

**ROOF EVALUATION
POLICE DEPARTMENT
59 MAIN STREET
PEPPERELL, MA 01463
GALE JN 834720**

INTRODUCTION

In accordance with our agreement, Gale Associates, Inc. (Gale) performed a visual evaluation of the existing sloped asphalt shingle roof and slate-clad dormers at the Pepperell Police Department to determine their condition and provide recommendation for repairs and or replacement. Gale’s visual evaluation was performed on Tuesday, January 15, 2019. During the evaluation, we performed the following scope of services:

- Toured the facility with Police Station personnel who are familiar with the building’s moisture infiltration and repair history.
- Viewed the interior attic space of the Police Station to locate damages due to reported moisture infiltration.
- Performed a visual evaluation of the roofing and flashing systems from grade using binoculars and from dormer windows.
- Performed a visual evaluation of the roof and dormers via drone survey.
- Located observed deficiencies on a digital plan that was obtained via satellite imagery. Roof plans were not available for this facility.



Figure 1: Drone image of the front of the Police Department roof, which consists of asphalt shingles.

BACKGROUND INFORMATION

The Police Department was originally the home of the Clara M. Shattuck School, which opened in 1898. The building had closed in 1980 and remained unoccupied until approximately 1990, when it became the home of the Town of Pepperell’s Public Safety Building. The building’s exterior walls consist of multi-wythe brick masonry construction with decorative granite and cast elements at the ground floor and around the main entrance.

EXISTING CONDITIONS

The roof system on the building, including the dormers, consists of a combination of three-tab and architectural asphalt shingles. The age of the sloped asphalt shingle roof system is unknown at this time however it appears to be approximately 25 to 30 years old. Roof valley flashings consist of copper that extend to the gutters. Ridge and hip flashings consist of asphalt shingles. Perimeter aluminum gutters are drained by aluminum downspouts that direct water to grade. Slate shingles clad the dormer facades and cheek walls. Single-pane, wood windows and painted wood trim accent the dormer façades. Copper flashings are installed at the base of the slate cladding. Single-pane, wood windows and painted wood trim accent the dormer façades.

INTERIOR LEAK AUDIT

An interior leak audit was performed during a period of non-precipitation with below-freezing exterior temperatures. Therefore, the location of reported leak areas was based on Gale’s visual observation of the underside of the wood-plank roof deck and wood framing. Water staining was visible on the underside of the wood-plank deck and wood framing at each of the reported leak locations.

According to Police Department personnel, the building is currently experiencing issues associated with moisture infiltration, and it has for many years. Due to access limitations, there is no evidence or known history of repairs. Evidence of leaks observed included the following:

1. Water staining on the underside of the wood-plank deck and the wood beams beneath the west dormer on the south side of the building (figure 2).
2. Water staining on the underside of the wood-plank deck and the wood beams starting from the chimney on the south side of the building (figure 3).
3. Water staining on the underside of the wood-plank deck and wood beams under the east valley on the north side of the building (figure 4).
4. Water staining on the underside of the wood-plank deck and wood beams under the east valley on the north side of the building (figure 4).

Refer to the comments below and to the attached roof plan in Appendix A, which shows the approximate location of the reported leak locations in the Police Department attic.



Figure 2: Water staining was noted on the underside of the wood-plank deck and on wood beams at the dormer on the west end, south side of the building.

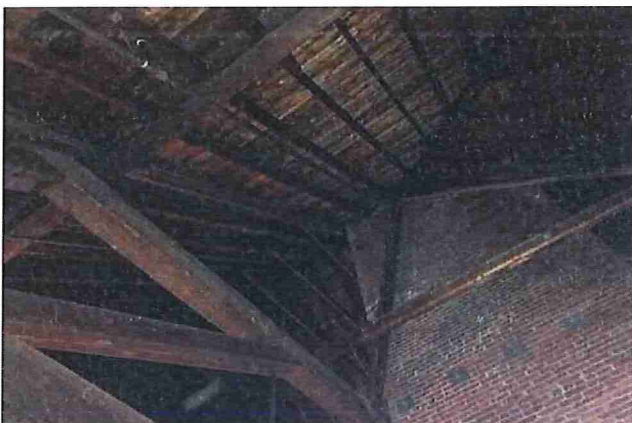


Figure 3: Water staining on the underside of the wood-plank deck and on roof rafters on the south side of the roof near the chimney.



Figure 4: Water staining on the underside of the wood-plank deck and wood rafters at the roof valley.

OBSERVATIONS

In accordance with our agreement, Gale performed a visual evaluation of the existing roof, flashings and associated dormer cladding and flashing components for the purpose of identifying conditions that may be associated with reported interior moisture infiltration issues, and to provide recommendations for repairs, replacement or other improvements to these systems.

The shingles exhibit deterioration, which appears most prominent on the north and partial west sides of the roof. Widespread loss of granular surfacing is noted throughout. Vegetative growth indicates that water is present in the roof system, and is noted prominently on the north elevation, and at random locations on the east and west sides of the roof. Damaged and missing shingles are noted on the roof near the southwest dormer, where moisture infiltration occurs. Concentrated displacement of, and scattered damaged, asphalt shingles are noted on the east dormer.

The copper flashing at roof valleys are open at the seams. It appears that one seam is reverse-lapped in the valley at the northeast corner of the building. This condition appears to coincide with the reported moisture infiltration inside the attic at this location.

Substrate deterioration could not be confirmed however, due to the water staining observed on the underside of the roof deck, there could potentially be

areas of deteriorated wood-plank decking. Please note that destructive testing (removal of exterior components) was not included in the scope of our evaluation.

The aluminum gutters appear in overall good condition. However, the displaced gutter on the north and partial west edges of the building require attention.

Wood windows are beyond their useful service life. They are generally deteriorated and do not function. The existing wood trim is experiencing peeling paint throughout. Deterioration of wood components could not be confirmed, as Gale did not perform a physical assessment of the dormers.

The chimney exhibits widespread deterioration of mortar within the masonry joints. Vegetative growth on the north side of the chimney indicates that the masonry is not drying sufficiently. Large step cracks run from the top of the chimney to the roof on each of the chimney's elevations.

The lead flashing on the south side of the chimney is damaged and open to moisture entry. The attic space beneath the chimney is currently experiencing moisture infiltration as a result.

The following specific observations and conditions are based on Gale's field evaluation:



Figure 5: Photo from the building interior shows visible daylight at the roof edge beyond the wall plane. This condition provides ventilation to the attic.



Figure 6: Dormers facades and cheek walls are clad with slate. Wood windows and painted trim accent the facades.



Figure 7: Closeup photo of wood windows and painted wood trim on a representative dormer.



Figure 8: Drone image of the upper north side of the roof where widespread deterioration of asphalt shingles is noted.



Figure 9: Drone image of the lower north side of the roof where widespread deterioration of asphalt shingles is noted.



Figure 10: Drone image of the east end, north side, of the roof where widespread deterioration of asphalt shingles is noted.



Figure 11: Drone image shows deterioration of shingles on the west side roof.

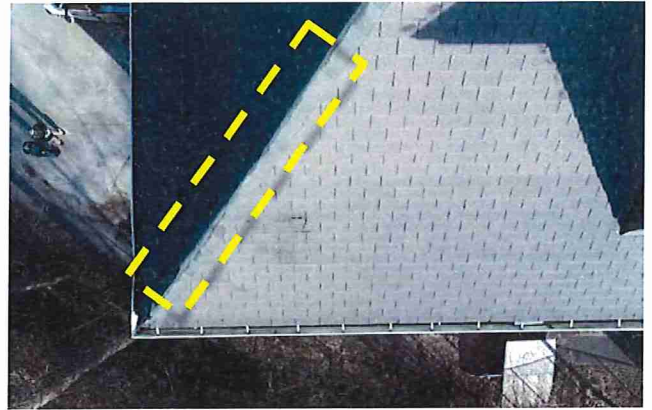


Figure 12: Drone image shows deterioration of shingles on the southwest hip of the roof (dashed outline).



Figure 13: Drone image shows damaged and missing asphalt shingles adjacent to the southwest dormer. The damage closer to the ridge is in the proximity of the reported moisture infiltration below (figure 2).



Figure 14: Drone image shows an overview of the conditions referenced in figures 11 and 12.

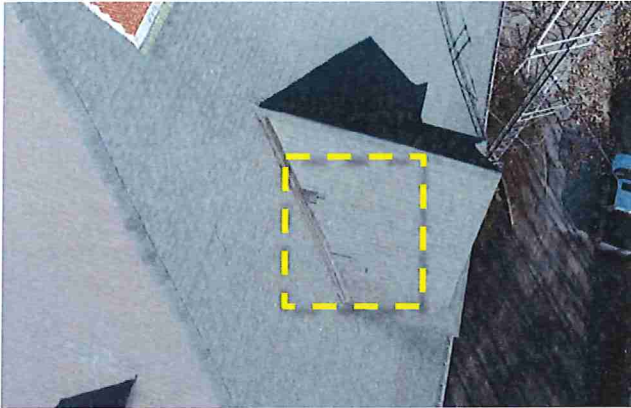


Figure 15: Drone image shows damaged and displaced asphalt shingles on the east dormer roof.



Figure 18: Drone image shows the gutter on the south edge of the roof. The gutter appears clear of debris and obstructions to the downspouts.



Figure 16: Drone image shows the copper valley flashing above the reported leak area at the northeast corner of the building. The flashing appears to have open seams, one that appears reverse-lapped (dashed outline) that could allow moisture to bypass the roof system.

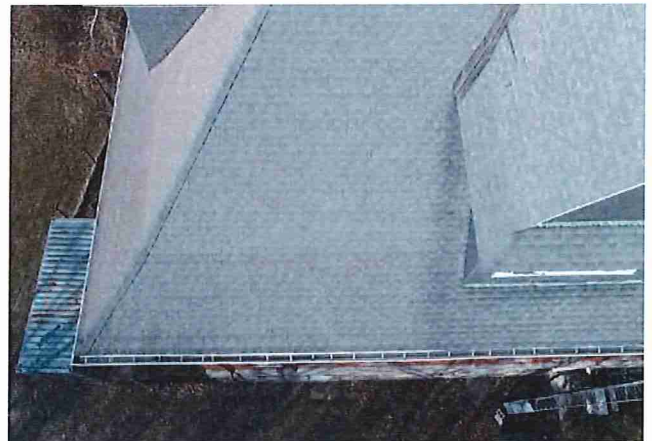


Figure 19: Drone image of the east side roof and gutter. The asphalt shingles exhibit scattered deterioration. The gutter appears clear of debris and obstructions to the downspouts.



Figure 17: Drone image shows the aluminum gutter on the north and west edges of the roof exhibit some deflection. The gutter flange appears loose on the north edge of the roof. The gutter generally appears clear of debris and obstructions to the downspouts.



Figure 20: Deteriorated wood trim (arrow) noted on the soffit of the west-side dormer.



Figure 21: Closeup photo of a dormer façade shows loose, damaged and missing slate. Wood window sashes are deteriorated. Peeling paint is noted on wood trim.

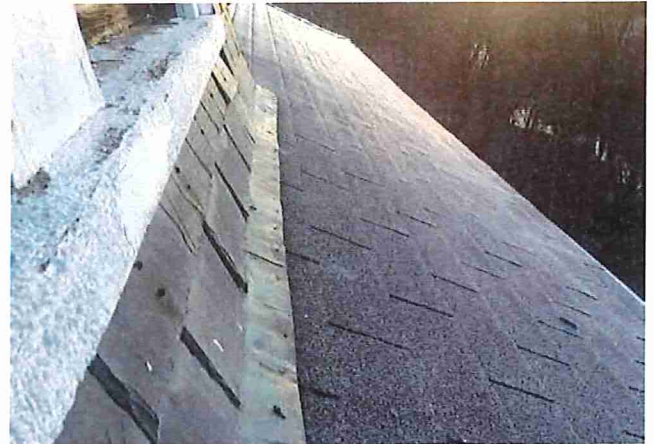


Figure 24: Closeup photo from inside a dormer shows slate nails are generally rusted and loose (backing out).



Figure 22: Closeup photo of a dormer façade shows loose and missing slate. Wood window sashes are deteriorated. Peeling paint is noted on wood trim.

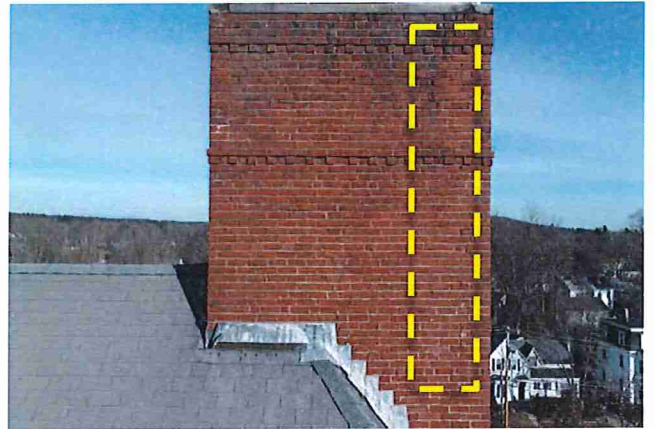


Figure 25: Drone image shows deteriorated mortar joints and step cracking (dashed outline) on the south side of the chimney. The metal flashing, which appears to be lead, at the chimney base is torn open, allowing moisture to bypass the flashing and migrate to the underside of the shingles, and building interior.

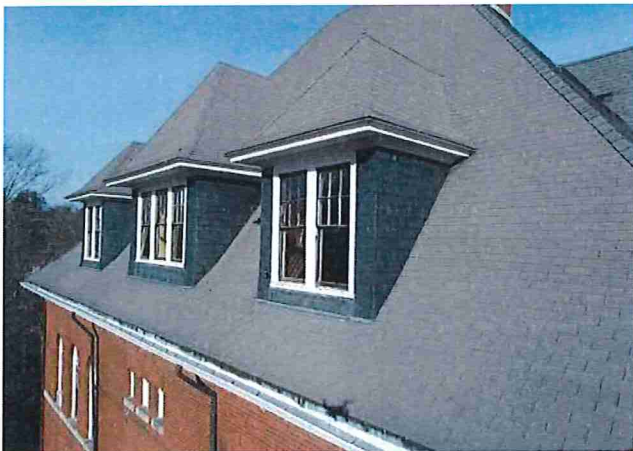


Figure 23: Angled drone image shows loose, damaged and missing slate on the cheek walls as well as on the facades.

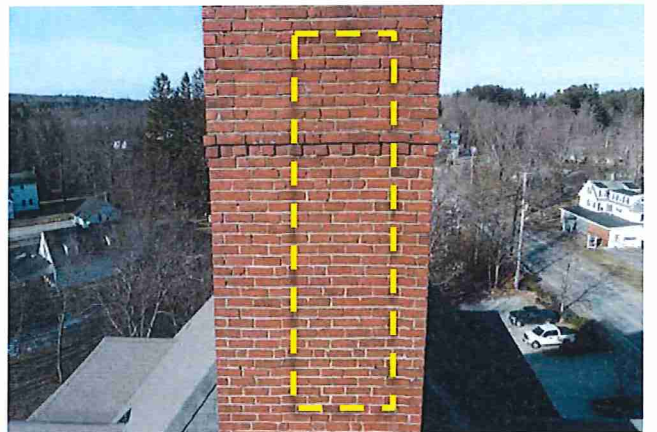


Figure 26: Drone image shows deteriorated mortar joints and step cracking (dashed outline) on the east side of the chimney.

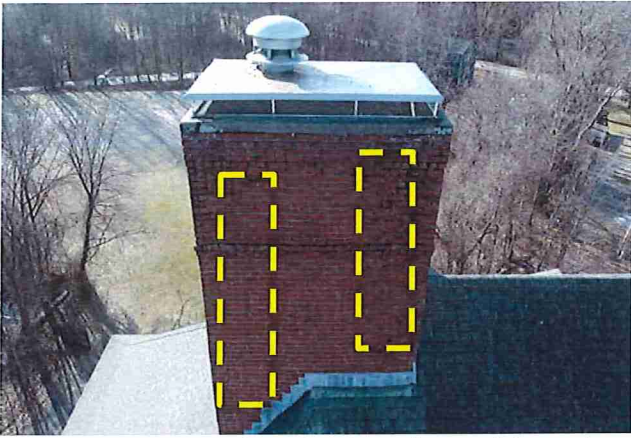


Figure 27: Drone image shows deteriorated mortar joints and step cracking (dashed outline) on the north side of the chimney. Vegetative growth within the mortar joints indicates the masonry is not drying sufficiently on this elevation.

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DISCUSSION AND RECOMMENDATIONS

The building interior had experienced issues associated with moisture infiltration below the sloped asphalt shingle roof, including water staining on the underside of the wood roof deck. According to Police Department personnel, there is no documented history of repairs that may have been performed to address the reported moisture infiltration issues. During our visual evaluation of the sloped roof and associated components, Gale noted there were no visible repairs above reported leak locations. We also found several conditions that could be associated with moisture infiltration inside the building.

Sloped Asphalt Shingle Roofing – Based on Gale’s observations, which include deterioration and loss of granular surfacing, damaged and missing shingles, open copper flashings and interior water staining, repairs to the existing sloped asphalt shingle roofing should be considered. Short-term repairs could extend the useful service life of the asphalt shingle roof, in terms of addressing moisture infiltration issues. Short-term repairs would include the following:

1. Replace damaged shingles where noted on the roof.
2. Re-secure the loose and displaced shingles on the east dormer roof.
3. Strip-in copper valley flashing seams with uncured EPDM rubber stripping.
4. Re-secure the aluminum gutter on the north and west elevations.

Please note that short-term repairs may not provide a cost-effective approach, as the contractor would be required to access the roof via boom lift or staging. As such, the costs associated with mobilization could potentially exceed the costs for the short-term repairs.

Due to the deteriorated condition of the roof, Gale recommends complete removal and replacement of the asphalt shingle roof and associated flashings within 2 to 3 years. Gale also recommends the replacement of the aluminum gutters with new copper gutters and downspouts to avoid compatibility issues between dissimilar metals.

The dormer cladding is in poor condition and requires removal and replacement. Several slates are damaged, loose and displaced. Nails are typically rusted and loose which could result in the detachment of slate from the dormers. The slate cladding should be removed down to the wood substrate to accommodate repairs to any deteriorated substrate conditions (if found). Further review of the substrate conditions would be required to identify areas of deteriorated or damaged substrates that would need to be addressed during the roof replacement. New slate, underlayment membrane and nail base should be installed over the existing substrate. Cladding replacement should include new copper flashings at cheek walls and at the façade.

Since the wood windows are deteriorated and beyond their useful service life, they should be removed and replaced with new, thermally efficient windows and perimeter membrane flashings and sill-pan flashings. The existing wood trim appears to need 100% scraping and repainting. Deterioration of wood components could not be confirmed, as Gale did not perform a physical assessment of the dormers. Further review of the wood components would be required to confirm the locations of deteriorated wood that will need to be replaced.

Chimney – Based on the widespread deterioration of mortar joints, vegetative growth, step cracking and damaged flashing observed, the chimney should be demolished down to roof level and be reconstructed complete with new copper or lead coated copper flashings.

PRELIMINARY COST ESTIMATES:

The budget estimates presented in this report are based on current construction costs and should be considered preliminary and should not be used for sensitive budgeting. All estimating was performed using historical and market trends to establish unit pricing. These estimates have been generated by various sources and may not reflect the actual conditions at the time of construction. These budget estimates do not include additional engineering evaluation or design services, construction

administration services, or permitting costs. These budget estimates also do not include soft costs associated with Town of Pepperell's project management, site supervision, designer fees. The line items within the estimate include a fifteen-percent (15%) design and construction contingency, as a defined scope has not been determined, as well as to account for potential unforeseen conditions that may be encountered. The potential budget is as follows:

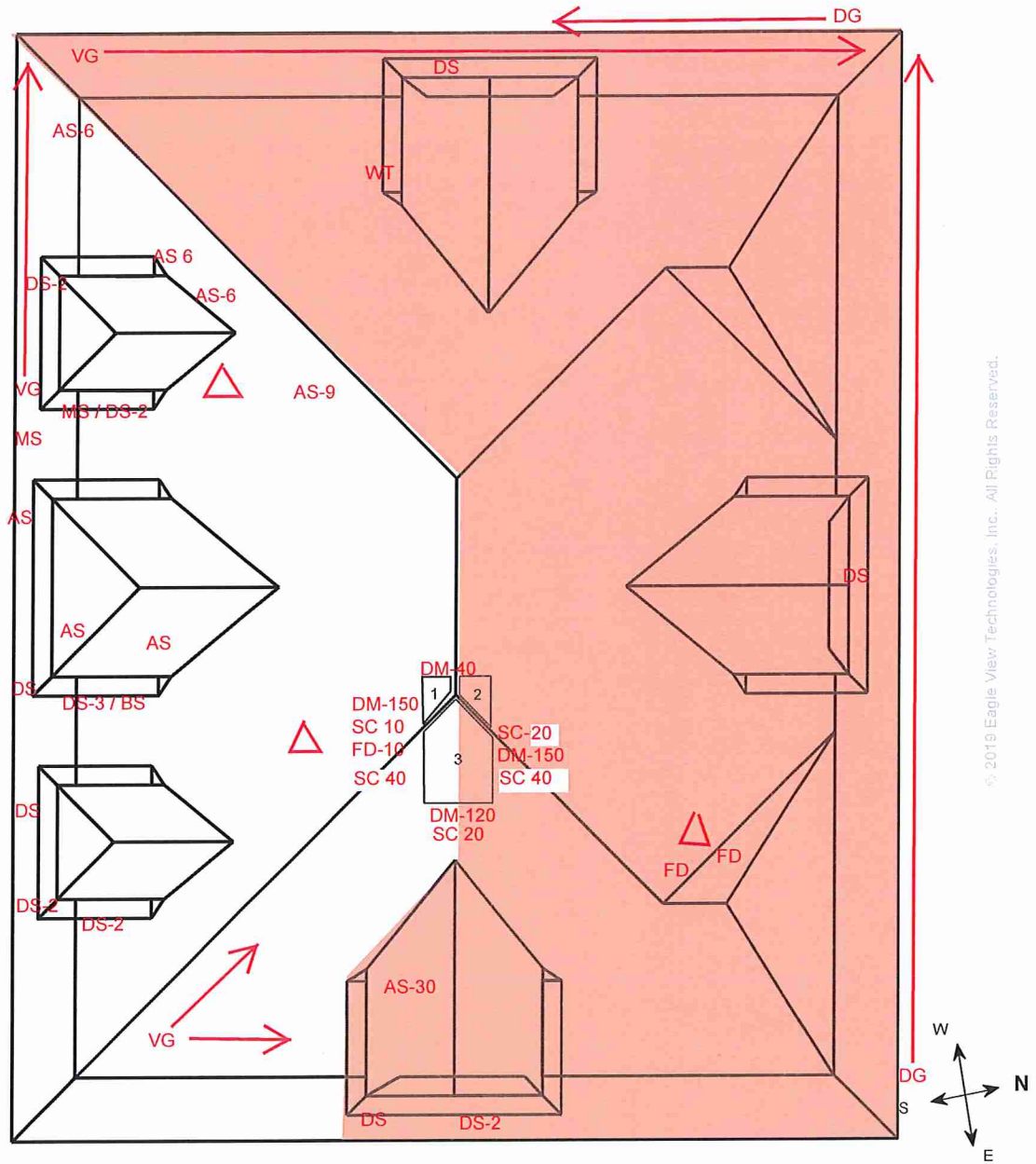
Short-Term Repairs:

<i>Replace damaged asphalt shingles</i>	<i>\$2,250.00</i>
<i>Replace loose and displaced asphalt shingles</i>	<i>\$2,250.00</i>
<i>Strip-in copper valley flashing seams</i>	<i>\$3,200.00</i>
<i>Re-secure aluminum gutter</i>	<i>\$2,350.00</i>
<i>Man-lift to access to the work area</i>	<i>\$7,200.00</i>
Construction Budget	\$17,250.00
(With 15% Design and Construction Contingency)	\$19,838.00

Long-Term Repairs:

<i>Sloped roof replacement (includes flashing and gutter replacement)</i>	<i>\$194,000.00</i>
<i>Re-clad dormers with new slate</i>	<i>\$57,000.00</i>
<i>Replace wood windows</i>	<i>\$24,000.00</i>
<i>Remove and rebuild chimney</i>	<i>\$60,000.00</i>
Construction Budget	\$335,000.00
(With 15% Design and Construction Contingency)	\$385,250.00

GALE ASSOCIATES, INC.
 ROOF EVALUATION
 POLICE DEPARTMENT
 PEPPERELL, MA



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CONDITION LEGEND:
 DG - DISPLACED GUTTER
 VG - VEGETATIVE GROWTH
 AS - DAMAGED / MISSING ASPHALT SHINGLE
 DS - DISLODGED SLATE
 MS - MISSING SLATE
 BS - BROKEN SLATE
 SC - STEP CRACK IN MASONRY
 DM - DETERIORATED MORTAR IN MASONRY
 WT - WOOD TRIM DEFECT (DETERIORATED)
 FD - METAL FLASHING DEFECT
 [Red shaded area] - GENERAL DETERIORATED SHINLE AREA
 [Red triangle] - REPORTED LEAK LOCATION

GENERAL NOTES:
 1. ASPHALT SHINGLES EXHIBIT WIDESPREAD LOSS OF GRANULE SURFACING.
 2. ASPHALT SHINGLES IN HATCHED AREA EXHIBIT ADVANCED DETERIORATION COMPARED TO ADJACENT NON-HATCHED AREA.
 3. SLATE-SHINGLE CLADDING ON DORMERS IS GENERALLY LOOSE; NAILS ARE RUSTED AND BACKED OUT AT MANY LOCATIONS.
 4. DORMER WINDOWS ARE PUTTY-GLAZED, SINGLE-PANE WOOD-FRAMED WINDOWS. SASHES ARE TYPICALLY DETERIORATED; GLAZING BEADS ARE MISSING.