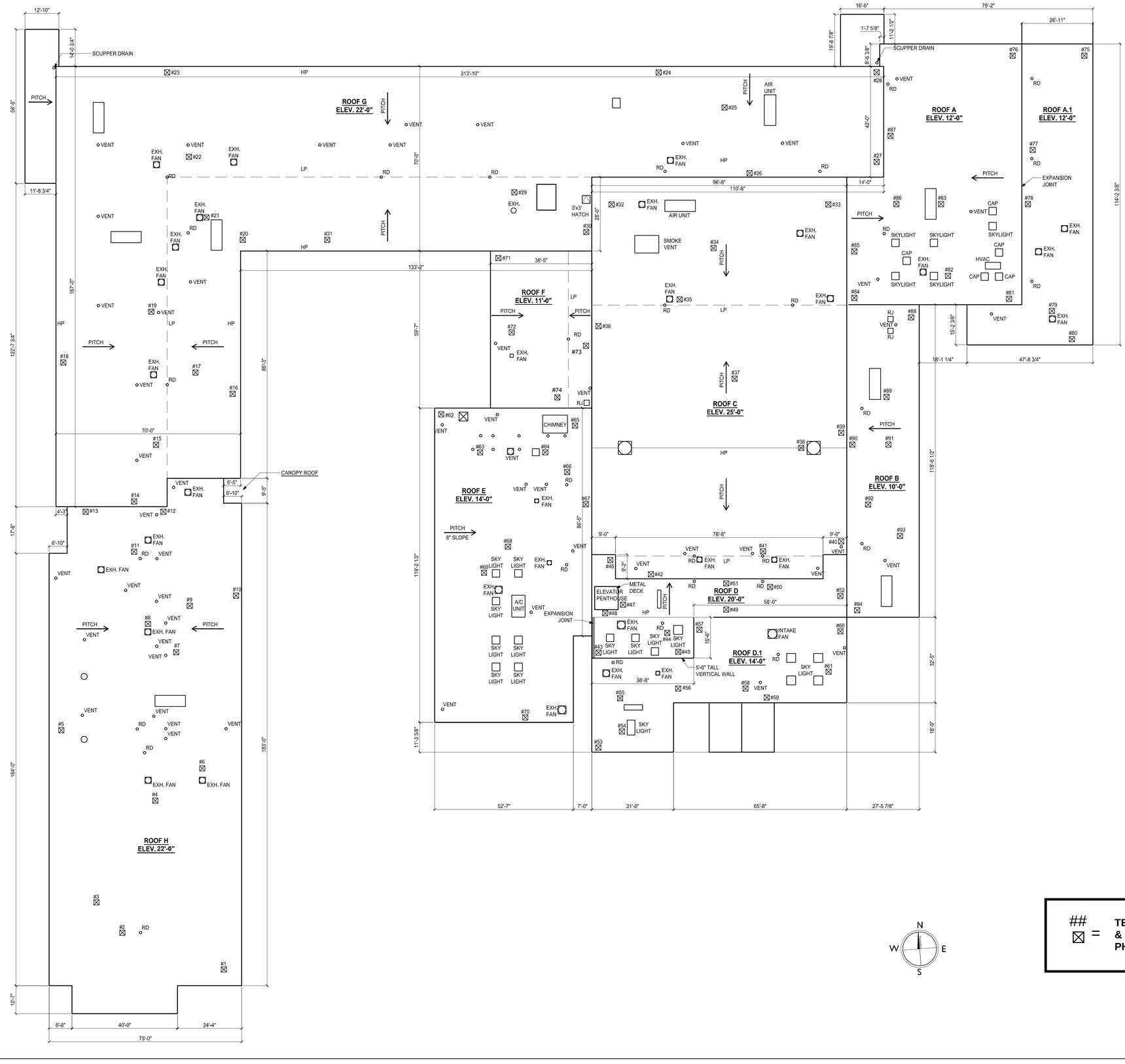
vidaris.com



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N
W E
S

☒ = TEST CUT NUMBER & LOCATION - REFER PHOTO INDEX

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MILLIS MIDDLE SCHOOLE

TOWN OF MILLIS

245 PLAIN ST
MILLIS, MA 02054

Drawing Title:

ROOFING TEST CUT LOCATION PLAN

Revisions:

PROGRESS SET NOT FOR CONSTRUCTION

Submission:

EXISTING CONDITIONS

Date:	2/6/2020
Project Number:	CB192030
Project Manager:	ALS
Drawn By:	LY/JK
Scale:	1/16"=1'-0"

A1-01

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Appendix F – Structural Reserve Capacity Plan

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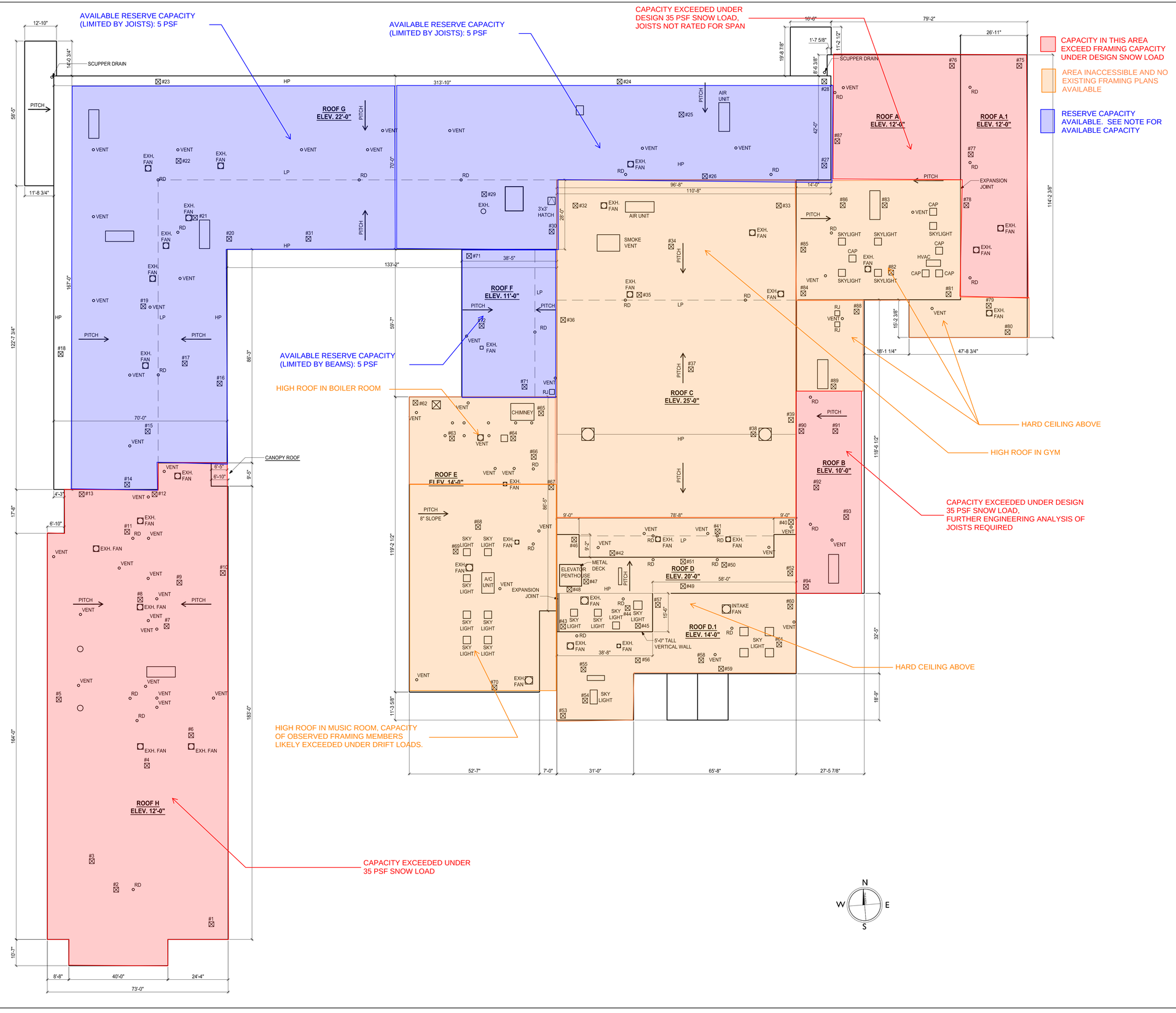

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A1-01

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