GALE

Evaluation for the Roof Replacement and Associated Work at the Warren House Newton, MA

June 7, 2007

Gale JN 817220

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Prepared for:
Newton Community Development Foundation, Inc.
Newton, MA

table of contents

INTRODUCTION

In accordance with our Contract, Gale Associates, Inc. (Gale) has completed our evaluation of the roofing, flashing and associated required work at the Warren House located in Newton, Massachusetts. Throughout the month of April 2007, representatives from Gale traveled to the Warren House to perform field evaluations and research. The purpose of Gale's services is to identify potential sources of leakage infiltration and generate a phasing plan for repairs of the above roofline components and for replacement of the roof covering. Gale's evaluation included visual observations, destructive testing of roofing components and a review of the interior conditions where water infiltration is reportedly occurring. The purpose of this report is to aid The Newton Community Development Foundation (NCDF) in identifying the items that require immediate repair/replacement and to provide recommendations, preliminary budget estimates and construction time lines.

OBSERVATIONS

The following outlines the conditions of each of the roof areas. Refer to the attached Roof Area Plan for additional information and Roof Designations.

North Wing Roof

The North Wing Roof is comprised of steep slope slate roofs and a low sloped ballasted EPDM roof. Two brick masonry chimney units are located on either end of the slate roofs, and a cupola composed of a stucco base and sheet metal upper portion is located in the center of the slate roof.

Low Sloped Roof Cover

- The ballasted EPDM roof is in fair to poor condition. Much of the roof area is congested with duct work and wood stairs/platforms. Delaminated membrane seams and patches, as well as soft insulation were noted through out the roof area. Defects such as delaminated seams and patches could be potential sources of moisture intrusion into the roof area. Areas of soft insulation indicate moisture within the insulation layer or crushed insulation components. The aluminum parapets around the perimeter of the roof have been stripped in with elastomeric flashings.

- Test cuts performed at this roof area indicate that the ballasted EPDM roof is an overlay assembly, meaning it was installed over an original bituminous built-up membrane system. A layer of isocyanurate insulation was mechanically attached through the built-up membrane to the concrete roof deck. At the test cut performed (located at the EPDM membrane to slate transition), the insulation was noted to be wet.

Slate Roof

- The slate shingles appear to be the original except for six (6) aluminum frame skylight units. The shingles appear to be in fair condition. Broken, cracked, and loose slate are located throughout the interior facing side of the roof area. Isolated missing slates were also noted. The exterior side of the roof area (facing Washington Street) could only be observed from the ground, but appears to have a minimal amount of broken, cracked or loose slate. However, in the area along the west chimney, the slates appear to be out of plane, potentially resulting from deck deformation underneath.

- Test cuts performed at this roof area revealed that a copper ice belt is located along the base of the roof and is covered with EPDM membrane and terminated with an aluminum transition flashing which extends under the starter course of the slate. The slate underlayments consist of a felt layer set in mastic at the lower limits of the roof and a second felt layer over the remaining portions of the wood deck.

Rising Walls Above the Roof:

Chimneys

- The brick masonry chimneys above the slate roofs are in fair condition with many of the mortar joints noted to be cracked or deteriorated, along with isolated cracked brick masonry units. Portions of the chimneys appear to have been previously repointed, and do not match the color of the original mortar.

- The chimneys are clad with copper caps that are secured via exposed fasteners around the perimeter of the fascias.

- The copper louvers located at the upper limits of the chimneys are enclosed with plexi-glass which may have been installed to reduce moisture infiltration through the louvers.

- Copper step flashings at the slate roof to chimney transitions are in fair to poor condition. The copper is patinated and appears worn in some locations. More importantly, the upper joint/edge of the flashings is sealed with sealant which prevents water from weeping (exiting) the wall system. End dams were not observed at any of the through-wall flashing locations.

Parapets

- A parapet is located along the east, south and west sides of the main roof. The parapets along the east and west elevations are clad with aluminum caps. The cast stone coping along the south parapet is not clad. The exposed coping stone is typically in fair condition. The head joints are typically in fair condition with some deteriorated joints, and some joints which have been repaired with sealant. The bed joints are typically deteriorated. Isolated stone cracks were noted.

- Copper through-wall flashing was noted below the capstones. Portions of the EPDM flashing membrane extend onto the aluminum cap flashing, covering the through-wall flashings on the roof surface, which may be a source of moisture intrusion into the building.

Tower:

- As noted in Gale's report "Exterior Façade Evaluation at the Warren House" dated August 31, 2005, the stucco base of the tower has several cracks that are temporarily sealed with sealant. The lead coated copper cladding that comprises the upper portion of the tower has multiple openings at the mitered corners. Bird and bee nests are located within and around the balusters and cornice below. The portion of the tower above the perimeter baluster (lead coated copper roof, walls and arched window openings) appears to be in fair condition. A closer evaluation of the tower, via portable hoist apparatus or access through the interior of the tower, to more closely review the roof condition, is recommended prior to determining the specific scope of repairs and associated costs. At this time, only those visual conditions noted from the lower roof areas have been included in our recommended preliminary budget presented later in this report.

Active Leaks:

- An active leak was reported to be occurring into Unit P01. At the request of NCDF, Gale traveled to the Warren House on Wednesday, April 18, 2007 to identify the potential source of water infiltration. At that time, Gale identified that the leak was located in the proximity of a drain unit on the low sloped portion of the Roof Area. On April 24, 2007 Warren House maintenance staff removed the interior ceiling finishes below the drain unit. Following observation of the interior drain components, it is Gale's opinion that the leak appears to be occurring as a result of inadequate band clamps and improper fitting of the PVC drain leader elbow. NCDF reported that on April 26, 2007 a plumber replaced the 2 band clamp on the drain pipe in apartment P01. As of this date, no subsequent leaks have been reported at this location.

Other:

- The HVAC (chiller) unit on the main roof is anticipated to be removed and replaced within the near future. However, the majority of the existing ductwork is scheduled to remain. Much of this ductwork has been wrapped with an EPDM membrane to reduce the water infiltration into the building. Some modifications to this ductwork may be required for the installation of a new roof system. Further discussion may be required depending on the replacement schedule of the individual roofs.

East and West Wing Roofs

Low Sloped Roofs

- The ballasted EPDM roofs are in fair to poor condition. Defects noted on these roof areas are similar to those observed on the North Wing (Main Roof).

- Test cuts revealed that the EPDM membrane has been installed over fiberboard insulation and the original built-up membrane system, over a concrete deck. The fiberboard insulation was observed to be wet at the test cut locations.

- Each of the penthouse units have balcony doors that open up to wood decks constructed above the roof. The wood decks are set on sleepers resting on two layers of loose EPDM membrane. The decks do not appear to be attached to the underlying roof/deck components.

Slate Roofs

- Slate roofs are located at the east and west ends of Roof Areas 2 and 3 respectively. The slate is in similar condition to that identified on the North Wing Roof.

Rising Walls Above the Roof

- The gable ends of the slate roof are comprised of decorative cast stone. Copper through wall flashings are located beneath the cast stone gables. Several cast stone units exhibit cracks and/or minor spalls. Mortar bed joints are typically deteriorated and some sealant repairs are noted.

- The decorative cast stone located on the south side of the west gable end is severely deteriorated and could present a potential falling debris hazard. Refer to the Appendix for additional information.

- The rising brick masonry walls (bases of the chimneys seen to project from the North Wing Roof) are in fair condition with areas of cracked or deteriorated mortar joints and isolated cracked brick masonry units. Portions of the walls appear to have been previously repointed. The existing mortar does not match the color of the original mortar.

- The copper louvers located at the upper limits of the chimneys are enclosed with plexi-glass. We assume that the louvers were removed in an attempt to reduce moisture infiltration through the louvers.

- Copper wall flashings at the low slope roof to brick masonry wall transitions are in fair to poor condition. The copper is patinated and appears worn in some locations. Rope weeps were noted along the top edge of the flashing. However, the spacing of the rope weeps exceeds the recommended spacing of 16" on center. Also, through-wall flashing heights are typically lower than the 8" recommended flashing height.

- EIFS (exterior insulation finish system) walls: As noted in Gale's report "Exterior Façade Evaluation at the Warren House" dated August 31, 2005, the east (Unit P01) and west (Unit P05) faces of the penthouses are clad with EIFS. The EIFS was apparently installed in an attempt to reduce moisture infiltration into these walls. The EIFS cladding on unit P01 incorporates control joints to accommodate movement of the wall assembly. Also, the aluminum parapet cap above unit P01, includes a counter flashing with a drip edge which extends beyond the EIFS wall. The EIFS wall at unit P05 does not include control joints and the parapet cap along the top edge does not provide a counter flashing with a drip edge. The exterior face of the parapet cap is terminated leaving the top edge of the EIFS wall exposed and utilizes a sealant joint as the means of preventing moisture from penetrating behind the EIFS wall. The sealant appears in fair condition.

South Wing Roof

Low Sloped Roof

- The ballasted EPDM roof is in fair to poor condition. Defects noted on this roof area are similar to those described for the North, East and West Wing Roofs.

- Test cuts performed at this roof area indicate that the ballasted EPDM membrane is installed over isocyanurate insulation and a wood roof deck. A test cut performed at the southwest corner of the penthouse revealed that the wood deck was deteriorated and water was noted between the EPDM membrane to flashing interface. A test cut in the field of the roof revealed a plywood deck which appears to be a replacement of the original wood deck.

Gale could not confirm how much of the wood deck was replaced with plywood or the overall condition of the deck, due to the relative size of the test cut openings.

Slate Roofs

- Slate shingle areas are located at the south end of the roof at a lower elevation than the Main South Roof. The slate is in similar condition to that described in the interior facing roof areas.

Rising Walls Above the Roof Line

- Penthouse: The stair penthouse that leads up from the building is comprised of standing seam copper wall panels and an EPDM membrane. The penthouse envelope components appear in fair condition.

- The decorative coping stone that is located at the ridge of the slate roof is experiencing map cracking (crazing), which could be allowing moisture intrusion within the stone components. This can cause spalling of the stone components as a result of freeze thaw cycling. Spalling stone can become a potential falling debris hazard.

Brick Masonry Walls at the South Wing Balconies

Gale reviewed the masonry wall flashings of the 3rd Floor Apartments South Wing West Balcony (refer to the Appendix for additional information of this wall/flashing configuration). Moisture infiltration is reportedly occurring along these areas and into the ceilings of the units below the balconies (second floor units No. 221 and 223, located on the west side). In both units, Gale verified the leak location which appears to correlate with the locations of the brick masonry walls of the balconies directly above. Warren house staff reported that the roofs on the balconies were replaced within the last two (2) years, at which time an EPDM membrane was also applied to the lower limits of the walls in an attempt to seal the areas from reported leakage. Gale noted that sealant was applied along the top edge of the membrane and over the rope weeps and sheet metal flashings, which inhibits the proper drainage of water from exiting the wall system. The brick masonry components underneath the membrane were wet and deteriorated in this area. Gale also noted that throughwall flashings above the balcony doors have no end dams and are not continuous at the upper elevations.

Leak Audit

Warren House staff/NCDF reported that the following areas are experiencing active leakage in varying types of precipitation events, but mostly during wind driven rain.

- Units No. 221 and 223 (discussed in the previous section) – West Wing Balcony
- Unit No. 307 – North Wing Roof – Slate Portion/Masonry
- Unit No. 323 – West Wing Roof
- Penthouse Unit No. 5 (P05)– North Wing Roof – EPDM Portion

DISCUSSION AND RECOMMENDATIONS:

Below you will find a brief discussion of the recommended roof replacement options which are considered appropriate for this project. Addition comments for associated work items follow.

Low Slope Roofs:

There are four (4) types of roof coverings which could be considered for the low slope replacement systems at this facility. Each system has its own chemical and physical properties and proven performance characteristics. These membrane systems are as follows:

1. Gravel Surfaced Built-Up Roofing (GSBUR) membranes are alternating layers of asphalt, reinforcing felts (organic or non-organic) and gravel surfacing. Of the systems discussed herein for low slope applications, the GSBUR is the most time proven. Properly designed and installed, these systems have shown good longevity. GSBUR systems are field fabricated and therefore, considered more workmanship dependent, and can be susceptible to problems during construction. GSBUR can be applied with hot asphalt or cold mastics. Hot applied systems are accompanied by the odor of asphalt and use of 450°F to 500°F asphalt on the roof. The asphalt acts as the waterproofing materials while the fabric and felts provide the strength. Hot asphalt used to install the system can have logistic implications due to the strong fumes associated with the asphalt and the possibility of a fire hazard created by the asphalt kettle application. "Cold-process" built-up systems avoid temperature application of asphalt, and as such, have less odor. The cold process systems offer superior resistance to vandalism, but are also difficult to repair. Manufacturers of this type of system offer 10-20 year material and workmanship guarantees.

2. SBS Modified-Bitumen Roof Membranes (SBS) are another option that may be considered appropriate for installation at this project. SBS membranes are field fabricated and installed in multi-ply (minimum of two preferably three-ply) configurations. SBS membranes can be set in hot asphalt or cold adhesive similar to a GSBUR system, or they can be torch applied. With its thick, puncture resistant, granular surfaced cap sheet, SBS exhibits excellent puncture and impact resistance similar to the BUR systems. As with cold and hot applied BUR systems, modified-bitumen membranes are workmanship dependent and can be susceptible to problems during construction for contractors not proficient with the installation requirements. Similar to the GSBUR system, the hot asphalt used to install the system can have logistic implications due to the strong fumes associated with the asphalt and the possibility of a fire hazard created by the asphalt kettle or torch application. Cold process systems are also available for the SBS systems and would be considered a good alternative. The manufacturers of SBS membrane systems offer guarantees that are similar with other membrane system manufacturers.

3. Elastomeric Roof Membranes (EPDM - Ethylene Propylene Diene Terpolymer) are single-ply synthetic rubber membranes which can be installed as a fully adhered, mechanically attached or a loose laid, ballasted system. Currently, the Warren House has ballasted EPDM systems installed on the roofs. EPDM roof coverings are field fabricated with the seams of the membrane adhered with adhesive or a two sided adhesive seam tape. The adhered membrane seams require specific preparation work to conform to the manufacturer's requirements. It has been Gale's experience that the seams of EPDM systems are prone to delamination within the warranty period and unless leaks occur, are not repaired under warranty. Proper slope to drain to effectively remove water from the membrane surface is critical for extended surface life and warranty coverages. EPDM warranties have specific limitations excluding ponded water as a result of seam adhesive degeneration when exposed to prolonged moisture. EPDM sheets are prefabricated off-site in the manufacturer's plants by making large sheets of membrane that are installed in "panels" on the site. Each of these panels is then adhered together using the bonding adhesives or pre-manufactured tapes to provide a watertight roof. These systems have a lower puncture resistance compared to the GSBUR, but their repair ability is good and can easily be performed by certified maintenance personnel.

Gale is aware of 15 year old EPDM systems which are currently performing satisfactorily. However, it can be expected that after seven to ten years, maintenance in the form of seam repairs will be required. Manufacturers of this type of system typically offer 10 to 20 year materials and workmanship warranties. Gale would recommend stripping-in all field fabricated seams if EPDM is specified, as well as designing for complete removal of all water through proper slope to drain (i.e. tapered insulation).

4. Single-ply thermoplastic (polyvinyl chloride – PVC) roof membranes are another option. PVC membrane systems are available from several manufacturers. Based on our experience, it is Gale's opinion that the reinforced coated systems offer satisfactory chemical/physical properties. PVC membranes can be installed as fully adhered, mechanically attached or loose laid and ballasted applications. Similarly to the EPDM membrane, the PVC membrane is manufactured in wide rolls. However, the PVC membrane seams are thermally fused (hot air welded) to form a monolithic sheet that does not rely on adhesives for a watertight bond. Warranties competitive with EPDM systems are available. PVC warranties do not typically contain a ponded water exclusion as a result of the thermally fused seams. Similarly, to the EPDM systems, the puncture resistance of the PVC membrane is lower than that of a SBS, but is easy to repair using handheld heat welding equipment. NCDF should be made aware that PVC systems are very slippery when wet, and therefore should have limited traffic on the roof surface. Gale is aware of several membrane assemblies in New England which have been performing successfully for over 20 years. There are European installations of these products reported to be in excess of 25 years old.

The above referenced systems were chosen due to their durability and expected service lives. Ballasted roof configurations were not considered or recommended due to additional weight applied to the roof system and the difficulty of trying to locate potential defects or performing routine maintenance in the future. Ballast can also contribute to vandalism or building damages, as projectiles.

Based on the size and complexities of removing and replacing the roof coverings at this site, it is Gale's opinion that each of the systems is a viable alternative. Both the gravel surfaced system and the SBS modified systems have superior puncture resistance than that of the single-ply roof covers, which is an important consideration as a result of the wood decks on the roofs. Also, as the building tenants and personnel can potentially access the roof areas, slip resistance may be another factor.

However, the installation of either a gravel surfaced or SBS modified bitumen roof system could increase the labor and material costs associated with the installation of the multiple ply's of membrane and could extend the overall schedule. A PVC roof system could be considered an acceptable option, however, it is more slippery than other roof systems and does/nor proved good puncture resistance.

- *Duct Work:* According to NCDF the majority of the duct work was rewrapped approximately one year ago. One section of ductwork on the North Wing Roof was not rewrapped and should be completed in conjunction with the roof renovations at this area.

- *Drain Replacement:* It is recommended that NCDF consider the replacement of all of the drain bowl assemblies at this site to reduce the potential of water infiltration into the roof system.

- *Repair of Parapets:* In conjunction with the roof replacement, remove all bird fencing and aluminum parapet caps. There are two options for the repair of the parapets. One is to remove the existing parapet stones, replace the underlying through-wall flashings and install new cap stones. The second is to stabilize the coping stones that are experiencing severe cracking and or spalling and covered the coping with metal flashings. Due to the high costs associated with replacement of the through-wall flashings and high potential of breakage of the stones (many are currently in poor condition and will likely break from the process of removal and reinstallation), option one is not recommended. The second option appears to be more cost effective and allows for the majority of the existing stone components to remain in place. Keeping with the historic character of the building, as the majority of the original sheet metal is copper or lead coated copper, it is recommended that the existing aluminum parapet caps be replaced with new copper caps to reduce water infiltration.

- *Removal and reinstallation/replacement of the apartment area wood decks:* Remove and reinstall all wood walkways and decking – provide walkway pads underneath all deck support locations. All deck and walkway components should be repaired as necessary prior to reinstallation. Note that some modification to the deck configurations will be required to remove the units and accommodate for the installation of the new roof system. At current, many of the decks are only accessible by stepping over the door threshold for access and do not appear to be ADA compliant. Further discussion may be required should NCDF be required to adhere to their accessibility requirements.

- Dome Skylights: The majority of the skylight units and curbs appear to be in fair condition. Several of the dome skylights were noted to have cracked glazing and should be replaced.

Sloped Roof Replacement:

- *Slate Replacement:* Good slate roofing practice and Preservation Briefs 29 "The Repair, Replacement & Maintenance of Historic Slate Roofs" as generated by the National Park Services U.S. Department of the Interior, as well as other industry standard reference material, recommended a 20% limit of broken, cracked, missing or sliding slate for deciding whether to repair or replace an existing slate roof system. Once this percentage is exceeded, it is usually less expensive to replace the roof in its entirety than to perform repairs. Although at this time it does not appear that the majority of the roof areas exceed this percentage, the impact of the repair work on the remaining slate shingles may result in significant additional damage.

  Defective/damaged slate shingles are located throughout the various areas. Access to perform the required repairs to these shingles as well as associated repairs, such as through-wall flashings at the chimneys and gables, repointing of the chimneys and repair of stone gables, will result in construction trafficking of the roof surface. As slate ages, it becomes more brittle and prone to damage from freeze/thaw and other sources. Typically, trafficking aged slate to repair individual shingles results in damage to the surrounding shingles as the roofer must walk on the roof surface to make repairs. Therefore, trafficking the slate will likely result in additional slate breakage which will require additional replacement. Also, in order to perform repairs at the chimneys, staging will be required. Staging around the chimneys typically requires removal and reinstallation of slate shingles around the bases of the chimneys. Removal of slate may result in slate breakage, which will require replacement. While the majority of the through-wall flashing repairs impact only the North Wing slate roof, another issue is tying the new low-slope roof systems to the adjacent slate roofs, which will require removal and replacement of the lower limits of the slate.

  As the Warren House is a historic building that is on the National Register of Historic Places, alternative materials were not considered appropriate for the slate roof replacement. It is recommended that slate be used for the sloped roofs at this site.

Above Roofline Repairs:

In order to reduce the potential of damage to the new roof systems, it is highly recommended that all above roofline repairs be performed in conjunction with and prior to the respective roof replacement/renovations.

- *Tower:* The Tower is one of the most notable historic features at the Warren House. It appears that the sheet metal components at the baluster and cornice level directly above the stucco base are in poor condition. The deflection in the metal and open miter corner joints could be a result from the stucco installation at the base of the tower, because it forced the sheet metal elements to be pushed outward at the base to allow the installation of the stucco. Although there is no current water infiltration into the building around the area of the Tower, it is recommended that if work at the North Wing Roof is performed, stabilization repairs to the Tower, such as the removal and reinstallation of deflected sheet metal elements to seal all corners and provide a water tight condition and stucco repairs be considered.

- *Chimney Step/Through-wall Flashings:* The existing through-wall flashings at the chimneys and Tower were noted to be typically in poor condition. Some of the throughwall flashings are sealed along the top edge with sealant, the copper is typically worn and no end dams are present. In order to minimized the potential of water infiltration at these areas it is recommended that all of the through-wall and step through-wall flashings be replaced at this time.

- *Other Through-wall Flashings:* As the through-wall flashings at the base of the balcony walls are concealed with roofing membrane, these flashings are not properly functioning/draining the water out of the masonry rising walls. Also, the existing through-wall flashings are not continuous throughout the length of the wall and do not have end dams at areas where the flashings change in height (i.e. at balcony door openings, refer to photograph in the Appendix). The most appropriate repair for the balcony wall base flashings would be to remove all of the existing doors and install new through-wall flashings to be in one continuous line along the length of the wall. The existing doors have original wood frames with aluminum inserts. The existing doors appear to be in good condition, and removal and replacement of these doors with new doors that match the material construction and aesthetics of the existing, may not be economically feasible at this time. If the existing doors remain in place, it is recommended that all through-wall flashings are installed with end dams and new pan flashings are installed at existing door thresholds.

- *Brick Masonry Repointing and Brick Masonry Repairs:* The existing brick masonry components are in fair condition, but show multiple signs of previous repairs and typically exhibit "spotty" repointing and various joint configurations. It is recommended that in conjunction with removal and replacement of deteriorated masonry components (penthouse walls, chimneys, other rising walls), all of the brick masonry walls above roof levels be repointed 100% in order to give the building an even appearance. However, this repointing should only be performed in conjunction with other water management repairs, such as new through-wall flashings, to reduce the overall potential of water infiltration into the building via the masonry walls.

- *Miscellaneous Chimney Repairs:* Provide new copper caps at chimneys. Remove plexi-glass from the louvers as to install new pan flashings and replacement louver configurations.

- *EIFS Repairs/Renovations:* The existing EIFS walls appear in fair condition It is recommended that in conjunction with the roof repairs, several maintenance repairs be performed at the EIFS wall in an attempt to minimize the potential of premature deterioration of the EIFS components and to better transition the EIFS walls to the replacement roof system. Recommended repairs include the installation of control joints at the EIFS wall above the West Wing Roof; and cutting the lower limits of the EIFS wall to provide a minimum of an 8" flashing height and installing sheet metal flashings along the base of the EIFS walls. The upper elevations of the EIFS system are to be properly sealed in conjunction with the parapet cap installation to reduce wind driven rain infiltration.

- *Cast stone – stabilization or replacement:* Depending on NCDF's current budgetary considerations, we have considered two options for cast stone repairs. The temporary option is to stabilize the deteriorated cast stone that could present a falling debris hazard. Stabilization in the form of netting or removal of the stone component (if it is a decorative unit) should be performed to prevent a potential falling debris hazard. Note that if a cast stone unit is removed, it should be stored to be utilized as a mold for making future replacement units. As the stones are located at the perimeter/edges of the building, the replacement of the stone should not interfere with the anticipated replacement roofing as the stone replacement/repair can be performed from staging or lifts around the perimeter of the building.

- *Other:* While on site, Gale noted that the ladders accessing the North Wing Roof from the East and West Wing roofs are not code compliant. The distance between the EIFs wall and the rungs of the ladder are approximately 4" which is less than the required 7" minimum. Also note that the units do not extend the required distance above the parapet walls. Should any modifications of these ladders be required, (i.e. removal to perform the work) it is recommended that they be removed and replaced with new to meet the current code requirements.

SUMMARY OF RECOMMENDATIONS:

The following is a brief outline of the recommended work for each Roof Area. This outline takes into account that there are multiple different above roof line components that require repair and should be addressed in conjunction with each other to reduce future trafficking and damages, as well as potential additional mobilization costs to the roof system for the proper installation of individual components. Note that the items that have an * in front of them are not considered priority or required items. NCDF may wish to consider addressing these repairs while the roof renovations are being performed.

At the request of NCDF, Gale has generated the following recommendations based on our opinion of potential sources of moisture infiltration, coordination between sub-trades to complete the work, and life safety issues. As the leak associated with unit P01 appears to have been addressed via repairs to the plumbing leader lines, it is the opinion of Gale that the North Wing Roof is no longer a high priority. However, should the roof top chiller unit be replaced, Gale recommends that NCDF consider replacing this roof in conjunction with the HVAC work as there is a high probability that the existing roof system will become damaged as a result of the installation. If the chiller work is not anticipated to be performed at this time, it is recommended that the work at the Warren House be executed in the following order (highest to lowest priority):

1. South Wing East and West Balcony Roofs and Associated Work

- Replace low slope roof system(s)
- Remove, repair and reset existing roof decks, providing proper support systems
- Replace drain bowls and assemblies
- Replace existing parapet caps and provide additional flashings
- Install throughwall overflow scuppers
- Replace throughwall flashings at the base of the balconies and above balcony doors
- Replace deteriorated brick masonry

- Repoint brick masonry mortar joints 100%
- Cast stone repairs and/or replacement

2. North Wing Roof

- Replace low slope roof system
- Wrap one section of duct work
- Replace drain bowls and assemblies
- Replace existing parapet caps and provide additional flashings
- Replace slate roof
- Replace gutters, downspouts, and associated sheet metals
- Replace through-wall flashings at the Tower and Chimneys
- Replace deteriorated brick masonry
- Repoint brick masonry mortar joints 100%
- Remove plexi-glass and existing louvers to install pan flashings and replacement louvers
- Provide copper caps over existing concrete chimney caps
- Crack repairs at stucco base of the Tower
- Repairs to lead coated copper upper section of the Tower
- Cast stone repairs and/or replacement

3. East and West Wing Roofs and Associated Work

- Replace low slope roof system(s)
- Replace drain bowls and assemblies
- Remove, repair and reset existing decks, providing proper support systems
- Replace existing parapet caps and provide additional flashings
- Replace slate roof
- Replace gutters, downspouts and associated sheet metals
- Replace through-wall flashings at the Chimneys
- Replace deteriorated brick masonry
- Repoint brick masonry mortar joints 100%
- Remove plexi-glass and louvers to install pan flashings and replacement louvering
- EIFS repairs (control joints and cutting lower segment to raise to 8" height above roof line to install new flashings)
- Cast stone repairs and/or replacement
- Replace ladders

4. South Wing Roof and Associated Work

- Replace low slope roof system(s)
- Remove, repair and reset existing roof decks, providing proper support systems
- Replace drain bowls and assemblies

- Replace existing parapet caps and provide additional flashings
- Replace slate roof
- Replace gutters, downspouts and associated sheet metals
- Replace deteriorated brick masonry
- Repoint brick masonry mortar joints 100%
- Cast stone repairs and/or replacement

*Replace Penthouse roof

Based on our evaluation at the site, and the reported moisture infiltration, it is the recommendation of this office that the South Wing Balcony Roof Areas (East and West), be considered the high priority for this project.

PRELIMINARY BUDGED ESTIMATES

The following outlines the budget estimates of the various roof replacement options and associated work at the Warren House. These estimates should be considered preliminary and should not be used for sensitive cost estimating. All estimating was performed using historical and market trends to establish unit pricing. As this project is anticipated to be phased, Gale attempted to project the estimate to reflect future labor and materials costs per 2008 construction costs. However, the costs of building materials, primarily metals and petroleum based products, are extremely volatile and the NCDF may want to utilize additional inflationary values for future planning. Also, note that these budget estimates do not include interior renovation costs, soft costs associated with the Owner's project management, or engineering costs as these may vary depending on the selected scope of renovation. In order to reflect actual renovation costs, a contingency was not included in these estimates. It is our strong recommendation that a 20% contingency be carried in the event that unforeseen conditions are encountered either during the design or construction phase of the project.

The budget estimates are broken down to illustrate the roof replacements (low slope and sloped) and associated above roofline work at each roof area. The estimates include labor, the replacement of the existing gutter systems with like kind details, new snow guards, roofing materials, general conditions, mobilization and a 20% overhead and profit costs. Please note that Gale utilized the cost of a modified bitumen roof system at the low sloped roof areas for budgeting purposes. Therefore, the costs to perform the individual roof area, in order of priority and including all associated renovations area as follows:

1. West Balcony $194,000
2. East Balcony $194,000

****Cost is projected based on West Balcony

3. North Wing Roof $248,000
4. West Wing Roof $259,000
5. East Wing Roof $259,000
6. South Wing Roof $193,000

TOTAL $1,347,000

Therefore, the recommended construction budget to complete all of the above roof line renovations as outlined in this evaluation is valued at $1,347,000 for the installation of a SBS system. Note that if a PVC system is used, the cost would be approximately $1,327,000. Please note that these costs include all of the recommended above roof line renovations discussed in this report. Again, this value does not include interior renovations, engineering costs, soft costs, or a recommended contingency.

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