Clara Barton National Historic Site Conditions Assessment

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National Park Service
George Washington Memorial Parkway

Final Submittal

Volume 1 of 3

November 27, 2018

Contract No. P14PC00202
Order No: 140P3018F0013
AECOM Project No.60562621

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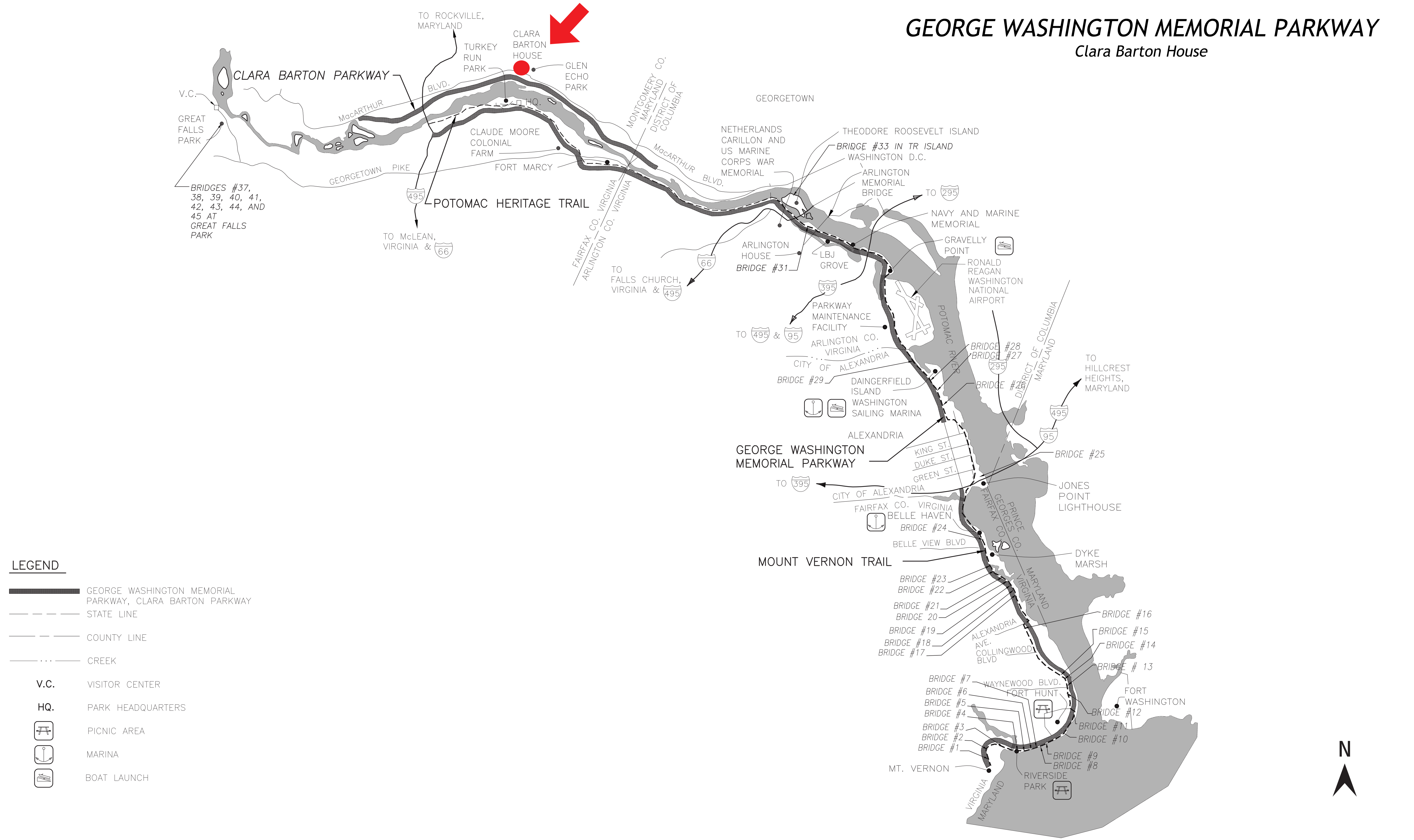

Figure 1.1 Site Location Plan

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1.0 EXECUTIVE SUMMARY

1.1 Overview

This Conditions Assessment is focused on three keys areas relating to the Clara Barton House at Glen Echo, MD. These areas are as follows:

1. Exterior considerations including:
   - Water ingress observations
   - Exterior weathering, deterioration and performance
   - Visual photography and infra-red observations study
2. Structural concerns primarily focused on floor loading.
3. Mechanical, Electrical and Plumbing (MEP)

1.2 Study Format

This study is divided into 3 volumes.

Volume 1

Chapter 1: Executive Summary

Chapter 2: Introduction

- An overview of the Clara Barton House.
- Historic designations - established in order to fully understand the future requirements of the building.

Chapter 3: Conditions Assessment

Identification of existing conditions based on field visits, site observations and historic information by discipline:

- Architectural
- Structural
- Mechanical
- Electrical
- Plumbing

Chapter 4: Recommendations

A series of recommendations, organized by discipline based on deficiencies / existing conditions identified in the previous a chapter and upon guidance provided by the NPS.

Chapter 5: Conclusions

Conclusions based on the conditions assessment and the recommendations.

Volume 2

This volume primarily contains the cost estimate for all recommendations and the technical studies that support the findings.

Volume 3

The final volume contains the mechanical whole building energy study.

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2.0 INTRODUCTION

2.1 Overview

The Clara Barton House (CLBA) is located in the Clara Barton National Historic Site, Glen Echo Park, Maryland, approximately 3 miles northwest of the Washington, DC city boundary. It is situated in a small woodland area overlooking Clara Barton Parkway and the Chesapeake & Ohio Canal (C&O) to the south and a parking lot to the east. The approach to the building is from a landscaped and less wooded area to the northwest.

The house was constructed in 1891 to serve as a storage facility for disaster relief supplies for the American Red Cross until 1897. The building was remodeled under the direction of Clara Barton during that year and became both the national headquarters building for the American Red Cross and Ms. Barton's home until 1904.

The house was closed to the visiting public in 2015 due to several ongoing preservation projects (fire suppression and roof repair), water ingress and environmental control issues. The museum collection has been moved into storage during this dormant period.

The Clara Barton House comprises 3 stories with basement, has a typical floor area of 4,300 gross square feet (gsf) and a total square footage of approximately 14,000 gsf. The top floor (3/F) has a smaller footprint occupying only the central, longitudinal bay and has a floor area of 1,350 gsf, approximately 1/3 the area of the other floors.

Table 2.1 Area Schedule

AREA SCHEDULE	
Basement	4,231 gsf
First Floor	4,306 gsf
Second Floor	4,297 gsf
Third Floor	1,478 gsf
Total	14,312 gsf

The house has a wood framed superstructure above solid masonry exterior walls of rubble stone construction forming a horizontal datum separating the upper floors from the basement level. The front entrance is flanked by two rubble stone decorative towers, each topped with metal hipped roofs. The front entrance porch is of wood construction on a rubble stone base that engages with the basement stone walls. The porch roof once formed a balcony at the second floor level.

2.2 Team

NATIONAL PARK SERVICE

Stacey Rickard	NCR Contracting Officer
Anale Young	NCR Contracting Specialist
Kimberly Benson	NCR Chief of Design and Construction, COR
Simone Monteleone	GWMP Chief of Resource Management
Ming-Yi Wong	GWMP Historical Architect

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Tom Woods	Project Manager
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Alexeus Nicol	Architectural Designer
Brent Golden	Topographical Surveyor
Mike Ramos	Mechanical / Plumbing Engineer
Pedro De Jesus	Electrical Engineer

WOODS PEACOCK

Consultant to AECOM

Seth Takoch	Lead Structural Engineer
Carrie Seifert	Structural Engineer

JMA PRESERVATION

Consultant to AECOM

Amanda Edwards	Architectural Conservator

DMS CONSTRUCTION CONSULTING SERVICES

Consultant to AECOM

Kirk Miller	Cost Estimator

2.3 Goals

The National Park Service (NPS) intends to restore the Clara Barton House to its historic period of significance in order to educate the public about the Red Cross and its owner. Upon completion of the restoration, the Clara Barton House will once again serve as a museum, interpreting the period of Clara Barton's occupation.

The goal of the Conditions Assessment is to document, analyze and identify any building deficiencies and to recommend methods to improve the building in order to accommodate museum functions. In addition, the AECOM team has provided a cost estimate for the various recommendations.

Any restoration approach will follow National Park Service Technical Preservation Services standards. National Park Service Technical Preservation standards can be found at: https://www.nps.gov/tps/standards/four-treatments.html

2.4 Scope of Work

This Conditions Assessment covers the following key areas:

- Exterior conditions assessment (four sides and roof) including an Infrared Photographic study. An assessment of the interior is excluded from this study.
- Structural assessment including floor loading studies and material testing.
- Mechanical assessment including HVAC system recommendations.
- Electrical assessments and recommendations.
- Civil site survey of the entrance walkway and ramp.

Figure 2.1 Clara Barton Historic Site Plan

2.5 Applicable Codes

ICC 2015 Building Codes

Architecture Barriers Act Accessibility Standard (ABAAS)

Secretary of Interior's Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings

Secretary of Interior's Guidelines for the Treatment of Historic Landscapes

NPS-28 Cultural Resource Management Guide

RELEVANT AUTHORITIES

Commission of Fine Arts (CFA)

Advisory Council on Historic Preservation (ACHP)

Maryland State Historic Preservation Office (SHPO)

National Capital Planning Commission (NCPC)

REFERENCE MATERIALS

1979 National Register of Historic Places

1981 As-built drawings

1999 Underground Storage Tank Removal

2004 Clara Barton National Historic Site: Historic Structure Report

2008 Exterior West Wall Repair- stripping and painting Construction Drawings

2009 UV Shades- interior of windows

2010 HPTC Wood repairs to sitting room and Dr. Hubbels sitting room- reinforce 3rd floor, restore 10 window sashes, fabricate install doors, interior finishes repair

2010 APEX Asbestos Report

2012 HVAC loading calculations- in preparation for Geothermal Climate Management project

2013 Hazardous Materials Abatement- Drawings 2012

2014 Fire Protection System and Underground Utility Work

2015 Low Roof Replacement Details

2018 CLBA Historic Furnishings Report Floor Plans and Room-Object Images

National Technical Preservation Services Preservation Briefs

The Clara Barton House was designated a National Historic Landmark in 1965 and listed in the National Register of Historic Places in 1966.

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2.6 Plan Form

Sited with the main facade approximately at 45 degrees of true north, this report will refer to the main entrance facade as being east. The floor plan is rectangular, approximately 86' in the north-south direction and approximately 48' in the east-west direction. Two internal bearing walls run along the longitudinal axis of the three-story building, creating a tripartite arrangement dominated by a multi-story central hall, flanked by perimeter rooms. The rear, west facade is marked by a projecting bay extending approximately three feet beyond the face of the building, at the first and second floors.

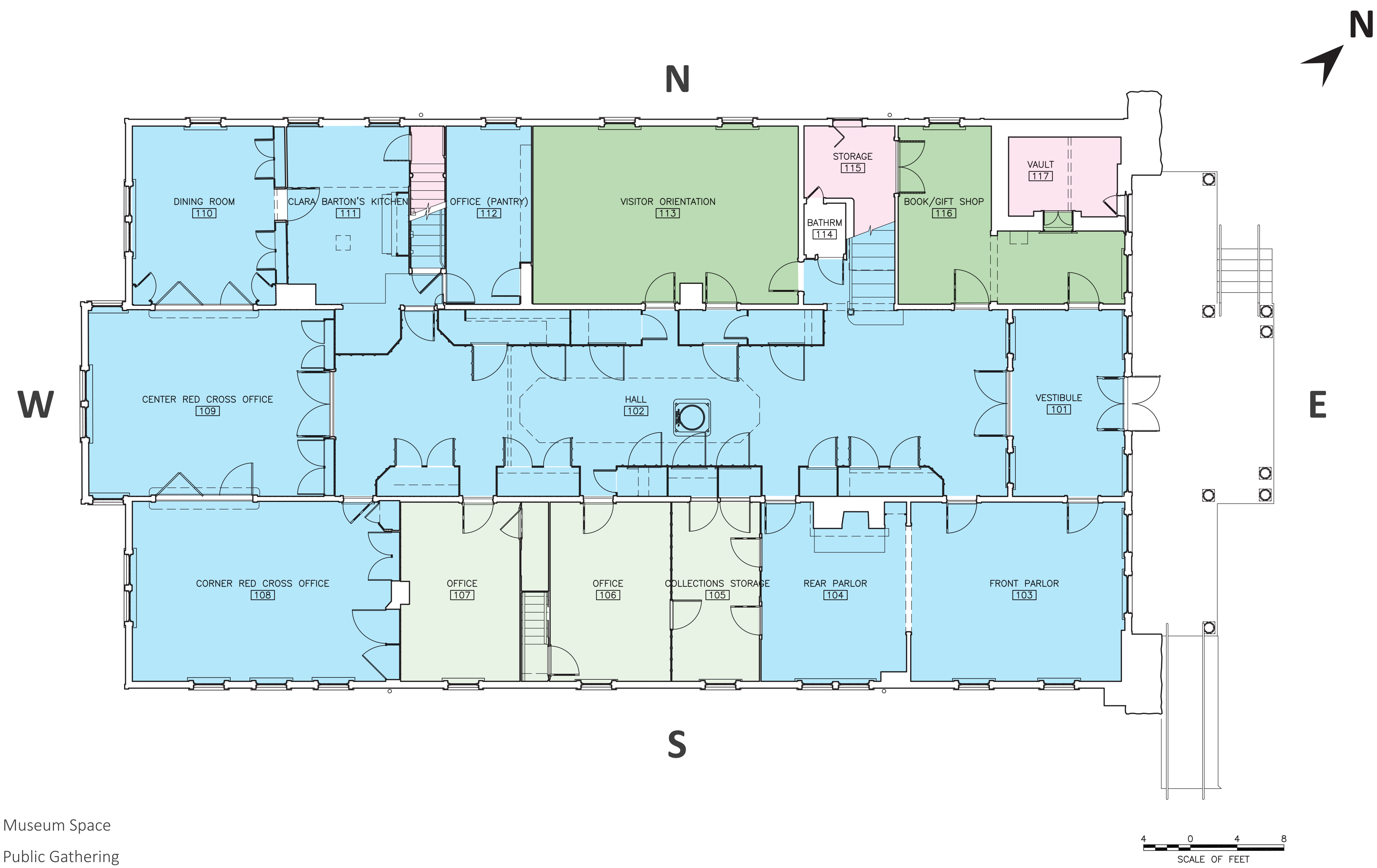
Perimeter rooms line the north and south walls of the building, surrounding the main central hall – symmetrical with the front entrance and entrance vestibule. This hallway has a small central atrium that connects the first floor to both the second and third floors. The third floor occupies only the central band, along the longitudinal axis and is approximately 1/3 the floor area of the other floors.

2.7 Use Designation Plans

The NPS has provided use categories for the rooms in the Clara Barton House. These plans designate all areas intended for interpretation as museum space. Other spaces are categorized by use, rather than historic importance. Refer to Figures 2.3 - 2.6 for space designations.

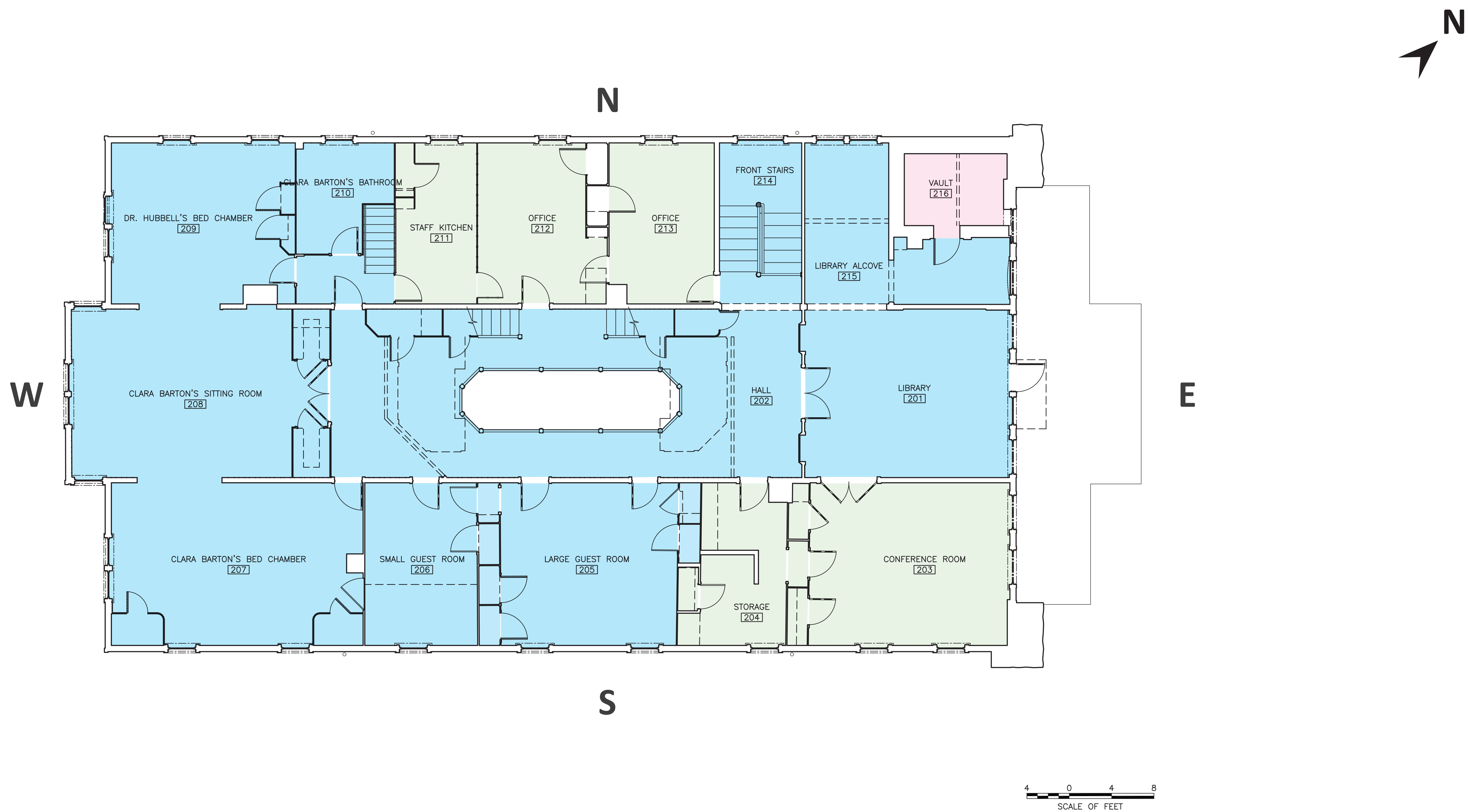
2.7.1 Key features

- The majority of the spaces on the first, second and third floors have an historic designation
- A portion of the basement (north end) has been designated for future mechanical use.
- Museum storage is located in the basement.



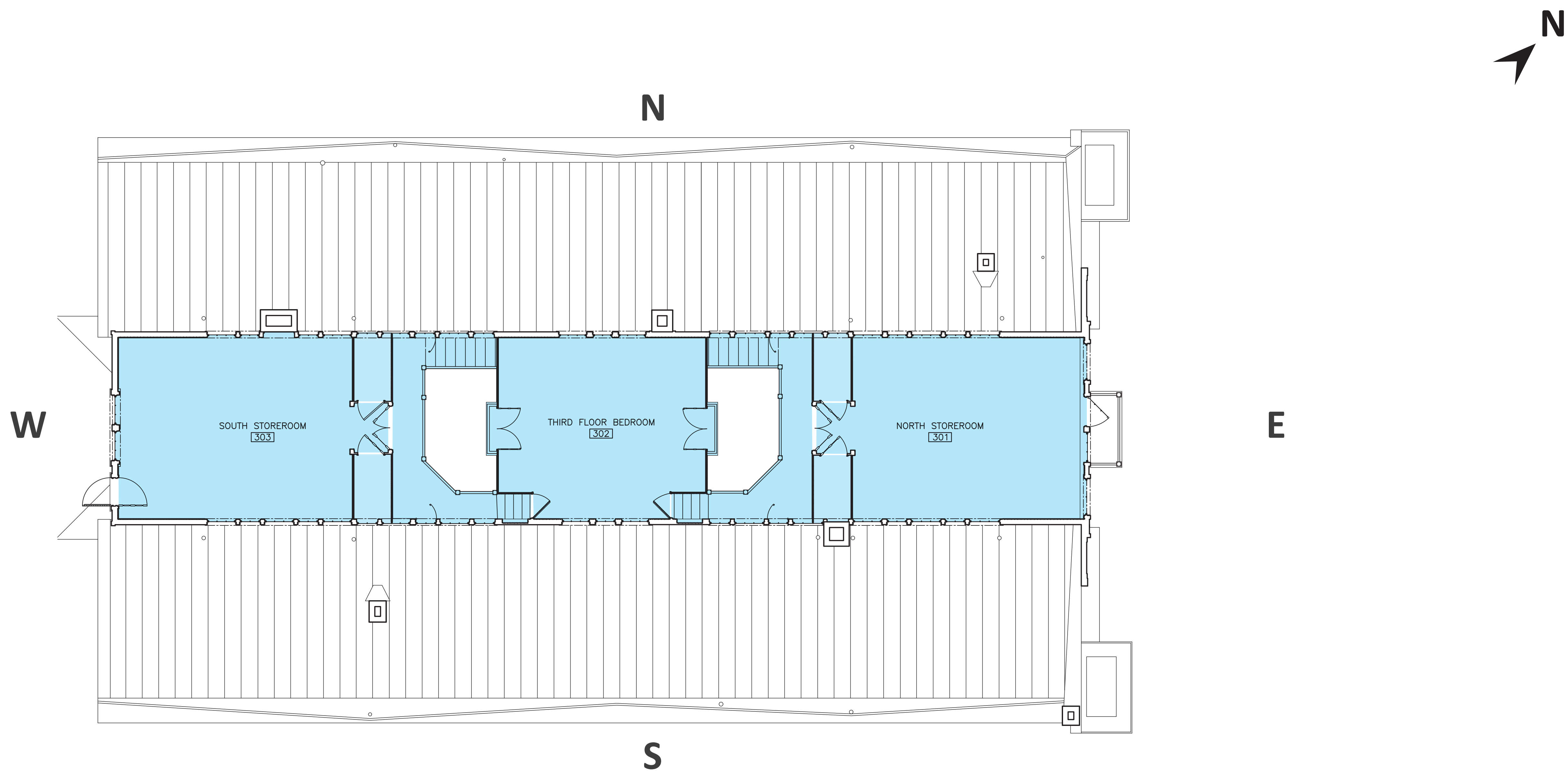
- Museum Space
- Public Gathering
- Office Space
- Critical Storage Space
- Storage Space

Figure 2.2 Space Designations - First Floor



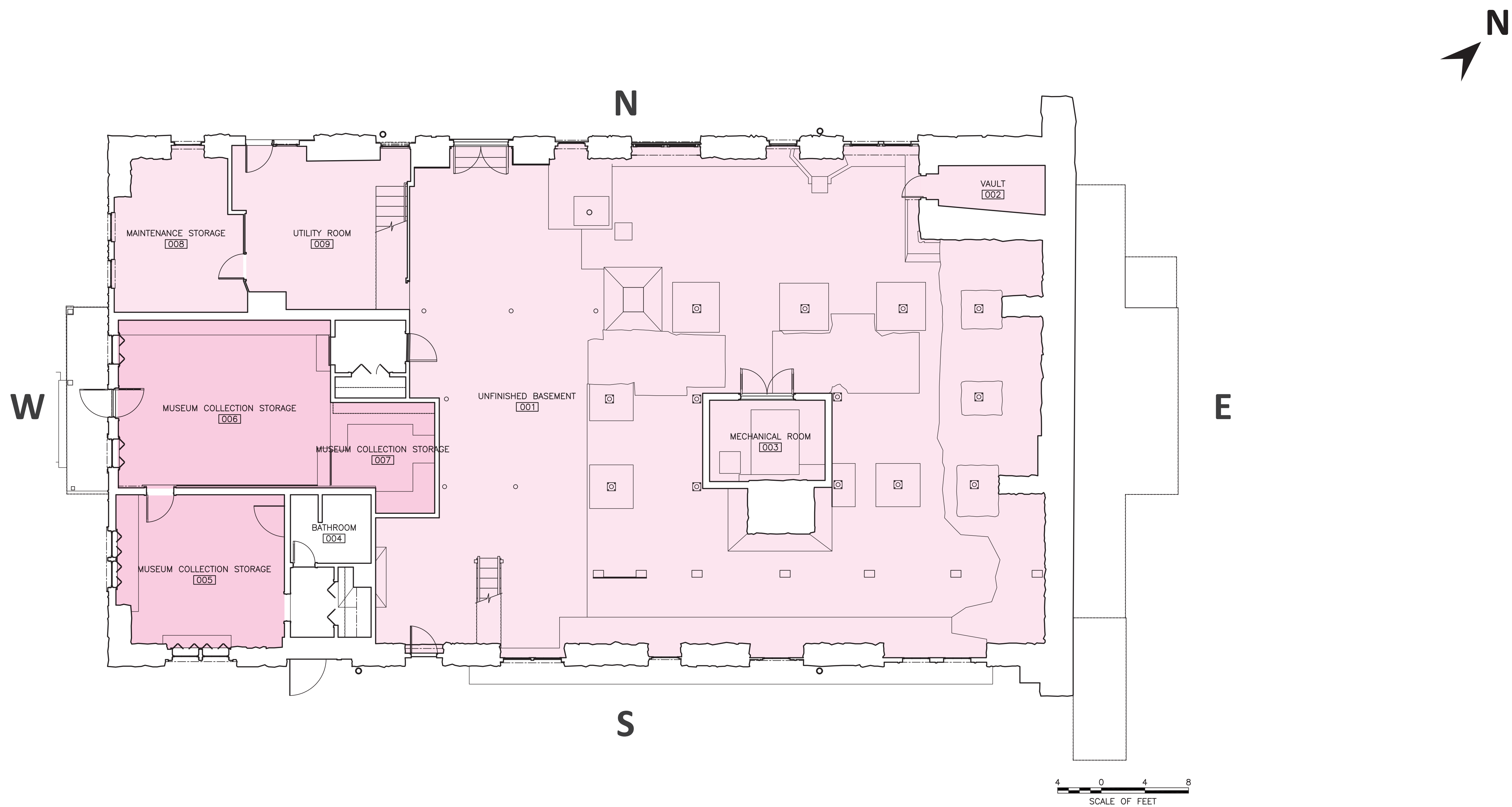
- Museum Space
- Public Gathering
- Office Space
- Critical Storage Space
- Storage Space

Figure 2.3 Space Designations - Second Floor



Museum Space
Public Gathering
Office Space
Critical Storage Space
Storage Space

Figure 2.4 Space Designations - Third Floor



Museum Space
Public Gathering
Office Space
Critical Storage Space
Storage Space

Figure 2.5 Space Designations - Basement Floor

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3.0 CONDITIONS ASSESSMENT

3.1 Architectural

3.1.1 Overview

This exterior conditions assessment reviews each of the four building facades in turn, starting at the south facade working around the building in a clockwise direction. Openings are a chief area of concern with most addressed individually using photographs and keyed notes. Windows and doors are individually numbered and a matrix of deficiencies has been provided. These are assessed per elevation and are fully tabulated at the end of the chapter. Missing insect screens, solar shading and broken glass are represented graphically on the elevations.

An analysis of roof conditions follows the facade evaluations.

For purposes of orientation, the front facade, facing east by northeast, will be referred to as the east facade, with the other facades following suit in the cardinal direction; south, west and north.

3.1.2 Room Designations

NPS has identified the use of each of the spaces within the Clara Barton House. Museum spaces require temperature and humidity regulation and will also accommodate tours depending on NPS layout. Public gathering spaces will accommodate high volume traffic and high occupancy loads. Office spaces are intended for NPS staff use only and therefore do not require as stringent of HVAC and loading needs. Critical storage space will house furniture and other priceless items pertinent to the museum use. Storage space is for everyday storage and does not need to be conditioned.

Museum Space

Public Gathering

Office Space

Critical Storage Space

Storage Space

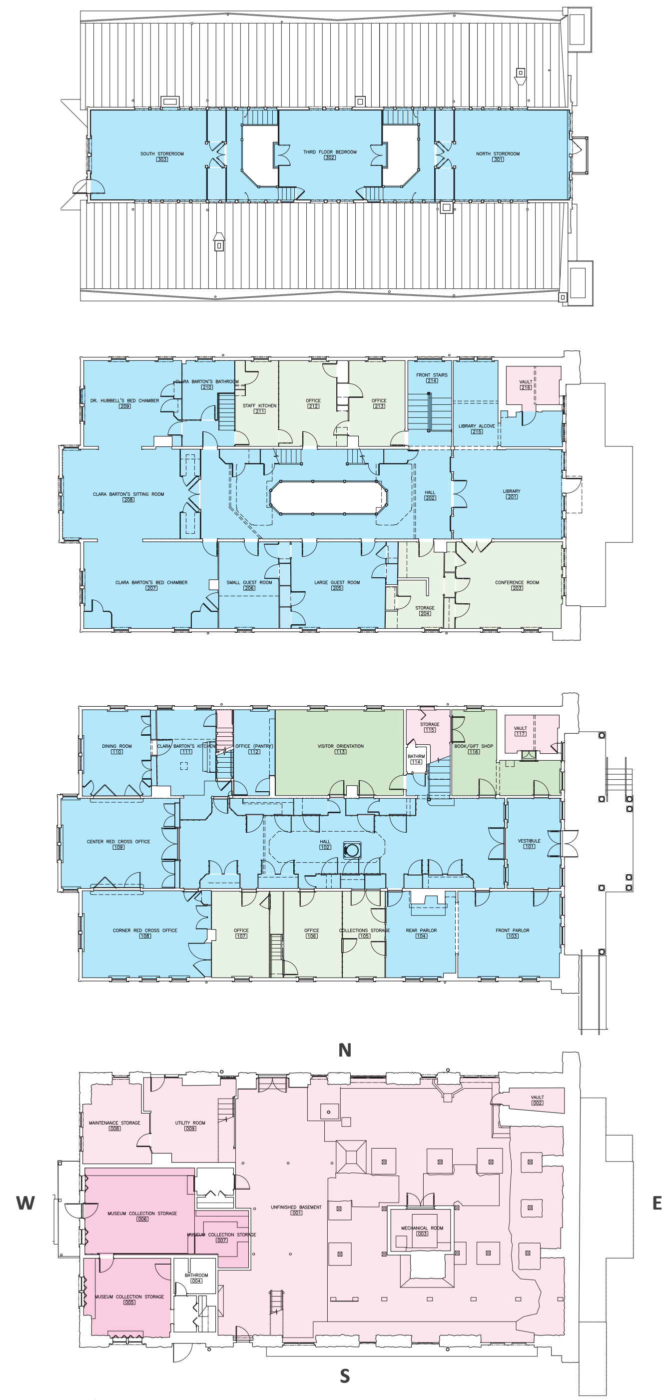


Figure 3.1 Room Designation Plans

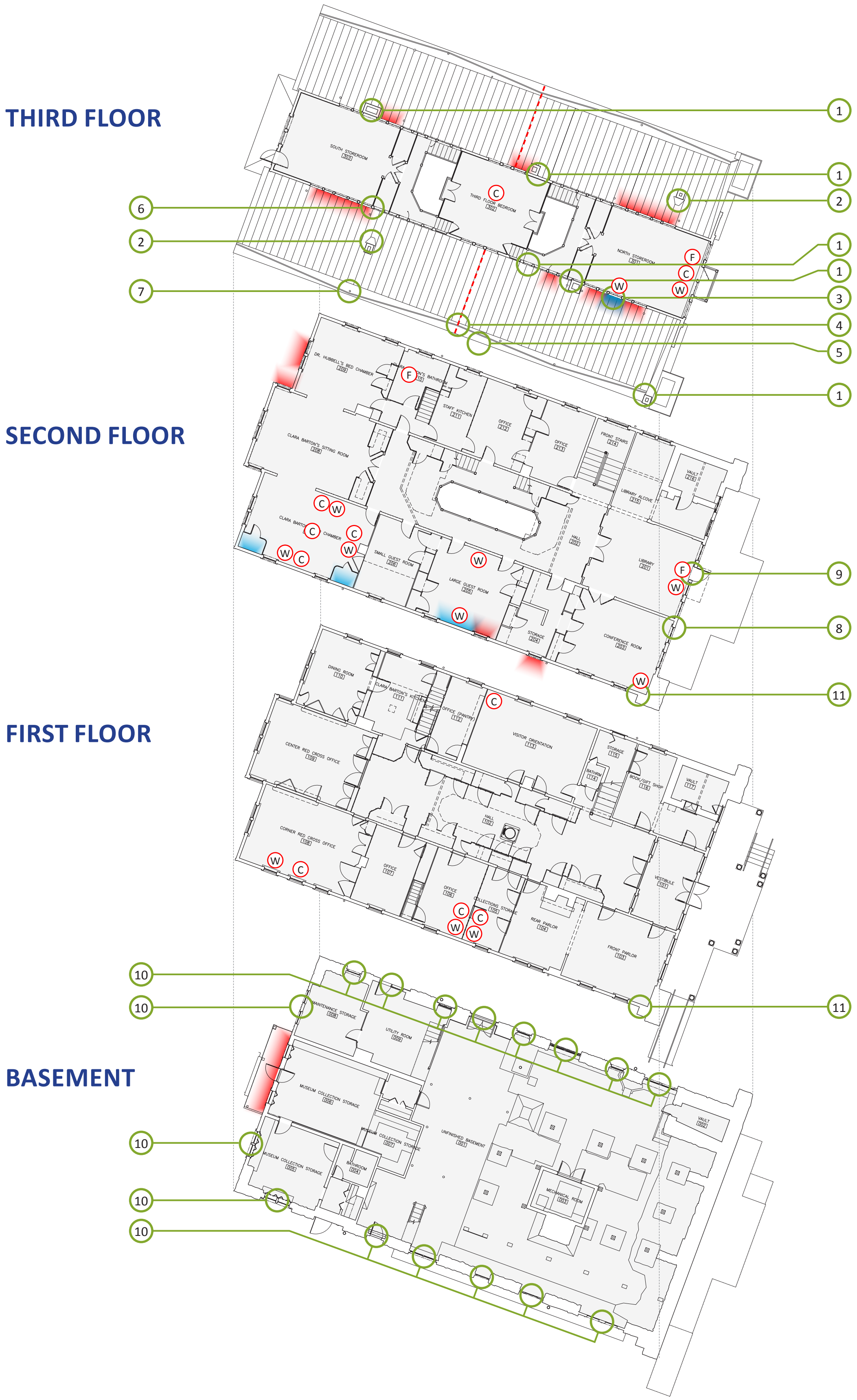
3.1.3 Envelope

The exterior cladding is predominantly horizontal clapboard fastened to vertical studs. At the north façade this clapboard is composed of sections with vertical trim board dividers. On the east, west and south facades, wood trim surrounds the wood windows, with minimally-protruding sills below. At the east (entrance) facade, the central, third floor window has a gabled transom, and gabled trim tops the other windows on the first and third floors. On the second floor, windows are finished with arched trim at the top. All other facade windows have square trim.

The exterior walls and windows are traditional wood construction as outlined in the *Clara Barton Historic Structure Report* of 2006. As with similar buildings constructed in the 1890s, it suffers from a lack of insulation, vapor barriers, proper caulking/sealant, primer and paint. Other issues are caused by the proximity of non-treated wood and masonry. All these building construction issues contribute to the intrusion of moisture and humid air permeating from the exterior environment into the internal portions of the building envelope. This situation is the primary reason for deterioration of the building structure as well as the ability to condition the interior space and protect its finishes and furnishings.

Generally the exterior is in poor condition. Many windows are in urgent need of repair and the paint is peeling from the clapboard in many areas. Peeling paint is typical on three facades – east, south and west. The north façade has been stripped and repainted within the last 20 years.

Various areas of masonry show signs of weathering. Gaps in the mortar allow water ingress and possible freeze thaw damage.



KEY SYMBOLS

- Ceiling Water Damage
- Floor Water Damage
- Wall Water Damage
- IR Air Infiltration/Exfiltration
- IR Water Infiltration
- Exterior Deficiencies
- Roof Expansion Joint

EXTERIOR DEFICIENCIES

1. Damaged flashing.
2. Chimney cricket not sealed.
3. Damaged window sill.
4. Damaged sealant at expansion joint.
5. Damaged eave.
6. Damaged diverter.
7. Damage at downspout.
8. Damaged window.
9. Door threshold insufficient.
10. Rot at ground plane.
11. Gap between chimney and german siding.

Figure 3.2 Water Damage Diagram (for enlarged diagrams, refer to Appendix)

3.1.4 Water Ingress and Damage

Water ingress is a continuing problem in the Clara Barton House. NPS has undertaken steps to resolve the issue, including a replacement of the lower roof. However, water ingress is still occurring.

Visible areas of water ingress have been identified and have been categorized as follows:

1. **Interior Water Damage –** Visible damage to areas at interior walls, floors and ceilings based on site visit inspections.
2. **Exterior Deficiencies –** Potential causes of water infiltration found on the exterior envelope of the building. These items are based on visible observations during site visits.
3. **Water Infiltration –** Current water infiltration occurring in the building. These observations are based on the results of the thermal imaging scan performed May 16, 2018.
4. **Air Infiltration / Exfiltration –** Current air infiltration and exfiltration occurring in the building. These observations are based on the results of the thermal imaging scan performed May 16, 2018 and visible exterior examples based on site observations.

Refer to Figure 3.2 for identified locations. This diagram is intended to compile the individual areas of observation in order to establish a more comprehensive understanding of water ingress problems.

Past corrections and repairs to the building have not followed a complete strategy and in some cases resulted in unintended damage. As an example the new roof on the lower portion of North and South wings were intended to correct an old, leaking roof. However, it appears that the roof joists were not completely level or do not slope to the downspouts. The expansion joint diverter used actually accumulates ponding water and debris which then leaks through the joints in the expansion joint and is leaking inside the exterior walls. This is damaging the eves, walls, and insulation. Refer to Volume II Section 2 for an IR report of the damages. The new roof also has an issue with maintenance of the downspouts, which constantly clog with leaves.

3.1.4.1 Thermal Energy Scan

Thermal imaging was performed on selected areas of both the interior and exterior envelope. The intent was to identify heat signatures indicating potential water ingress and air leakage. The imaging study identified significant air leakage and an overall lack of insulation throughout the entire envelope. Refer to Volume II, Chapter 2.0 for Thermal Energy Report.

3.1.4.2 Third Floor Bedroom [302]

There is water damage in the center of the ceiling, where the structural support for the flag pole is located. After the installation of the new flagpole, the roof membrane became damaged due to the constant movement of the new structure. There is visible staining in the bracing members and the cloth wall application is pulling away from the wall structure (Refer to Section 3.2 for structural analysis.

3.1.4.3 Clara Barton's Bedchamber [207]

There is visible staining on the north wall, running along the bottom of the ceiling and on the south wall. It appears as though water is entering from above the north wall and running towards the lowest point. It is moving along the bottom of the ceiling joists and pooling at the south wall. The path of this water appears to continue down to the Corner Red Cross Office [108] below as staining is present at the ceiling and wall at the same location.

The water infiltration could be due to the damaged diverter above this location on the upper roof or due to the poor condition of the windows located on the southern wall of the South Storeroom [303]. A lack of moisture was noted indicating that this issue may have been resolved by the installation of the new lower roof.

Additionally, there is visible staining at the ceiling and wall near the chimney stack in this room. This could be from the same source as the adjacent staining or could be from the lack of sealant at the chimney cricket above room 303. The missing sealant allows for water to hit the cricket and run back under the metal roofing.

3.1.4.4 Large Guest Room [205]

On the south wall, visible staining and moisture is present. Additionally, the thermal imaging scan discovered active water infiltration at this location. Water moves from the ceiling, down the wall and pools at the horizontal framing in the center of the wall. It then proceeds to move towards the floor passing through to the Office [107] and Collections Storage [105] below. There is slight staining at the north wall but moisture is not present. Due to the recent restoration of the walls, any historic water movement is not present and movement from the north wall to the south wall could not be determined.

The water infiltration is likely caused by the roof expansion joint above. This joint occurs at a low point on the roof, allowing for water to pond at this location. The sealant is cracked and peeling. This allows water to penetrate the roof membrane and enter the wall cavity below. Additionally, there is damage to the eave outside of this room. This could allow water to penetrate the building envelope and allow water to move down the walls.

3.1.4.5 Clara Barton's Bathroom [210]

The water damage to the floor is likely the result of a bathroom flood that had occurred. There is no indication that this damage is due to water infiltration of the building envelope.

3.1.4.6 Library [201]

On the east wall there is water damage along the bottom of the wall and the floor. The door at this location does not close completely allowing water to enter. The windows also leak into the room as is evident by an apparent attempt to mitigate water infiltration using an absorbent quilt material. The cause is likely due to insufficient weather stripping of the windows as well as the insufficient slope of the porch roof preventing shedding of rain and snow. These window sills are only a few inches above the high point of the porch roof. In winter, snow will build up allowing saturation of the wood sills resulting in decay and failure. Additionally, the false gable roof above allows run-off to cascade down the front façade and pond at this location.

3.1.4.7 Conference Room [203]

There is evidence of water damage at the southeast corner of the conference room. This is likely due to both the damaged chimney flashing above and the large gap between the chimney and the german siding on the southern façade. It is unknown if the damage continues to the room below due to the new paint in the Front Parlor [103].

3.1.4.8 Basement Thresholds

The exterior doors along these facades and the vertical clapboard under the windows show signs of rot.

This is due to the water movement along the ground plane. The site slopes downward from east to west, so water often moves along the long north and south facades of the building. In addition, there is insufficient slope away from the building.

Figure 3.3 South Facade

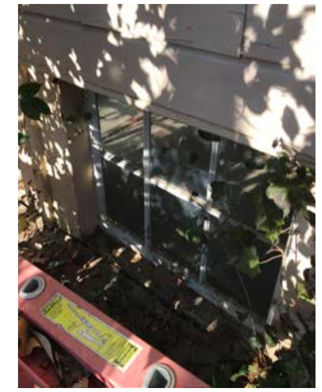
3.1.5 South Façade

The south façade extends approximately 86’ and is predominantly clapboard (first floor and second floor) with individual punched window openings. The third floor steps back from the main facade, with an irregular five-part profile punctuated by a square central monitor topped by a pyramidal roof topped by the flagpole. The grade slopes from the north (high) to the south gradually exposing the rubble stone basement foundations of the building. The basement walls have individual doors and windows with sills of varying heights.

The incoming electrical service and meter are located at the approximate midpoint of this facade.

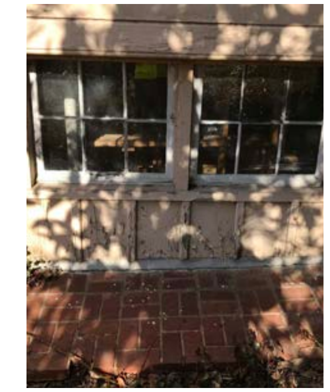
There is significant paint failure across the entire façade.

Generally, the rubble stone construction is in fair condition but spot re-pointing is recommended.



W0.1 Water Infiltration and Rot at Ground Plane

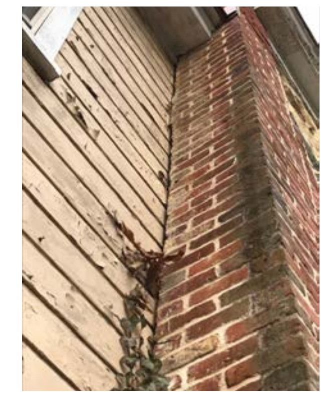
Tower Fascia has Peeling Paint



W0.5 Peeling Paint

Eave Fascia is Damaged

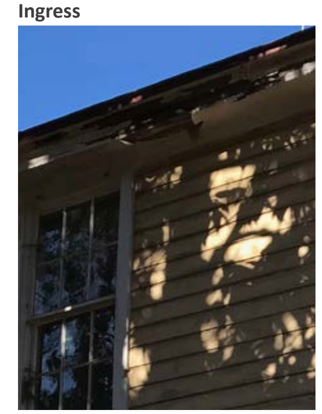
W0.2 Peeling Paint and Water Ingress



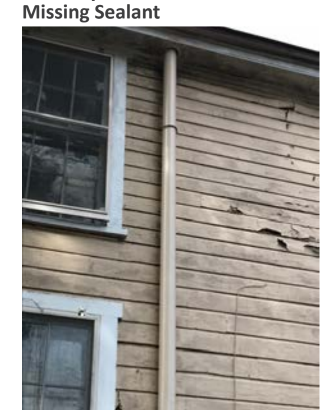
Chimney is Weathered and is Missing Sealant

D0.1

Drain Sleeve is Damaged



Eave Fascia is Damaged



Siding has Peeling Paint

W0.6 Water Infiltration and Rot at Ground Plane

W1.9 Peeling Paint

W0.3 AND W0.4 Water Infiltration and Rot at Ground Plane

D0.2 Water Infiltration and Rot at Ground Plane. Peeling Paint.

Key

- Solar Shade Present
- Broken Window Pane
- Missing Exterior Insect Screen*

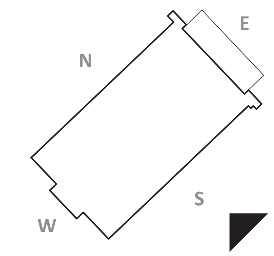


Figure 3.4 South Elevation Window and Door Assessment

*NPS notes that many exterior insect screens are stored on-site in the George Washington Memorial Parkway Headquarters. The park will have to locate them or secure replacements.

Table 3.1 South Facade Window and Door Assessment

	SOUTH FAÇADE											
	Flaking Paint	Deteriorated Sill / Threshold	Deteriorated Frame	Missing Sealant	Deteriorated Mullion	Broken Glass Panes (ref. elevations)	Glazing Compound missing	Double Hung Sash Cord broken	Weather stripping Interfers with operation	Air infiltration	Water ingress	Inoperable
W0.1	X	X		X							X	X
W0.2	X			X			X			X	X	X
W0.3	X			X		X	X				X	X
W0.4	X		X	X			X				X	X
W0.5	X						X				X	X
W0.6	X						X				X	X
W1.1	X											
W1.2	X											
W1.3	X					X				X		
W1.4	X			X		X				X		
W1.5	X			X						X		
W1.6	X			X		X				X		
W1.7	X					X						
W1.8	X					X						
W1.9	X	X	X	X			X					
W1.11	X			X		X						
W2.1	X											
W2.2	X					X						
W2.3	X					X		X				
W2.4	X					X		X				
W2.5	X											
W2.6	X											
W2.7	X					X						
W2.8	X							X				
W2.10	X		X									
W3.1	X					X	X					
W3.2	X					X	X					
W3.3	X		X			X	X					
W3.4	X					X	X					
W3.5	X					X	X					
D0.1	X	X	X	X							X	
D0.2	X	X	X	X							X	

Figure 3.5 West Facade

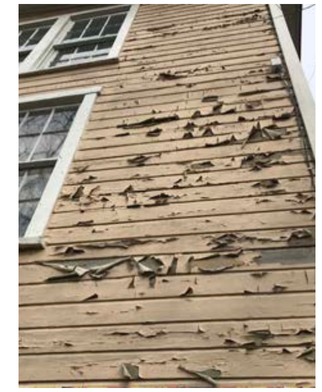
3.1.6 West Façade

The west façade overlooks the Clara Barton parkway. The grade drops off steeply approximately 10' from the face of the building and slopes down to the road about 50' below.

As a consequence of the sloping site, (from north to south), the basement level opens out to a small paved area at grade. At the corners of the building, the masonry foundation walls wrap around this facade approximately six feet on either side, but at the center of the facade, the rubble walls rise only about two feet above grade.

There is significant paint failure across the entire façade.

Generally, the rubble stone construction is in fair condition but spot repointing is recommended.



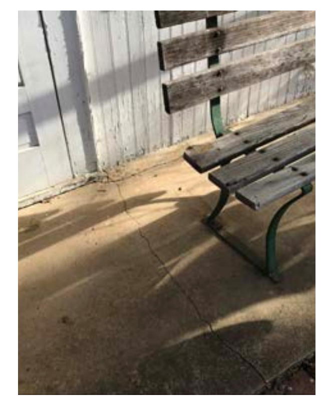
Siding has Peeling Paint

W0.7 Vegetation is Interfering with Window Function

W1.14 Peeling Paint and Damaged Sill

Damaged Masonry

W2.13 Peeling Paint



Concrete Patio is Cracked

Siding has Peeling Paint

Hole in the Ground at the Column Base

Brick Step has Missing Mortar and is Uneven

W0.10, W0.11 Peeling Paint

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Key

- Solar Shade Present
- Broken Window Pane
- Missing Exterior Insect Screen*

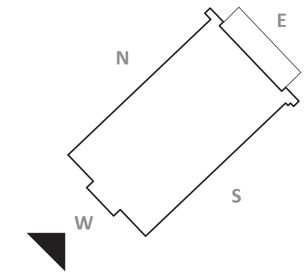


Table 3.2 West Facade Window and Door Assessment

WEST FAÇADE	Flaking Paint	Deteriorated Sill / Threshold	Deteriorated Frame	Missing Sealant	Deteriorated Mullion	Broken Glass Panes (ref. elevations)	Glazing Compound missing	Double Hung Sash Cord broken	Weather stripping Interfers with operation	Air inflitration	Water ingress	Inoperable
W0.7	X						X					
W0.8	X					X	X			X		
W0.9	X						X					
W0.10	X					X	X					X
W0.11	X											X
W1.10	X											
W1.12	X					X	X					
W1.14	X			X			X					
W2.9	X						X	X				
W2.11	X											
W2.13	X			X			X				X	
W3.6	X					X	X					
D0.3	X											
D3.2	X											X

Figure 3.6 West Elevation Window and Door Assessment

*NPS notes that many exterior insect screens are stored on-site in the George Washington Memorial Parkway Headquarters. The park will have to locate them or secure replacements.

Figure 3.7 North Facade

3.1.7 North Façade

Similar to the south façade, the north façade is predominantly clapboard (first floor and second floor) with individual punched window openings located above a rubble stone base. As at the south facade, the irregular third floor recedes from the main face of the building. This facade was stripped and painted in 2008 and is in fair condition.

There is evidence of water damage at the door thresholds and at the base of masonry openings at the basement punched windows. Recently added weatherstripping interferes with closing of the door, resulting in maintenance staff's consistent removal of the weatherstripping.

Generally, the rubble stone construction is in fair condition but spot repointing is recommended.

W0.12 Rotting at Ground Plane

Masonry / Siding Joint Lacks Sealant

W0.21

W0.20 Insect Infestation

Damaged Masonry

W0.17 Rotting at Ground Plane

D0.4 Rotting at Ground Plane. Recently installed weather stripping interfering with function of the door. This door requires a comprehensive rebuild. This can be done using modern standards while retaining the historic look of the existing doors.

AECOM

Key

- Solar Shade Present
- Broken Window Pane
- Missing Exterior Insect Screen*

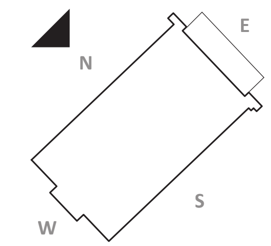


Table 3.3 North Facade Window and Door Assessment

NORTH FAÇADE	Flaking Paint	Deteriorated Sill / Threshold	Deteriorated Frame	Missing Sealant	Deteriorated Mullion	Broken Glass Panes (ref. elevations)	Glazing Compound missing	Double Hung Sash Cord broken	Weather stripping Interfers with operation	Air infiltration	Water ingress	Inoperable
W0.12	X			X		X	X				X	X
W0.13	X					X						X
W0.14	X			X								X
W0.15				X								X
W0.16				X								X
W0.17						X						X
W1.13	X	X										
W1.15	X											
W1.16	X						X					
W1.17	X			X			X				X	
W1.18	X						X					
W1.19	X									X		
W1.20	X						X					
W1.21	X			X			X				X	
W1.22	X											
W2.12	X		X									
W2.14	X											
W2.15	X											
W2.16	X					X	X					
W2.17	X						X					
W2.18	X					X	X					
W2.19	X						X					
W2.20	X						X					
W2.21	X					X	X					
W3.7	X					X	X					
W3.8	X					X	X					
W3.9	X		X			X	X					
W3.10	X					X	X					
W3.11	X					X	X					
D0.4	X	X	X	X							X	
D0.5	X	X	X	X							X	

Figure 3.8 North Elevation Window and Door Assessment

*NPS notes that many exterior insect screens are stored on-site in the George Washington Memorial Parkway Headquarters. The park will have to locate them or secure replacements.

Figure 3.9 East Facade

3.1.8 East Façade

The front entrance façade has a symmetrical arrangement with central main entrance doors flanked by windows and two large masonry towers. A single story porch extends between the towers supported by wood Doric columns sitting on a masonry base.

3.1.9 Porch and Balconies

The roof of the porch once had a full-height balustrade, allowing for its use as a second floor porch. Between 2008-2012, posts were removed and capped due to rot. Post stumps can be seen projecting up through the roofing material. In addition, the existing drawings received from the NPS indicate a railing at the perimeter of the porch roof. This railing is no longer present. This porch roof is currently not suitable for traffic and pending structural review, should not be accessed.

There is a small balcony on at the center of the third floor, supported by wood brackets. This balcony is currently not suitable for traffic and pending structural review, should not be accessed.

Weathering at Column Base

Damaged Masonry

Damaged Exterior Stucco

Masonry Tower

W1.23, W1.24, W1.25

W1.26, W1.27, W1.28

D1.1

W1.25 Insect Screen Damaged

Chimney

Damaged German Siding

Porch Ceiling

Damaged Balustrade at 3rd Floor Balcony

W3.13 Sill Damage Due to Low Slope of 2nd Floor Balcony

Damaged Window at 2nd Floor Balcony due to False Gable Roof Runoff

Key

- Solar Shade Present
- Broken Window Pane
- Missing Exterior Insect Screen*

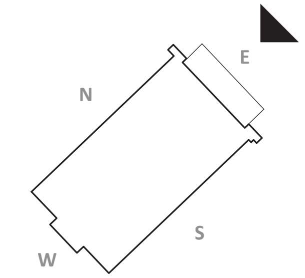


Table 3.4 East Facade Window and Door Assessment

EAST FAÇADE	Flaking Paint	Deteriorated Sill / Threshold	Deteriorated Frame	Missing Sealant	Deteriorated Mullion	Broken Glass Panes (ref. elevations)	Glazing Compound missing	Double Hung Sash Cord broken	Weather stripping Interfers with operation	Air infiltration	Water ingress	Inoperable
W1.23	X			X			X				X	
W1.24	X			X			X				X	
W1.25	X					X						
W1.26	X			X		X	X				X	
W1.27	X			X			X					
W1.28	X			X			X					
W2.22	X						X					
W2.23	X						X					
W2.24	X					X	X					
W2.25	X						X					
W2.26	X						X					
W2.27	X					X	X					
W2.28	X						X					
W3.12	X			X								
W2.13	X					X				X		
W3.14	X			X			X					
D1.1	X	X										
D2.1	X	X								X	X	
D3.2	X	X								X	X	

Figure 3.10 East Elevation Window and Door Assessment

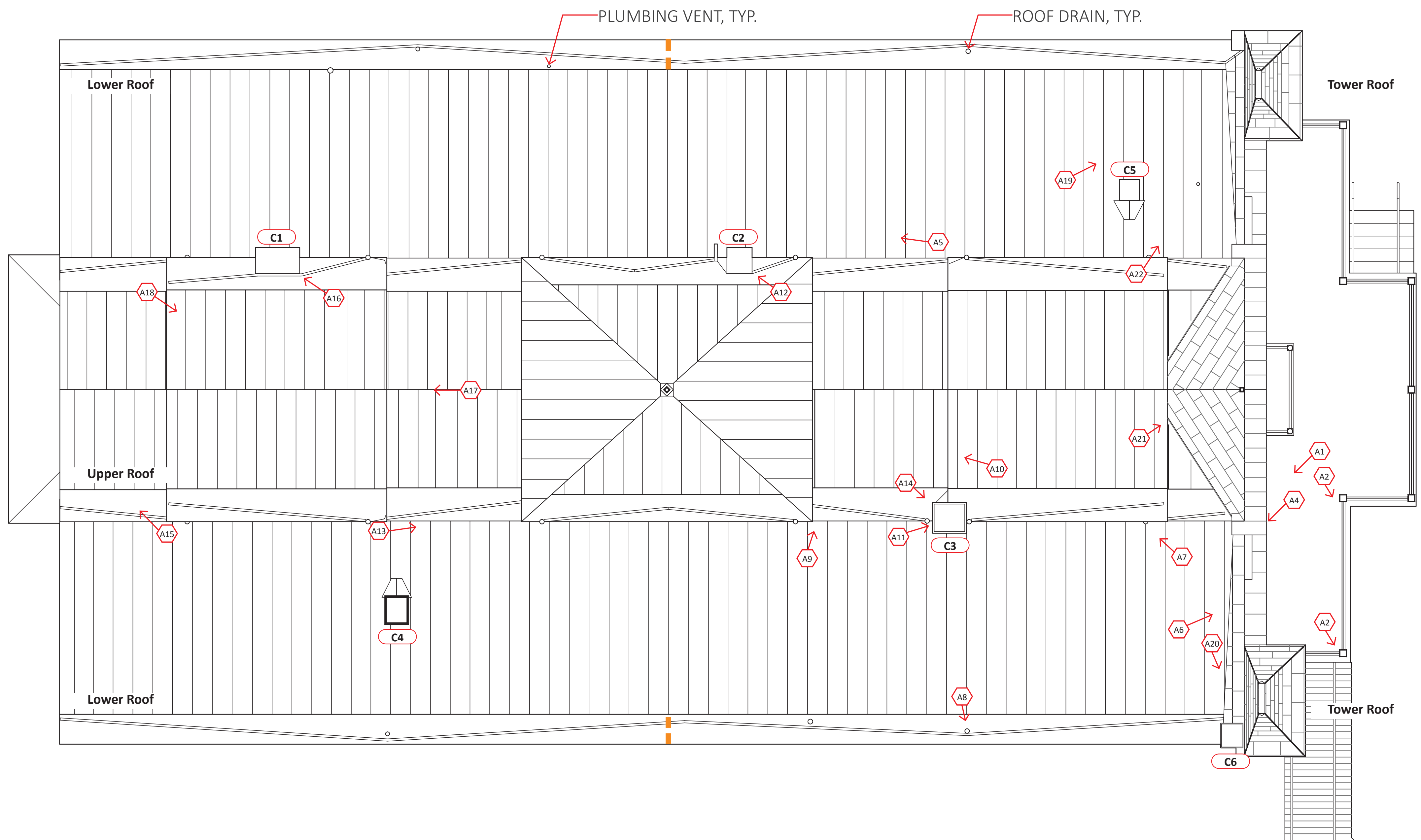
*NPS notes that many exterior insect screens are stored on-site in the George Washington Memorial Parkway Headquarters. The park will have to locate them or secure replacements.

3.1.10 Roof

The roof is constructed of sloped sheet metal with wood boards, on wood rafters and is separated into a lower tier (second floor) and an upper tier (third floor). These tiers correspond to the longitudinal banded structure of the building. The upper tier is separated into two halves by the central square pyramidal hipped roof, topped by the flagpole. The central peak roof drains on two sides to each wing of the upper tier. Each wing of the upper tier is itself divided into multiple sections.

The two main wings of the upper tier drain down to, and across, the lower tier via 3 downspouts on each side of the building and down to the ground via two downspouts on each side of the building. There are overhanging eaves at the perimeter with a series of rainwater diverters that channel the water to the downspouts and the downspouts pass through the eaves. The lower roof has been recently re-roofed. The slope of the lower roof is relatively shallow at approximately 1:8. This relative flatness does not allow water to shed well leading to low flow speeds and a build up of water on the roof during rainfall (and snowfall). In addition, the roof is framed (per the Historic Structure Report) using 3 1/2” deep rafters at 19” o.c. which are both inadequate for the loading and span and are susceptible to deflection.

The main entrance (front of the house) faces northeast. The two flanking masonry towers each have a hipped metal roof that engages the lower roof. A central gable with metal roofing sweeps back to engage the upper tier roof with a triangular form resulting in some complicated roof geometries and connections.



Key

CX Chimney Number

AX Roof Photograph

Expansion Joint

Figure 3.11 Roof Plan


Porch Roof - Low Slope A1


Level 2 Roof - Chimney C2 A5


Obstructed Roof Downspout A8


Cracked Flashing - Chimney C3 A11

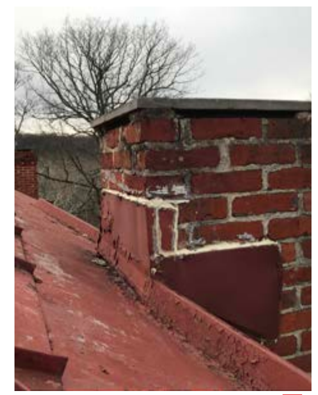

Peeling Paint at Upper Roof A15


North Tower Roof - Chimney C5 A19


South Tower Roof - Chimney C6 A20


Front Porch Column / Flashing A2


Peeling Paint A6


Flashing Cracked - Chimney C2 A12


Peeling Paint at Upper Roof A17

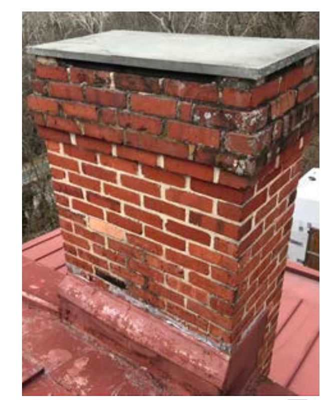

Peeling Paint at Rear of Front Gable A21


Front Porch Gutters A3


Obstructed Down Spouts A7


Cracked Flashing A9

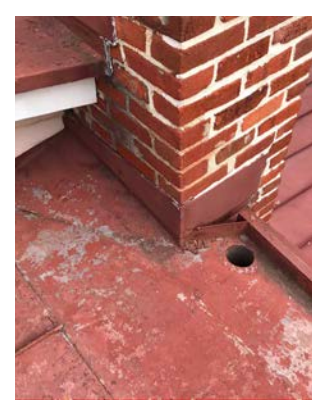

Diverter Separating A13

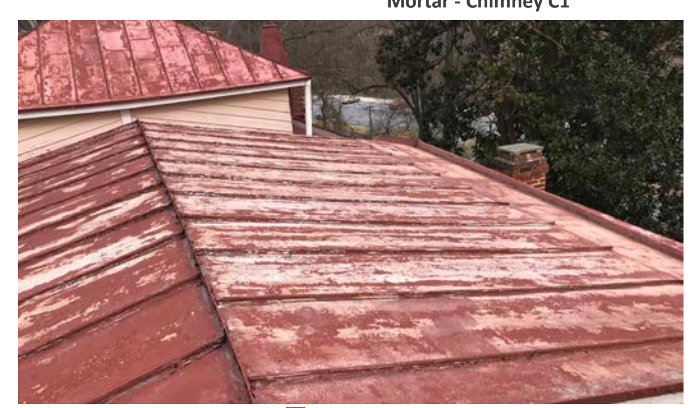

Weathered Masonry and Mortar - Chimney C1 A16


Peeling Paint at North Tower Roof A22


Water Damage to Sill and Window at Porch Roof A4


Peeling Paint at Upper Roof A10


Peeling Paint at Upper Roof - Chimney C3 A14


Peeling Paint at Upper Roof A18


Pooling Water at Roof Expansion Joint

3.1.10.1 Roof Drain Capacity

A roof drain calculation has been performed. Based on International Plumbing Code (IPC) requirements, the site is located in zone 3 and has an average rainfall rate of 3.2 in/hr (IPC, Figure 1106.1). The existing roof drains have an estimated interior circumference of 3.5 inches. Based on this information and using Table 1106.2(1) of the IPC, 2 vertical leaders can accommodate approximately 9,060 sf of horizontally projected roof area. The Clara Barton House currently has approximately 4,682.5 sf of horizontally projected roof area. Therefore, the downspouts are sufficient for accommodating the rain load.

(The area calculation includes a quantity for vertical surfaces in addition to the horizontal area. Calculated total Drain capacity is based on International Building Code tables, which in turn are based on location, calculation and historic rainfall data.)

3.1.11 Chimneys

There are 6 brick chimneys in total, three engage the upper roof (C1,C2,C3), two pass midway through the lower roof, independent of any walls (C4,C5), and one engages the east flanking masonry tower (C6). All six chimneys have been capped with a stone slab that has been mortared at the corners, creating a horizontal slot that allows for ventilation.

Refer to Figure 3.11 for the roof plan and for chimney numbering and identification. Refer to Table 3.6 for Chimney Conditions Summary.

Table 3.5 Chimney Conditions Summary

	TYPE	ROOM ORIGIN	USE	MORTAR	FLASHING	CAP	WALL
C1	Flue	Utility Room [009]	Inactive	Insufficient	Insufficient at upper roof Sufficient at lower roof (replaced during recent roofing update)	Slate cap Ventilation slot	No sealant at wall
C2	Flue	Hall [102] (connected to hall stove) Third Floor Bedroom [302]	Inactive	Sufficient	Insufficient at upper roof Sufficient at lower roof	Slate cap Ventilation slot	No sealant at wall
C3	Fireplace	Rear Parlor [104] (open fireplace)	Inactive	Insufficient	Insufficient at upper roof Sufficient at lower roof (replaced during recent roofing update)	Slate cap Ventilation slot	Sealant present
C4	Flue	Clara Barton's Bedchamber [207]	Inactive	Insufficient	Sufficient at lower roof (replaced during recent roofing update) Insufficient cricket	Slate cap Ventilation slot	n/a
C5	Flue	Library Alcove [215]	Inactive	Insufficient	Sufficient at lower roof (replaced during recent roofing update) Insufficient cricket	Slate cap Ventilation slot	n/a
C6	Flue	Front Parlor [103]	Inactive	Insufficient	Insufficient at tower roof	Slate cap Ventilation slot	No sealant at wall

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3.2 Structural

3.2.1 Overview

This report will document the existing conditions of the structural elements, identify any structural deficiencies, and provide the NPS with an understanding of the live load capacity of the existing floors.

3.2.2 History of Structure

Over the building's lifespan, various reports and modifications were performed but unfortunately, very few structural drawings relating to the existing building were available for review with the exception of those documents listed below.

- As-built drawings prepared by Sheladia Associates, Inc. dated December 31, 1981 indicating a First Floor design live load of 60 psf.
- Clara Barton National Historic Site Historic Structures Report; (HSR), 2004.
- Valor Construction memo dated January 15, 2016, Re: Change Order 001 – Provide Temporary Structural Shoring – This document identifies the rationale for installing vertical shoring during the roof replacement project.
- Roof shoring drawings- These shoring drawings were provided however they didn't provide a date, professional engineer seal, or the name of the firm they were prepared by. Based on conversation with NPS staff, it is believed that these drawings prepared internally by prior NPS staff.
- Roof repair drawings dated June 2015 – George Washington Memorial Parkway, Clara Barton House – Replace Leaking Low Scope Metal Roofs- PMIS #196219 – These drawings show the repairs of the south wall and sill on the Second Floor as well as the roof repair details, roof photos, and accurate building plans, elevations, and building sections.
- Work was completed to shore the floor structure at the rear of the house in 2012.

3.2.3 Structural System

3.2.3.1 General

Constructed in 1891, the three story CLBA is a wood roof and floor structure supported by wood bearing walls and founded on stone foundations.

A majority of the rooms have finished ceilings, which limited our ability to verify the member size and spacing of the roof, ceiling, and floor framing. The scope of this project included a limited structural assessment with limited "disturbance to the CLBA". Due to this limited access, the framing plans provided in the HSR were used to establish the basis of analysis.

3.2.3.2 Floor Structure

The survey of the existing floor systems revealed no major visual signs of structural deterioration or deficiencies.

Although not necessarily visible, some serviceability issues were apparent and ranged from non-flat floors to some noticeable bounce in the floors. These issues were also observed during the preparation of the HSR and therefore it is determined that these conditions are not new items, or a result of deterioration, but rather existing conditions that are, and have been, a part of the CLBA. The methods of construction and original design of the floor structure have likely caused these serviceability issues. Specifically, the bounce in the floors are primarily a result of the shallow floor joist depth and a lesser contributor, the wider joist spacing. The non-flat floors are likely a result of shrinkage and swelling of the wood members.

See recommendations section, Section 4.2, for floor load capacity diagrams of the existing floors.

3.2.3.3 Roof Structure

Similar to the floors, no visual signs of deterioration or distress were observed in the roof.

Although, no deterioration was visually observed, multiple sections of shoring were observed under the roof framing on the Second Floor (Figure 3.14, 3.15 and 3.16) that extended down through the First Floor and into the Basement where it was supported on temporary wood block foundations (refer to Figure 3.13). Based on discussion with NPS staff, the shoring was installed during the recent roof replacement project and located in the following spaces:

- Second Floor, Room 209- Dr. Hubbell's Bed Chamber
- First Floor, Room 106 – Office
- First Floor, Room 104 – Rear Parlor
- Basement, Room 001 – Unfinished Basement

Additionally, based on our understanding of the shoring and as indicated by the remaining shoring in Rooms 104 and 106, there was also shoring likely installed in rooms 205 and 204 to support the roof above. That vertical line of shoring would have extended down into the Basement as well. The timing of the removal of these sections of shoring is unknown.

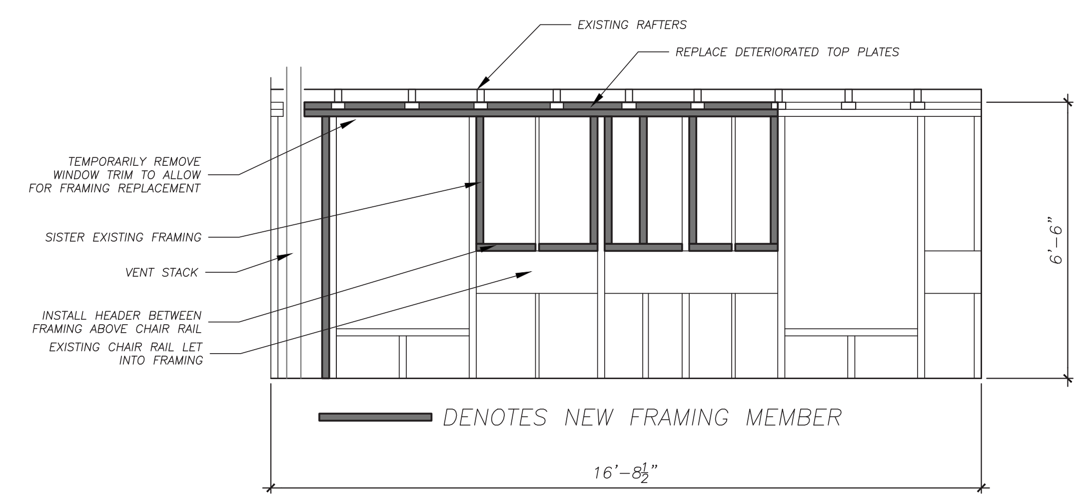

Figure 3.12 Repair of Wood Framing on south wall; see PMIS #196219 Drawings

3.2.3.4 Wall Structure

The house consists primarily of two exterior, balloon framed, load bearing wood stud walls and two interior load bearing wood stud walls that are platform framed. These bearing walls create three distinct sections of the house.

No signs of deterioration or failure were observed in the structural walls. The balloon framing was not visible during our survey efforts so the condition of the wall and joist supporting the floor joists as well as the connection of the joist to the balloon framing is unknown.

However, during the roof replacement project, portions of the existing south wall of room 205, Large Guest Room, were replaced. This work included the replacement of the wall top plates that support the roof joists. Refer to Figure 3.12 for extent of the repairs.

No other locations of repair along the north and south walls were identified during the roof replacement project.

3.2.3.5 Foundations

No signs of structural deterioration were observed on the existing foundations.

Figure 3.13 Structural Shoring in Unfinished Basement [001]

Figure 3.14 Structural Shoring in Rear Parlor [104]

Figure 3.15 Structural Shoring in Office [106]

Figure 3.16 Structural Shoring in Dr. Hubbell's Bedchamber [206]

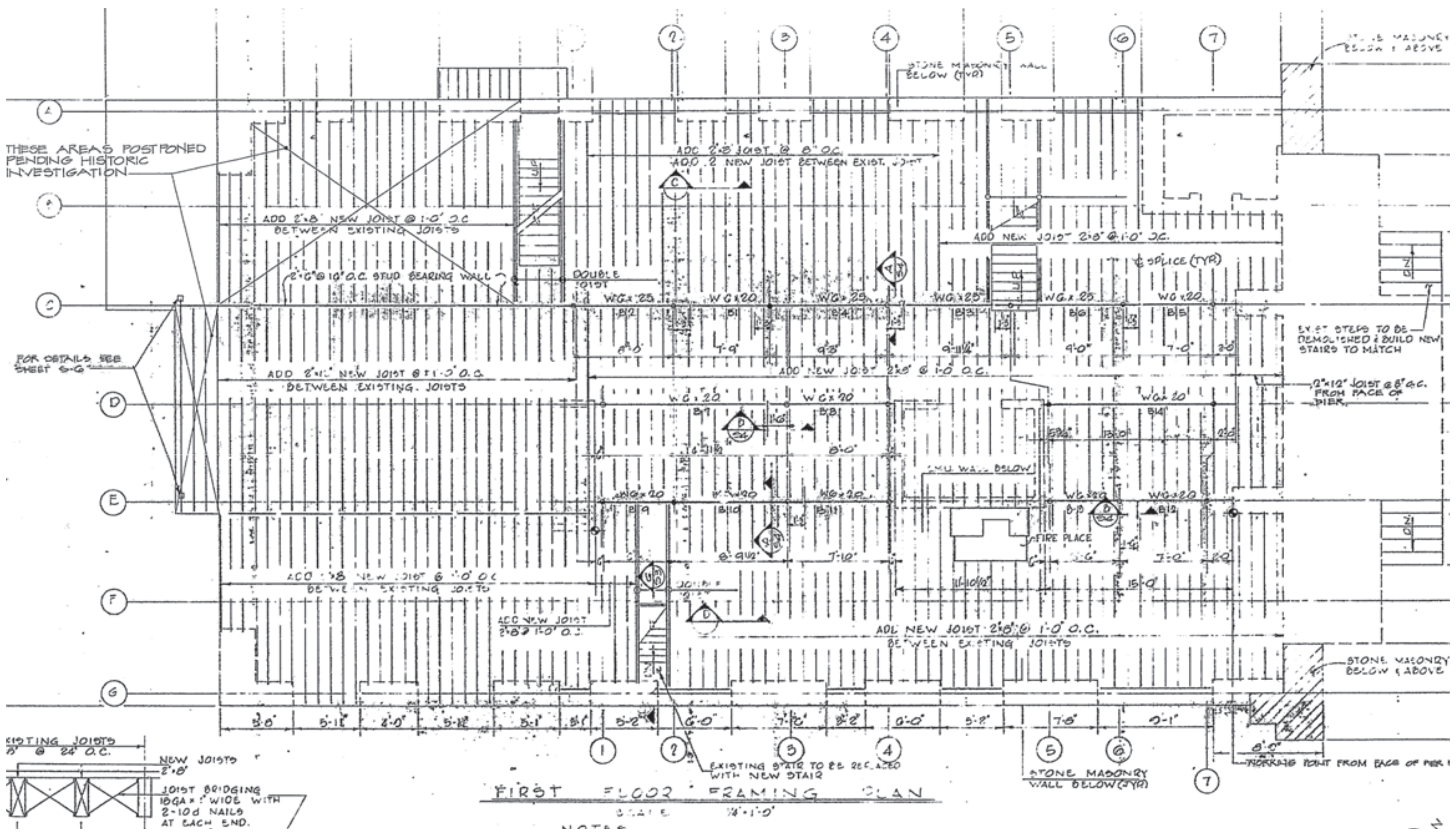

Figure 3.17 Structural Framing Plan - First Floor

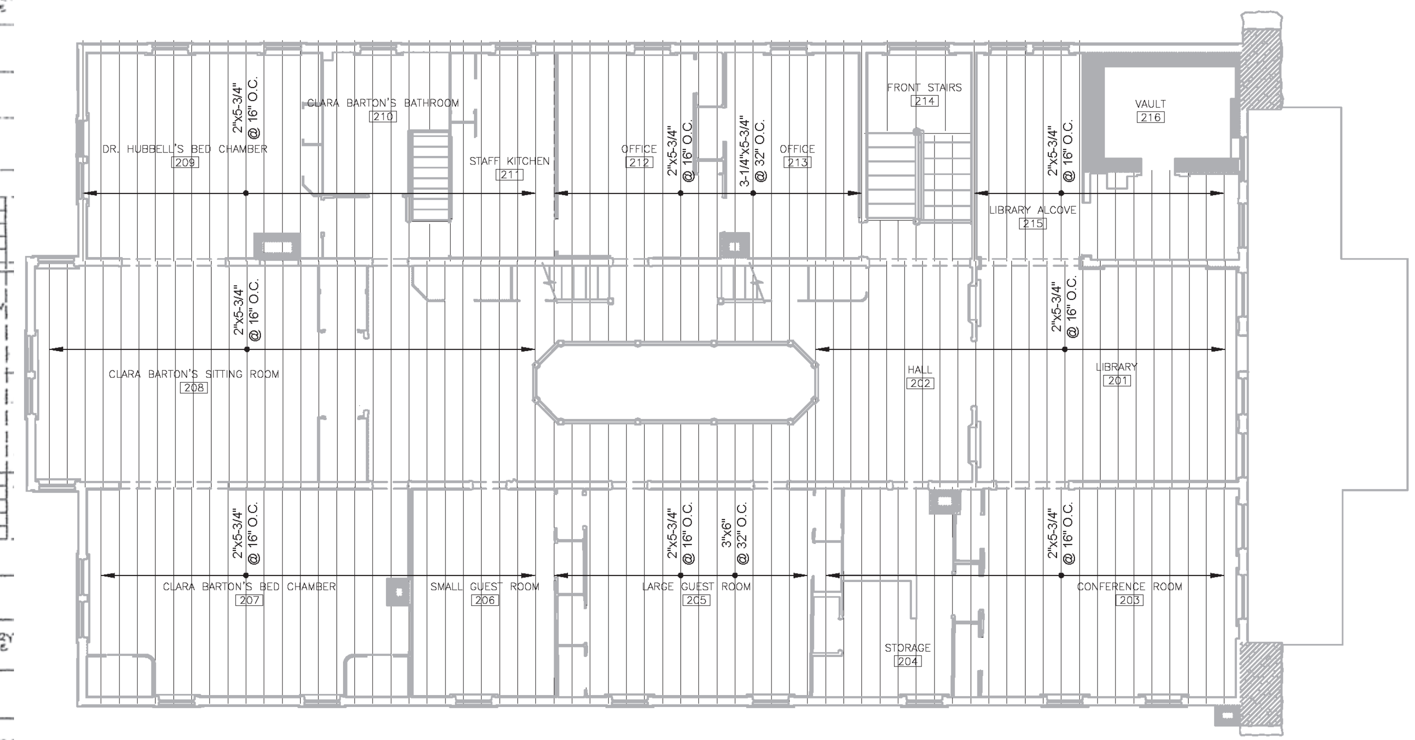

Figure 3.18 Structural Framing Plan - Second Floor

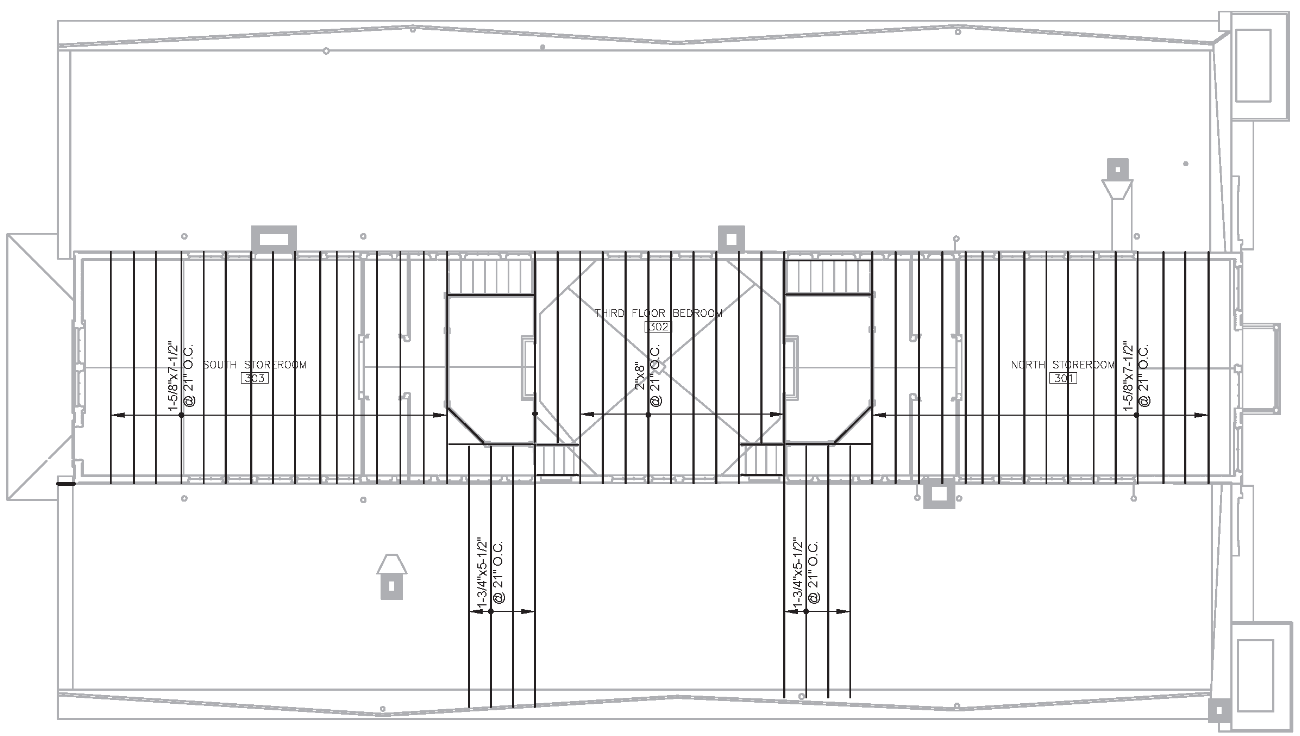

Figure 3.19 Structural Framing Plan - Third Floor

3.3 Mechanical

3.3.1 Overview

The Clara Barton House does not have a central cooling and/or heating system, but rather, it is served by terminal equipment such as fan coil units, unit heaters, and finned tube radiation (FTR). Not all rooms within the Clara Barton house are conditioned. Certain rooms in the house are provided with cooling and heating and others are just heated or cooled. Critical spaces such as Ms. Barton's Bedroom and Sitting Room and Red Cross Offices are not cooled, for example. An air-cooled chiller provides chilled water and a gas-fired boiler provides heating hot water to terminal equipment. The chiller and hot water boiler are in good condition and should have plenty of serviceable life left, if properly maintained. For the most part, associated trim and accessories are in fair condition; however, there are a few components that are in visibly poor condition. Fan coil units, unit heaters, and several finned tube baseboard heaters are in poor condition, as large amounts of rust and calcification are observable on the equipment interiors and exteriors. This equipment is well beyond its useful life. New finned tube baseboard heaters were recently added to rooms not previously provided with a heating source, such as Red Cross offices on the first floor and Clara Barton's bedroom and sitting room on the second floor.

Figures 3.20, 3.63, 3.83 and 3.99 provide a summary of existing conditions of mechanical equipment located in the basement, first floor, second floor, and third floor, respectively, of the Clara Barton House. Condition assessments are based on visual inspection. Refer to the legend on each figure for descriptions of condition designations. It is noted that during the site survey on January 31st, 2018, all HVAC equipment was off due to a water pipe rupture in the surrounding area. As such, operating condition of mechanical equipment could not be assessed.

3.3.2 Building Envelope

The Clara Barton house building envelope is its most critical deficiency. The older construction of the house does not include insulation on walls or on the roof. Additionally, its loose construction allows for a large amount of infiltration to enter the building during winter and cool air to escape the building during summer. The lack of insulation and loose construction contribute to the high cooling and heating loads required to maintain acceptable space temperatures and humidity levels throughout the house.

At the basement level, humidity issues are further exacerbated by the minimal exterior wall construction and dirt floor. Basement walls are made out of stacked stone, which over time, can be saturated with moisture. Similarly, the dirt floor can also become saturated with moisture during prolonged periods of rain. Humidity can thus accumulate in the basement and mitigate its way up to the upper floors.

The approximate thermal performance of the existing envelope has been calculated given the information found in existing drawings and per observations noted during the 1/31/18 survey (refer to Tables 3.7- 3.13).

For comparison, refer to Table 3.6 depicting the minimum thermal performance of an International Energy Conservation Code (IECC) 2015 compliant building envelope in this climate zone. The existing envelope performance does not meet current building standards.

Table 3.6 2015 International Energy Conservation Thermal Envelope Requirements

	R-VALUE	U-VALUE	SHGC
Roof	37	0.027	-
Wood Framed Walls	15.6	0.064	-
Mass Walls	9.6	0.104	-
Operable Windows (N)	2.22	0.45	0.40
Operable Windows (S, E, W)	2.22	0.45	0.53

HVAC recommendations provided in this report are made with the assumption that no building envelope improvements will be made. A short study on the impact of building envelope improvements on cooling, heating, and humidification loads can be found in section 4.3.7 of this report.

Table 3.7 Type 1 - With Lath and Plaster

	R-VALUE	U-VALUE
Inside Air Film	0.68	
1/2" Plaster	0.10	
1/2" Lath	0.79	
3.5" Stud/Air Gap	1.14	
3/4" Wood Siding	1.05	
Outside Air Film	0.17	
TOTAL	3.93	0.254

Table 3.8 Type 2 - With Wood Panel

	R-VALUE	U-VALUE
Inside Air Film	0.68	
1" Wood Panel	1.08	
3.5" Stud/Air Gap	1.14	
3/4" Wood Siding	1.05	
Outside Air Film	0.17	
TOTAL	4.12	0.243

Table 3.9 Type 3 - Basement

	R-VALUE	U-VALUE
Inside Air Film	0.68	
Stone (24" Thick)	0.33	
Outside Air Film	0.17	
TOTAL	1.18	0.845

Table 3.10 Type 4 - Vault

	R-VALUE	U-VALUE
Inside Air Film	0.68	
12" Brick	1.29	
3.5" Stud/Air Gap	1.14	
3/4" Wood Siding	1.05	
Outside Air Film	0.17	
TOTAL	4.33	0.231

Table 3.11 Insulated Exterior Walls

	R-VALUE	U-VALUE
Inside Air Film	0.68	
1" Wood Panel or Plaster/Lath	1.08	
3.5" Foil Insulation	12.00	
3/4" Wood Siding	1.05	
Outside Air Film	0.17	
TOTAL	14.98	0.067

Table 3.12 Roof

	R-VALUE	U-VALUE
Inside Air Film	0.61	
1" Wood Sheathing, No Insulation	1.08	
Outside Air Film	0.17	
TOTAL	1.86	0.538

Table 3.13 Glazing

	U-VALUE	SHAD. COEFF.
Single pane, 1/8" glass, operable, wood frame	0.91	0.45
TOTAL	0.91	0.45

3.3.3 Chilled Water

Cooling is the most critical HVAC deficiency of the Clara Barton House. The cooling load in the building, assuming no major upgrades to the existing envelope is approximately 50 tons, or 10 times that of the existing chiller. The Clara Barton House is currently served by a 5-ton chiller with a split configuration where the evaporator is located indoors in the unfinished basement and the condenser is located outdoors. While both components are only 8 years old, some of their associated accessories are beyond their useful life and need replacement. The most notable accessory needing replacement is the expansion tank, which is well over 30 years old. The associated chilled water pump is in visibly good condition. Associated chilled water piping is in visibly fair to poor condition. Oxidation can be observed on several portions of piping and deterioration of parts of its insulation was also observed. Chilled water is provided to fan coil units on the basement, 1st, and 2nd floors of the building.

3.3.4 Heating Hot Water

Heating hot water for the Clara Barton House is generated by a gas fired boiler rated for 571 MBH. The boiler was manufactured in 2008 and has approximately 10 years of additional service life remaining. Gas-fired boilers of similar size have an approximate lifespan of 20 years, per ASHRAE published data. The boiler is in visibly good condition. The associated pump and accessories are also in visibly good condition and appear to be manufactured around the same time as the boiler. Heating hot water piping and insulation in the Boiler shed appear to be in fair condition; however, the hot water piping and insulation within the Clara Barton House basement is in poor condition. There is visible water damage and deterioration on certain portions of hot water piping insulation within the basement. Additionally, segments of piping are uninsulated, contributing to unwanted heat loss.

3.3.5 Four-pipe Fan-coil Units

There are a total of 6 four-pipe fan coil units (FCU's) serving the Basement, 1st, and 2nd levels of the Clara Barton House. All FCU's are cabinet floor mounted type with top supply and bottom return and have a hot water heating coil and chilled water cooling coil. All fan coil units were manufactured in 1981 and are well beyond their useful lives. There is very noticeable rust on the casings and internal components of these units including the motor and the coils. Associated heating hot water and chilled water piping is also in poor condition, as large amounts of rust and calcium build-up are apparent. During the site survey, several of the fan coil units were observed with return air-side filters not properly installed.

3.3.6 Hot Water Unit Heaters

Unit heaters provide heating to spaces in the Basement and 1st floor levels of the Clara Barton House. New unit heaters serve the Utility Room and Unfinished Basement. Three custom built unit heaters installed within the three stoves on the 1st level provide heating to the Vestibule 101, Hall 102, and Center Red Cross Office 109. Nameplate data could not be seen on these units during the site visit; however, these units appear to be manufactured in the 1980's and are visibly at the end of their useful lives. Associated wall-mounted thermostats are also well beyond their useful lives and are antiquated.

3.3.7 Finned Tube Baseboard Radiators

Hot water finned tube radiators provide heat to several spaces throughout the basement, first, and second floors of the Clara Barton House. Several of these units were manufactured in the 1980's and provide approximately 690 Btu's per linear foot. They have reached the end of their useful lives are in visibly poor condition. Associated wall-mounted thermostats are also well beyond their useful lives and are antiquated.

In June of 2018, several new finned tube baseboard heaters were provided in areas that did not previously contain a heat source. These areas are primarily museum spaces. Refer to the Mechanical/Plumbing Existing Conditions plans on the following pages for heater locations.

3.4 Plumbing

3.4.1 Overview

The Clara Barton House is provided with domestic cold and hot water. The latter is provided by an electric domestic water heater located in the mechanical room within the unfinished basement. There are three bathrooms, one in each of the basement, first, and second levels. Each bathroom is provided with domestic cold and hot water and sanitary utilities. Only the bathrooms on the basement and first floor are operational, while the bathroom on the second level is defunct. Storm water management is primarily via roof drain gutters and downspouts.

3.4.2 Domestic Cold and Hot Water

In June of 2018, as part of the installation and commissioning of a new fire suppression and alarm system, the building incoming water supply line was upgraded to provide adequate pressure and volume for existing domestic and new fire water lines.

Domestic cold and domestic hot water are provided to the clothes washer and bathroom in the basement, the kitchen and bathroom on the first level, and the staff kitchen and bathroom on the second level. It was observed that the existing domestic water piping serving the Clara Barton Bathroom 210 was made out of lead. Although not observed, it is likely that lead piping is also serving the adjacent Staff Kitchen 211. Domestic hot water is provided via an electric water heater located in the Basement. Even though the water heater is 27 years old, it is in visibly fair condition. Associated piping is in poor condition; however. The estimated age of the existing domestic cold and hot water piping is over 30 years; which is beyond its expected useful life, per the equipment life expectancy database published by ASHRAE. Piping is visibly rusty and calcium build-up can also be observed.

Most domestic water piping is not insulated and portions that are insulated exhibit water damage and/or tears. Lack of insulation causes a greater amount of heat loss through the bare piping, which means the existing domestic water heater has to consume more energy to overcome these losses.

3.4.3 Sanitary Piping

Sanitary piping is estimated to be over 30 years old. Metal piping is in poor condition, as there is visible discoloration and rust on the piping. Polyvinyl Chloride (PVC) appears newer and is in much better condition.

3.4.4 Bathrooms

The bathrooms in the Clara Barton House are not currently exhausted. Per IMC 2012 Chapter 4, an exhaust rate of either 20 or 50 CFM per toilet fixture is required, depending on whether the means of exhaust is continuous or intermittent.

3.4.5 Make-up Backflow Preventers

The backflow preventer assembly at the make-up water connection to the chilled water loop is in visibly poor condition. The valve assembly is missing a plug/cap at one of the valves. Additionally, the valve assembly and associated piping are exhibiting rust.

The backflow preventer associated with the heating hot water system is located in the boiler shed. It is approximately 10 years old and is in visibly good condition. Backflow preventer valves have a typical life expectancy of 30-35 years.

3.4.6 Fire Protection System

In June 2018, a complete automatic sprinkler system was installed throughout the Clara Barton House. The new system includes all piping, hangers, sprinklers, valving, and alarm switches required for a fully functional system. One zone control valve assembly serves all the sprinklers in the system.

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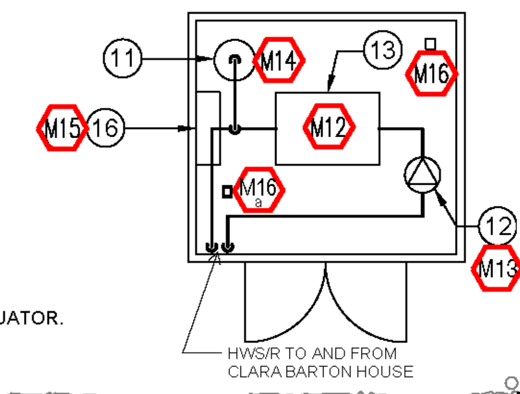
SPECIFIC NOTES

1. EXISTING HOT WATER UNIT HEATER (INSTALLED JUNE 2018).
2. EXISTING FAN COIL UNIT.
3. NOT USED.
4. EXISTING ELECTRIC WATER HEATER.
5. EXISTING CHILLED WATER SUPPLY AND RETURN PIPING.
6. EXISTING HEATING HOT WATER SUPPLY AND RETURN PIPING.
7. EXISTING DOMESTIC COLD AND HOT WATER.
8. EXISTING SANITARY PIPING.
9. EXISTING CONDENSING UNIT.
10. EXISTING CHILLER (EVAPORATOR).
11. EXISTING EXPANSION TANK.
12. EXISTING PUMP.
13. EXISTING GAS-FIRED HOT WATER BOILER.
14. EXISTING FINNED TUBE RADIATOR.
15. EXISTING THERMOSTAT.
16. EXISTING VENTILATION DAMPER AND ACTUATOR.



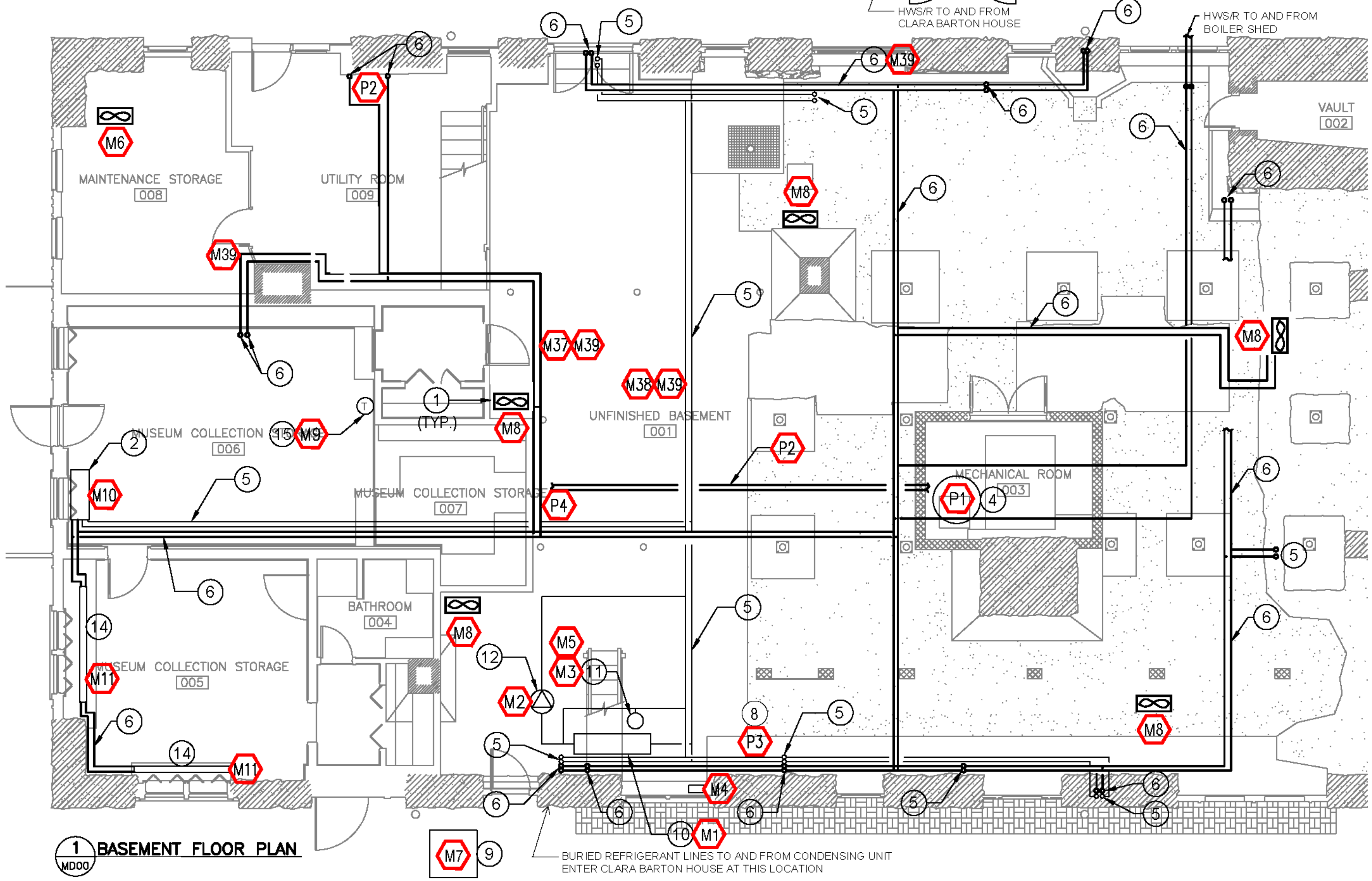


Figure 3.20 Mechanical / Plumbing Existing Conditions Plan - Basement

LEGEND

Condition	Description
Poor	Equipment is beyond its useful life. Exhibits significant amounts of deterioration, rust. Visually damaged.
Fair	Equipment is near the end of its useful life. Exhibits minimal amount of deterioration, rust. No signs of damage.
Good	Equipment has several years of useful life remaining. No visual signs of deterioration, rust, or damage.
Excellent	Equipment is brand new and has all of its useful life remaining.

BASEMENT

Discipline	ID	Equipment & Model / Serial No.	Room Location	Visible Condition	Photo (Y/N)
Mechanical	M1	Packless Coil (COCX-2501-J-13-178)	Unfinished Basement	Good	Y
Mechanical	M2	B&G Inline Pump (Motor - MRP58JV-758)	Unfinished Basement	Good	Y
Mechanical	M3	Airtrol Fitting (ATF-12)	Unfinished Basement	Fair	Y
Mechanical	M4	Little Giant Condensate Pump (VCMA-2OULS)	Unfinished Basement	Poor	Y
Mechanical	M5	Wood Ind. Prod. Co Expansion Tank	Unfinished Basement	Poor	Y
Mechanical	M6	Hot Water Unit Heater	Maintenance Storage 008	Excellent	N
Mechanical	M7	Thermal Zone Condenser (TZAA-348-2A757)	Outside Basement (Southeast)	Fair	Y
Mechanical	M8	Hot Water Unit Heater	Unfinished Basement	Excellent	N
Mechanical	M9	Honeywell Chronotherm (T8082)	Museum Collect Storage 006	Poor	Y
Mechanical	M10	FCU (4-pipe)	Museum Collect Storage 006	Poor	Y
Mechanical	M11	Finned Tube Radiators	Museum Collect Storage 005	Poor	Y
Mechanical	M37	Piping - Heating Hot Water	Unfinished Basement	Poor	Y
Mechanical	M38	Piping - Chilled Water	Unfinished Basement	Poor	Y
Mechanical	M39	HVAC Piping Insulation	Unfinished Basement	Poor	Y
Plumbing	P1	Electric Water Heater (Ruud PE52-2)	Mech Room 003	Fair	Y
Plumbing	P2	Piping - Domestic Water (hot & cold)	Unfinished Basement	Poor	Y
Plumbing	P3	Piping - Sanitary	Unfinished Basement	Poor	Y
Plumbing	P4	CHW Make-up water backflow preventer	Unfinished Basement	Poor	Y

BOILER SHED

Discipline	ID	Equipment & Model / Serial No.	Room Location	Visible Condition	Photo (Y/N)
Mechanical	M12	Smith Cast Iron Boiler (PGB300)	Boiler Shed	Good	Y
Mechanical	M13	Inline Pump (B&G RUK 56C17D5662E)	Boiler Shed	Good	Y
Mechanical	M14	Flexcon Expansion Tank (H2Pro XHT60)	Boiler Shed	Good	Y
Mechanical	M15	Ventilation Damper / Belimo TF-24 Actuator	Boiler Shed	Good	Y
Mechanical	M16	Electronic Metering Pump (LE02S1)	Boiler Shed	Poor	Y
Mechanical	M16a	Watts 1156F pressure regulator	Boiler Shed	Good	N
Mechanical	M17	Fisher Regulator (R622H-JGK)	Outside Boiler Shed	Fair	Y

AECOM

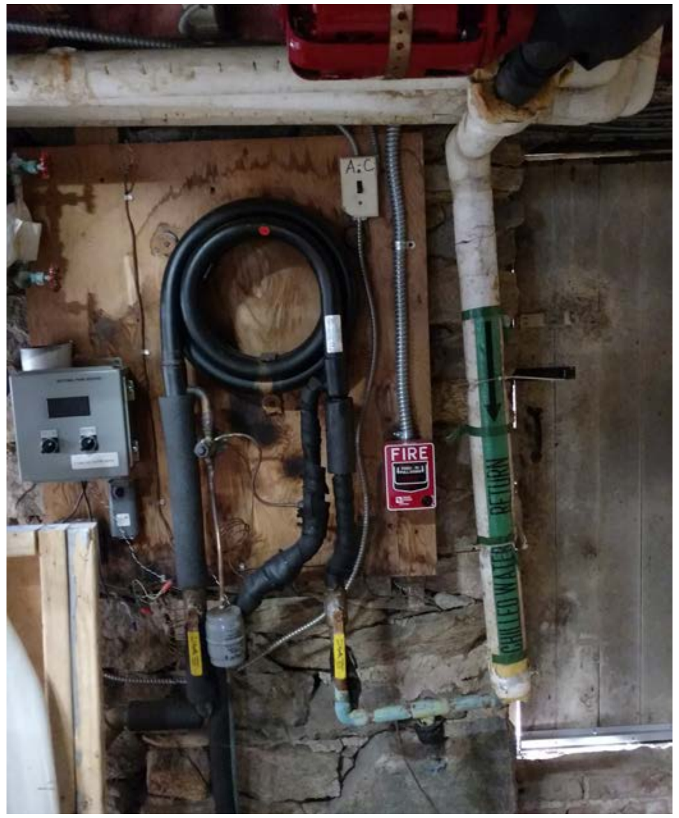


Figure 3.21 Chiller Evaporator Coil in Unfinished Basement M1

Figure 3.23 Chiller Air-Cooled Condenser M7

Figure 3.25 Chiller Air Cooled Condenser Nameplate Data M7

Figure 3.27 Chilled Water Airtrol Tank Fitting M3

Figure 3.22 Chiller Evaporator Coil Nameplate Data M1

Figure 3.24 Chiller Air Cooled Condenser Refrigerant Piping M7

Figure 3.26 Chilled Water Inline Pump in Unfinished Basement M2

Figure 3.28 Chilled Water Expansion Tank Nameplate Data M5

Figure 3.34 Chilled Water Expansion Tank in Unfinished Basement (M5)

Figure 3.36 Condensate Pump in Unfinished Basement (M4)

Figure 3.30 Four-Pipe Fan Coil Unit Serving Museum Collection Storage 006 (M10)

Figure 3.32 Finned Tube Radiator serving Museum Collection Storage 005 (M11)

Figure 3.35 Condensate Pump and Associated Tubing (M4)

Figure 3.29 Thermostat serving Museum Collection Storage 006 (M9)

Figure 3.31 Fan Coil Unit Controls and Valving (Museum Collection Storage 006) (M10)

Figure 3.33 Hot Water Piping associated with Finned Tube Radiators in Museum Collection Storage 005 (M11)

Figure 3.37 Rust on Heating Hot Water Piping & Damaged Insulation M37

Figure 3.38 Rust on Heating Hot Water Piping & Damaged Insulation M37

Figure 3.39 Chilled Water Piping with Mismatched Insulation Materials M38

Figure 3.40 Chilled Water Piping with Calcium Build-up & Missing Insulation M38

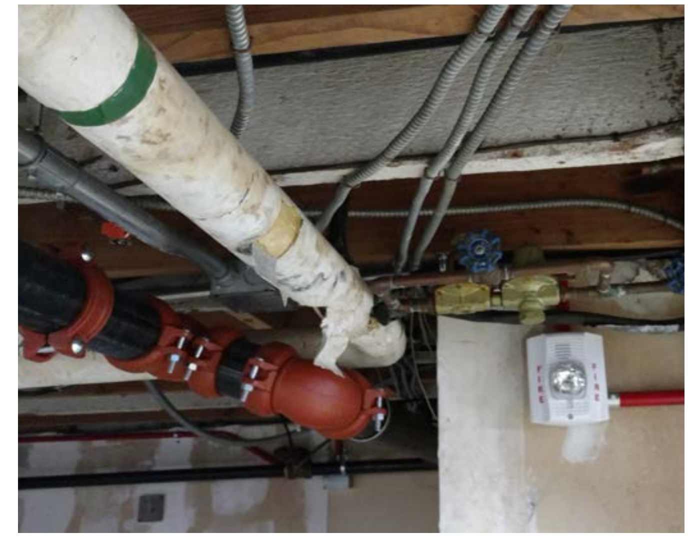


Figure 3.41 Chilled Water Piping with Torn & Water Damaged Insulation M39

Figure 3.42 Chilled Water Piping with Water Damaged Insulation M39

Figure 3.43 Missing Insulation on Heating Hot Water Piping M39

Figure 3.44 Damaged Insulation on Heating Hot Water Piping M39

Figure 3.50 Gas-fired Hot Water Boiler in Boiler Shed M12

Figure 3.52 Heating Hot Water Inline Pump in Boiler Shed M13

Figure 3.46 Heating Hot Water Vertical Expansion Tank in Boiler Shed M14

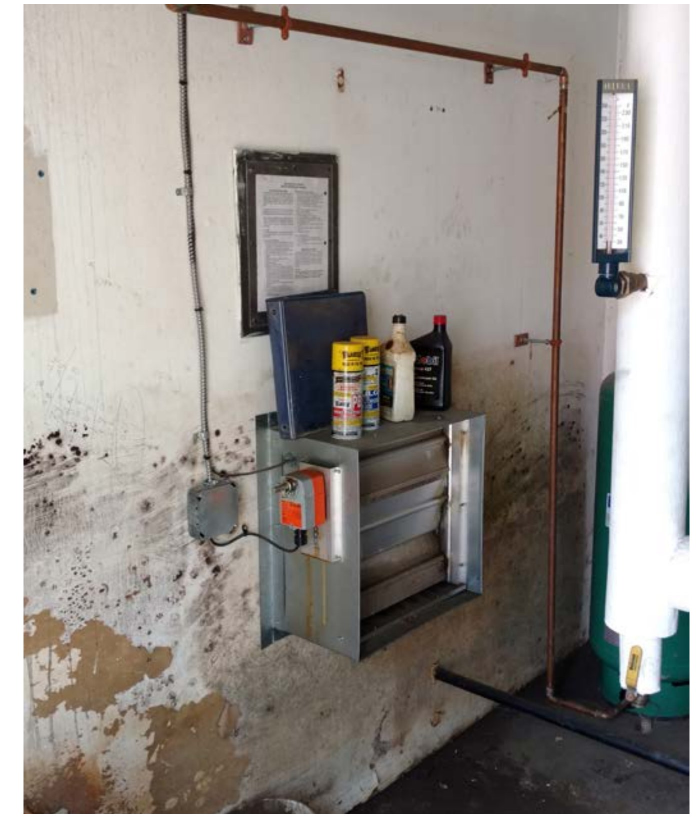


Figure 3.48 Boiler Shed Ventilation Damper and Actuator M15

Figure 3.51 Gas-fired Hot Water Boiler Nameplate Data M12

Figure 3.45 Heating Hot Water Inline Pump Nameplate Data M13

Figure 3.47 Heating Hot Water Expansion Tank Nameplate Data M14

Figure 3.49 Boiler Shed Ventilation Damper Actuator M15

AECOM

Figure 3.53 Electronic Metering Pump Nameplate Data M16

Figure 3.54 Electronic Metering Pump in Boiler Shed M16

Figure 3.55 Gas Regulator (Outside) M17

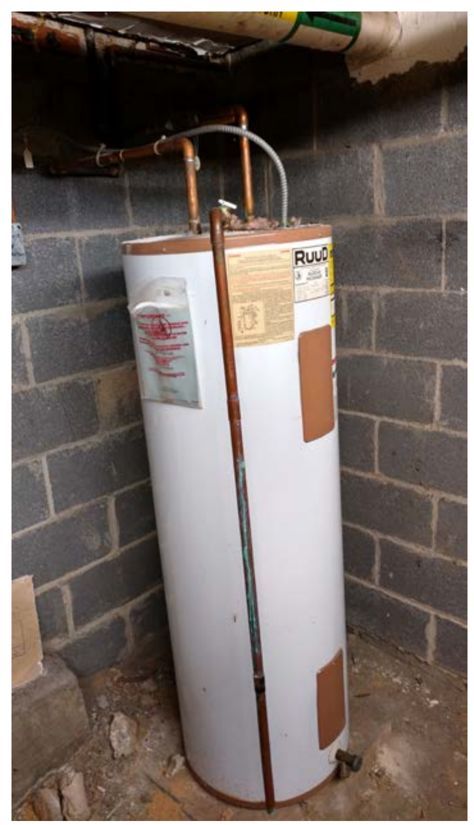


Figure 3.56 Electric Domestic Water Heater in Mechanical Room within Unfinished Basement P1

Figure 3.57 Electric Domestic Water Heater Nameplate Data P1

Figure 3.58 Uninsulated Domestic Water Piping & Valving Exhibiting Rust P2

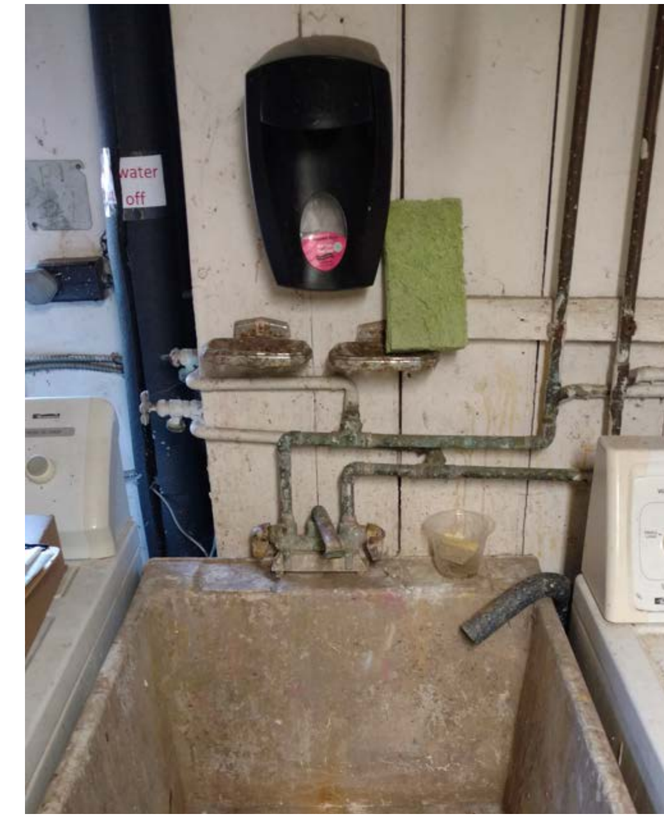


Figure 3.59 Oxidation and Calcium Build-up on Domestic Cold and Hot Water Piping P2

Figure 3.60 Uninsulated Domestic Water Piping P2

Figure 3.61 Large Amounts of Rust on Sanitary Piping in Unfinished Basement P3

Figure 3.62 Chilled Water Make-up Backflow Preventer P4

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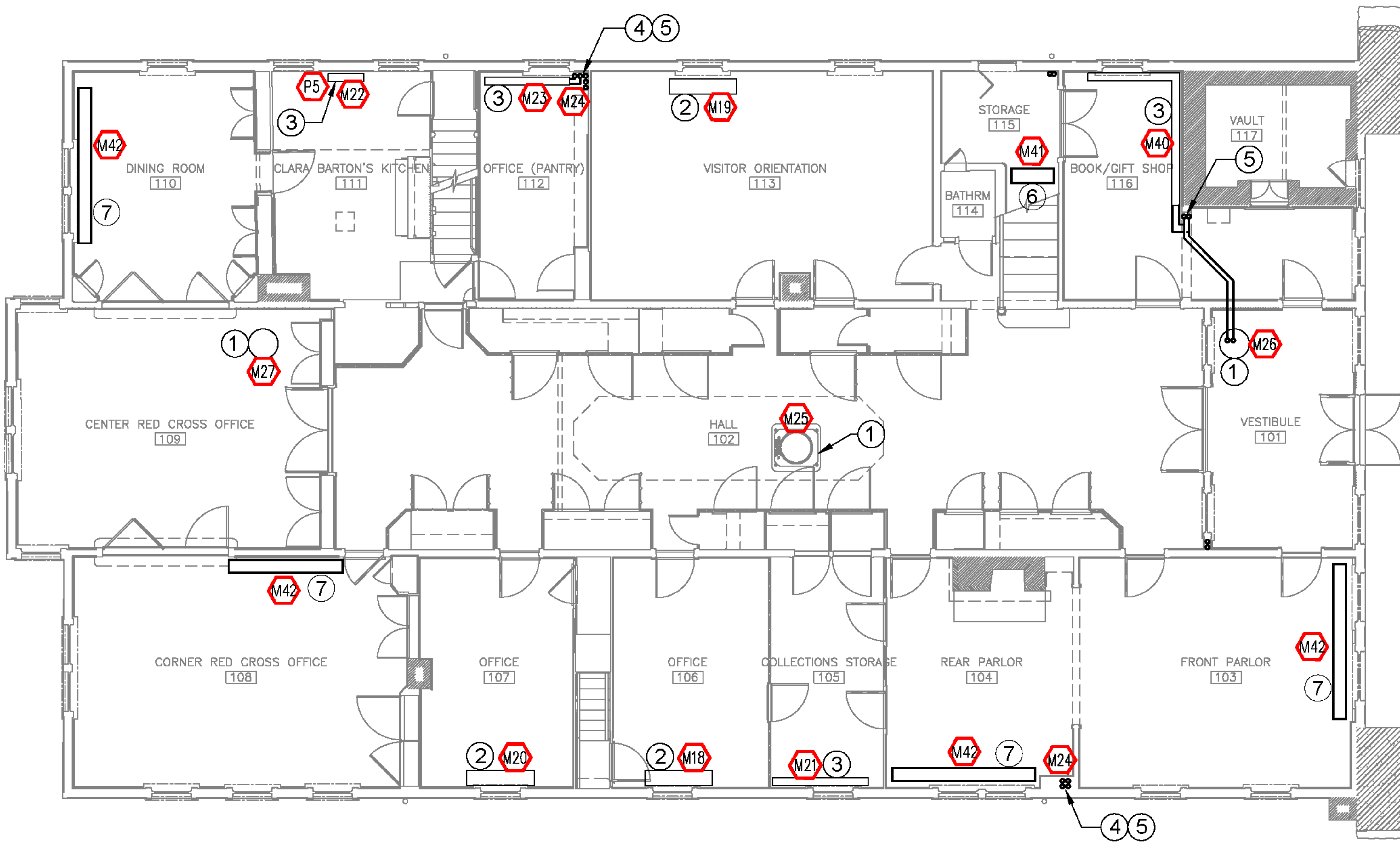


1 FIRST FLOOR PLAN M001

SPECIFIC NOTES

1. EXISTING CUSTOM HEATER.
2. EXISTING FAN COIL UNIT.
3. EXISTING FINNED TUBE RADIATOR.
4. EXISTING CHILLED WATER SUPPLY AND RETURN PIPING.
5. EXISTING HEATING HOT WATER SUPPLY AND RETURN PIPING.
6. EXISTING HOT WATER UNIT HEATER (INSTALLED JUNE 2018).
7. EXISTING HOT WATER BASEBOARD UNIT (INSTALLED JUNE 2018).

FIRST FLOOR

Discipline	ID	Equipment & Model / Serial No.	Room Location	Visible Condition	Photo (Y/N)
Mechanical	M18	Fan Coil Unit (Trane B12AL02)	Office 106	Poor	Y
Mechanical	M19	Fan Coil Unit (Trane L12AL04)	Visitor Orientation 113	Poor	Y
Mechanical	M20	Fan Coil Unit (Trane - model # unknown)	Office 107	Poor	Y
Mechanical	M21	Finned Tube Radiator	Collection Storage 105	Poor	Y
Mechanical	M22	Radiator	Clara Barton's Kitchen 111	Poor	Y
Mechanical	M23	Finned Tube Radiator	Office 112	Poor	Y
Mechanical	M40	Finned Tube Radiator	Book/Gift Shop 116	Poor	Y
Mechanical	M24	Heating HW and CHW Vertical Piping/Insulation	Office 112 / Rear Parlor 104	Poor	Y
Mechanical	M25	Stove Custom Heater (Pot Belly) (Modine)	Hall 102	Poor	Y
Mechanical	M26	Stove Custom Heater (Modine)	Vest 101	Poor	Y
Mechanical	M27	Stove Custom Heater	Center Red Cross Office 109	Poor	Y
Mechanical	M41	Hot Water Unit Heater	Storage 115	Excellent	N
Mechanical	M42	Hot Water Baseboard Unit	Parlor 103, 104; Office 108; Dining Rm. 110	Excellent	N
Plumbing	P5	Piping Insulation - Sanitary	Clara Barton's Kitchen 111	Poor	Y

LEGEND

Condition	Description
Poor	Equipment is beyond its useful life. Exhibits significant amounts of deterioration, rust. Visually damaged.
Fair	Equipment is near the end of its useful life. Exhibits minimal amount of deterioration, rust. No signs of damage.
Good	Equipment has several years of useful life remaining. No visual signs of deterioration, rust, or damage.
Excellent	Equipment is brand new and has all of its useful life remaining.

Figure 3.63 Mechanical / Plumbing Existing Conditions Plan - First Floor

Figure 3.64 Four-pipe Fan Coil Unit serving Office 106 M18

Figure 3.66 Four-pipe Fan Coil Unit serving Visitor Orientation 113 M19

Figure 3.68 Four-pipe Fan Coil Unit serving Office 107 M20

Figure 3.70 Hot Water Finned Tube Radiator serving Collection Storage 105 M21

Figure 3.65 Fan Coil Unit Motor and Nameplate Data (Office 106) M18

Figure 3.67 Fan Coil Unit Nameplate Data (Visitor Orientation 113) M19

Figure 3.69 Fan Coil Unit Controls and Valving (Office 107) M20

Figure 3.71 Hot Water Radiator serving Clara Barton's Kitchen 111 M22

Figure 3.72 Hot Water Finned Tube Radiator serving Office 112 M23

Figure 3.73 Heating Hot Water & Chilled Water Pipe Risers in Office 112 M24

Figure 3.74 Heating Hot Water & Chilled Water Pipe Risers in Rear Parlor 104 M24

Figure 3.75 Stove with Built-in Custom Heater serving Hall 102 M25

Figure 3.76 Hall 102 Stove Built-in Custom Heater Thermostat & Controls M25

Figure 3.77 Stove with Built-in Custom Heater serving Vestibule 101 M26

Figure 3.78 Vestibule 101 Stove Built-in Custom Heater Thermostat & Controls M26

Figure 3.79 Vestibule 101 Stove Built-in Custom Heater Hot Water Piping & Electrical Conduit M26

AECOM

Figure 3.80 Stove with Built-in Custom Heater serving Center Red Cross Office 109 M27

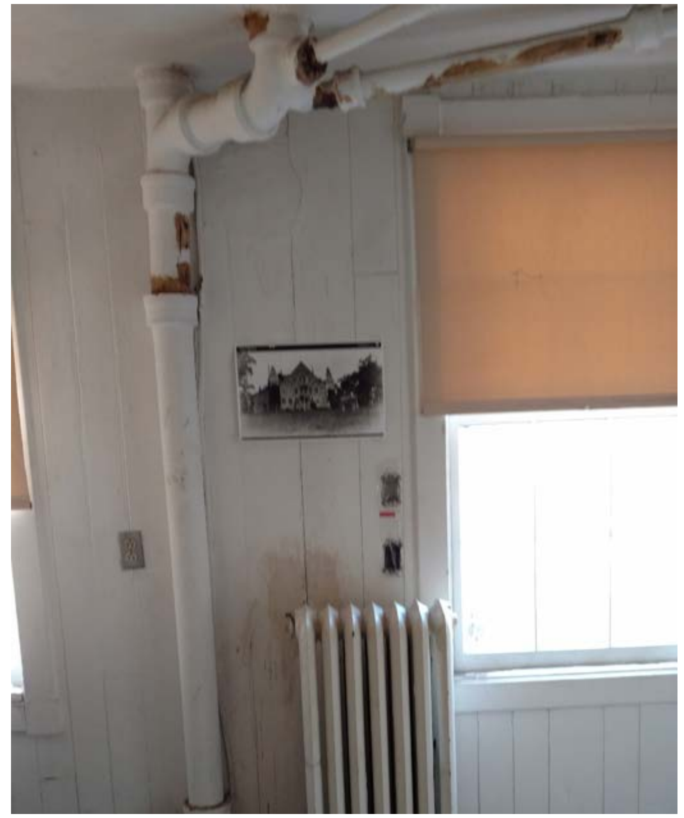
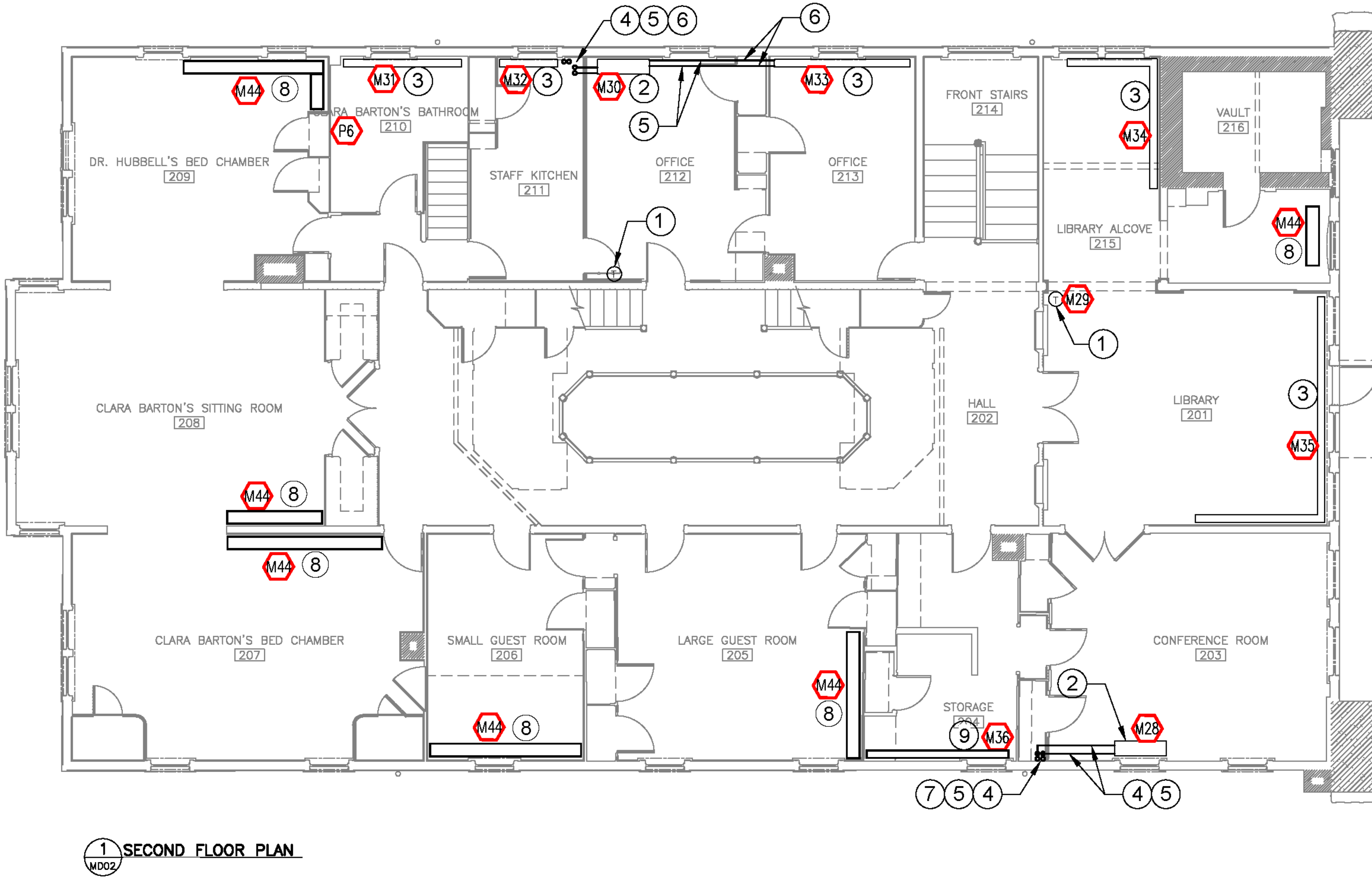


Figure 3.82 Damage on Sanitary Piping Insulation within Clara Barton's Kitchen 111 P5

Figure 3.81 Room 109 Stove Built-in Custom Heater Hot Water Piping & Electrical Conduit M27



SPECIFIC NOTES

1. EXISTING THERMOSTAT.
2. EXISTING FAN COIL UNIT.
3. EXISTING FINNED TUBE RADIATOR.
4. EXISTING CHILLED WATER SUPPLY AND RETURN PIPING.
5. EXISTING HEATING HOT WATER SUPPLY AND RETURN PIPING.
6. PORTIONS OF CHILLED WATER PIPING AND/OR HEATING HOT WATER PIPING AT THIS LOCATION ARE NOT INSULATED.
7. INSULATION WITH VISIBLE WATER DAMAGE. MISSING PORTIONS OF INSULATION ON HVAC PIPING.
8. NEW HOT WATER BASEBOARD UNIT (INSTALLED JUNE 2018).
9. REPLACEMENT HOT WATER BASEBOARD UNIT (INSTALLED JUNE 2018).

SECOND FLOOR

Discipline	ID	Equipment & Model / Serial No.	Room Location	Visible Condition	Photo (Y/N)
Mechanical	M28	Fan Coil Unit (Trane B12AL04)	Conference 203	Poor	Y
Mechanical	M29	Honeywell Chronotherm (T882A)	Library 201	Poor	Y
Mechanical	M30	Fan Coil Unit (Trane B12LA03)	Office 212	Poor	Y
Mechanical	M31	Finned Tube Radiator	CB Bathroom 210	Poor	Y
Mechanical	M32	Finned Tube Radiator	Staff Kitchen 211	Poor	Y
Mechanical	M33	Finned Tube Radiator	Office 213	Poor	Y
Mechanical	M34	Finned Tube Radiator	Library Alcove 215	Poor	Y
Mechanical	M35	Finned Tube Radiator	Library 201	Poor	Y
Mechanical	M36	Hot Water Baseboard Unit	Storage 204	Excellent	N
Mechanical	M44	Hot Water Baseboard Unit	Guest Room 205, 206; Sitting Room 208; Bed Chamber 207, 209; Library Alcove 215	Excellent	N
Plumbing	P6	Piping - Domestic Water (hot & cold)	Clara Barton's Bathroom 210	Poor	Y

LEGEND

Condition	Description
Poor	Equipment is beyond its useful life. Exhibits significant amounts of deterioration, rust. Visually damaged.
Fair	Equipment is near the end of its useful life. Exhibits minimal amount of deterioration, rust. No signs of damage.
Good	Equipment has several years of useful life remaining. No visual signs of deterioration, rust, or damage.
Excellent	Equipment is brand new and has all of its useful life remaining.

Figure 3.83 Mechanical / Plumbing Existing Conditions Plan - Second Floor

AECOM

Figure 3.84 Four-pipe Fan Coil Unit serving Conference 203 M28

Figure 3.85 Fan Coil Unit Nameplate Data (Conference 203) M28

Figure 3.86 Fan Coil Unit Valving (Conference 203) M28

Figure 3.87 Thermostat serving Library 201 M29

Figure 3.88 Four-pipe Fan Coil Unit serving Office 212 M30

Figure 3.89 Fan Coil Unit Motor and Nameplate Data (Conference 203) M30

Figure 3.90 Hot Water Finned Tube Radiator serving Staff Kitchen 211 M32

Figure 3.91 Hot Water Finned Tube Radiator & Associated Piping serving Staff Kitchen 211 M32

Figure 3.92 Hot Water Finned Tube Radiator serving Office 213 M33

Figure 3.93 Hot Water Finned Tube Radiator serving Library Alcove 215 M34

Figure 3.94 Finned Tube Radiator Piping & Valving (Library Alcove 215) M34

Figure 3.95 Hot Water Finned Tube Radiator serving Library 201 M35

Figure 3.96 Hot Water Finned Tube Radiator serving Library 201 M35

Figure 3.97 Hot Water Finned Tube Radiator serving Storage 204 M36

Figure 3.98 Domestic Water Lead Piping Exhibiting Rust within Clara Barton's Bathroom 210 P6

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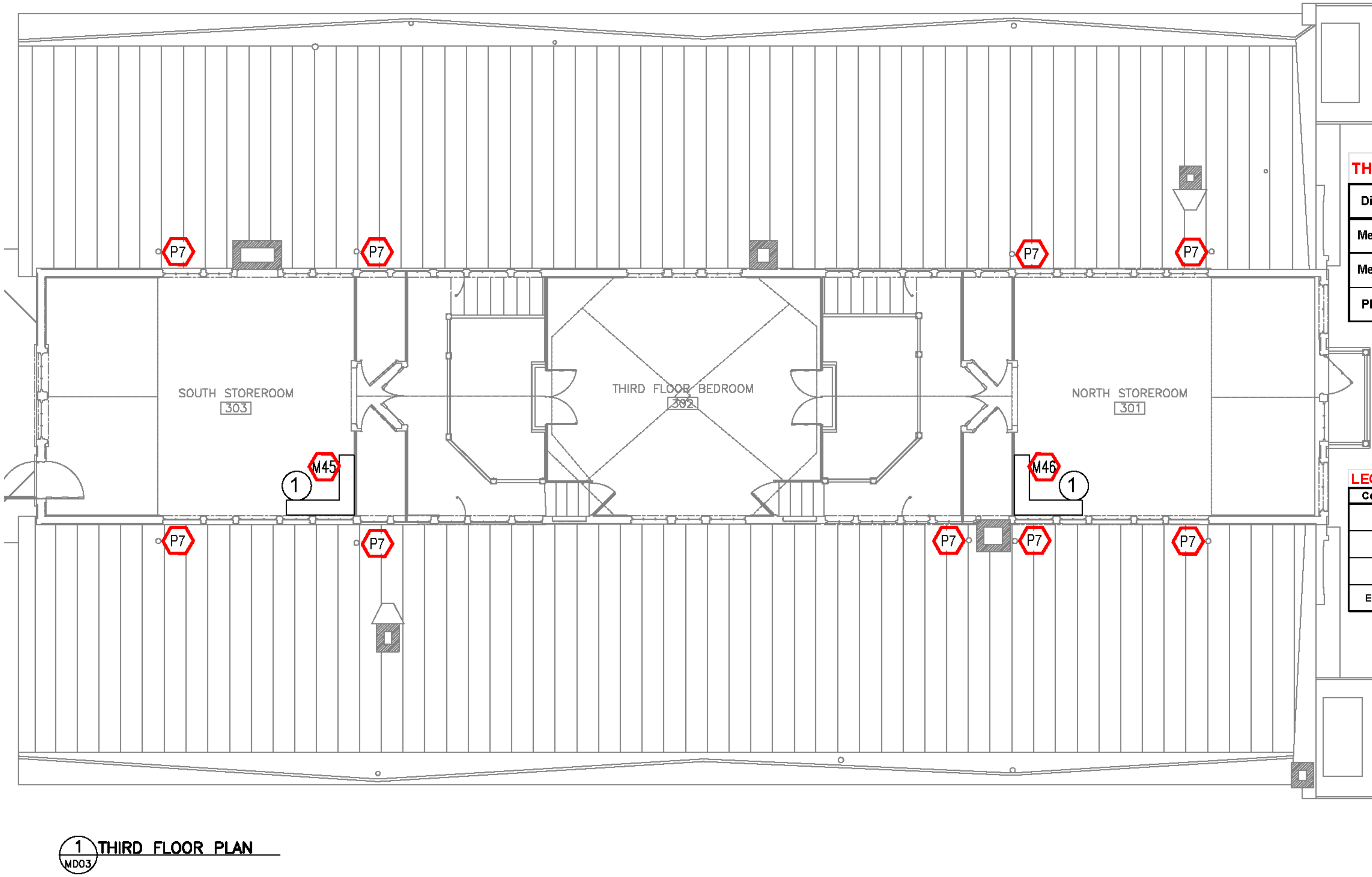
SPECIFIC NOTES

(1) NEW HOT WATER BASEBOARD UNIT (INSTALLED JUNE 2018).



THIRD FLOOR

Discipline	ID	Equipment & Model / Serial No.	Room Location	Visible Condition	Photo (Y/N)
Mechanical	M45	Hot Water Baseboard Unit	South Storeroom 303	Excellent	N
Mechanical	M46	Hot Water Baseboard Unit	North Storeroom 301	Excellent	N
Plumbing	P7	Metal Downspouts	Roof (3rd Flr. Exterior)	Fair	Y

LEGEND

Condition	Description
Poor	Equipment is beyond its useful life. Exhibits significant amounts of deterioration, rust. Visually damaged.
Fair	Equipment is near the end of its useful life. Exhibits minimal amount of deterioration, rust. No signs of damage.
Good	Equipment has several years of useful life remaining. No visual signs of deterioration, rust, or damage.
Excellent	Equipment is brand new and has all of its useful life remaining.

Figure 3.99 Mechanical / Plumbing Existing Conditions Plan - Third Floor

Figure 3.100 Metal Downspouts on Lower Roof (View from 3rd Level Windows) P7

Figure 3.102 Metal Downspouts on Lower Roof (View from 3rd Level Windows) P7

Figure 3.101 Metal Downspouts on Lower Roof (View from 3rd Level Windows) P7

3.5 Electrical

3.5.1 Electrical Service Entrance

The Clara Barton house is served by a single 25KVA transformer that provides 120/240V single phase power to the building from an existing overhead electrical utility line. An overhead service drop serves the building via a meter located on the exterior wall of the house. A 3 #4/0 Aluminum type SE cable is run from the meter to the service entrance equipment in the basement. The service entrance cable is run exposed along the wooden beam ceiling structure in the basement for approximately 12' up to the service entrance disconnects that are mounted on a plywood backboard. The plywood backboard is mounted on columns in the basement and is located approximately 10 LF from the basement wall. The service entrance cable is run to a cable trough where it is spliced four ways to serve three panelboards and one Fire Alarm disconnect. The disconnects are grounded using a single cable that runs to a single ground rod driven into the ground in the basement directly below the service entrance equipment. The ground rod in the basement is likely not very effective because soil areas under buildings tend to dry-out over time and the resistance of the earth goes up significantly as the ground dries. This is not a reliable ground.

The existing 25KVA transformer has a capacity of 104 Amp, and the service entrance conductor has 180A capacity. The existing service panelboards have main circuit breakers sized at 200A, 200A, and 100A. The size of the fuse for the fire alarm system is not identified on plans but is likely a 20A Fuse. Therefore the sum of the service disconnects is approximately 500A.

The existing electrical service has the following deficiencies:

1. The capacity of the 25 KVA transformers serving the building is not likely to be sufficient for future loads. Based on typical load per square foot of 9 to 11 w/SF it is likely that the load of the building could be approximately 126 kW to 168 kW (140 kVA to 186kVA) once renovated requiring 150 or 225 kVA transformer service. Also, the existing electrical service to the site is single phase which is inefficient for providing service to large electrical equipment.

2. The service entrance cable is exposed in the basement ceiling for approximately 12 LF and is subject to physical damage as it descends from the ceiling down to the service entrance equipment. This installation violates NFPA 70 Art 230.32 because the cable is not protected inside the house. Since the building is a wooden structure with exposed wooden beams in the basement, there is a higher risk of fire due to electrical overloads or faults.

3. The service entrance arrangement violates NFPA 70 Art 230.42 (B) because the main protective devices downstream of the service entrance conductors exceed the capacity of the incoming service entrance feeder. The unprotected service entrance feeder has a 180 A capacity, but the sum of the service entrance protective device ratings exceeds 500A. Therefore, the protective devices will allow loads to exceed 180A which could cause the service entrance cable to exceed its temperature rating and cause a fire. This is a very serious code violation.

4. The building has no surge protection. While not a code violation, the increase in the use of electronic LED fixtures and computers makes these essential for any facility.

5. The building is connected to a single ground rod in the building. There is no indication that any metallic piping is connected to the electrical grounding system and there is no indication that the electrical and communications system grounds are tied together.

3.5.2 Telecom Service Entrance

There appears to be twelve existing copper telephone lines terminated inside the building. The cables are very old and are run exposed along the wooden structure ceiling of the basement for about 20 LF. The incoming copper telephone lines are terminated on primary protectors that are very old. The primary protectors protect against lightning or other surges that may enter the building and damage cable or equipment which could result in a fire. There also appeared to be fiber optic cabling entering the building for high-speed internet access. The analog telephone lines must remain in service for critical remote annunciation of intrusion alarm and fire alarm systems.

The existing telecommunications service has the following deficiencies.

1. The incoming telephone cables are unprotected for about 20ft before they are terminated on the primary protectors which could be a fire hazard if lightning strikes and enters the house via the cable. NFPA 70 allows copper telephone cables to be exposed for 50 LF upon entering a building before being terminated on primary protectors. However, the building is a wooden structure, and the cables are installed in an unfinished portion of the basement with exposed wood structure which increases the risk of fire.

2. The existing telephone primary protectors are very old. These devices wear out over time, so it is likely that they are not protecting the cabling as intended.

3.5.3 Emergency Lighting System

The Emergency lighting in the building is inadequate. There is an emergency bug-eye lighting fixture located in the utility room in the basement, and there are several small spotlights mounted along the stairway originating in the basement utility room and mounted along the stairway from the basement to the first floor and then from the first floor to the second floor. The small spotlights appear to be connected to the bug-eye emergency fixture in the basement utility room. This installation may not meet the 90-minute minimum backup lighting requirement. The only other emergency lighting found in the building was a single bug-eye emergency lighting fixture in the library on the second floor. It was difficult to evaluate the egress path since there was no clearly marked exist signage and the emergency lighting spotty.

The existing emergency lighting system has the following deficiencies.

1. The layout of the emergency lighting system does not meet NFPA 101 illumination requirements for egress from all common areas in the building. Also, some parts of the existing system may not meet the 90-minute minimum backup power requirement.

2. Emergency exit signage is missing.

3.5.4 Fire Alarm

A new fire suppression and fire alarm system was installed and commissioned in 2018. Therefore, the fire alarm system was not assessed by this study.

3.5.5 Outlet and Wiring Issues

The following is a list of other issues observed during the site visit.

1. ADA compliance - There are multiple electrical and communications outlets located throughout the facility that are either too low or too high to meet ADA requirements for handicap accessibility. ADA compliance requires the operable parts of switches and receptacles to be no higher than 48" above finished floor (AFF) and no lower than 15 "AFF. Many receptacles are mounted at the floor level putting the operable parts as low as 1" AFF and various switches are mounted above 48" AFF.

2. Several electrical outlets are located above the baseboard heaters which is a potential fire hazard. NFPA 70 requires that electrical baseboard heaters be installed according to listing requirements of the equipment. Listed baseboard heaters include instructions that may not permit their installation below receptacle outlets.

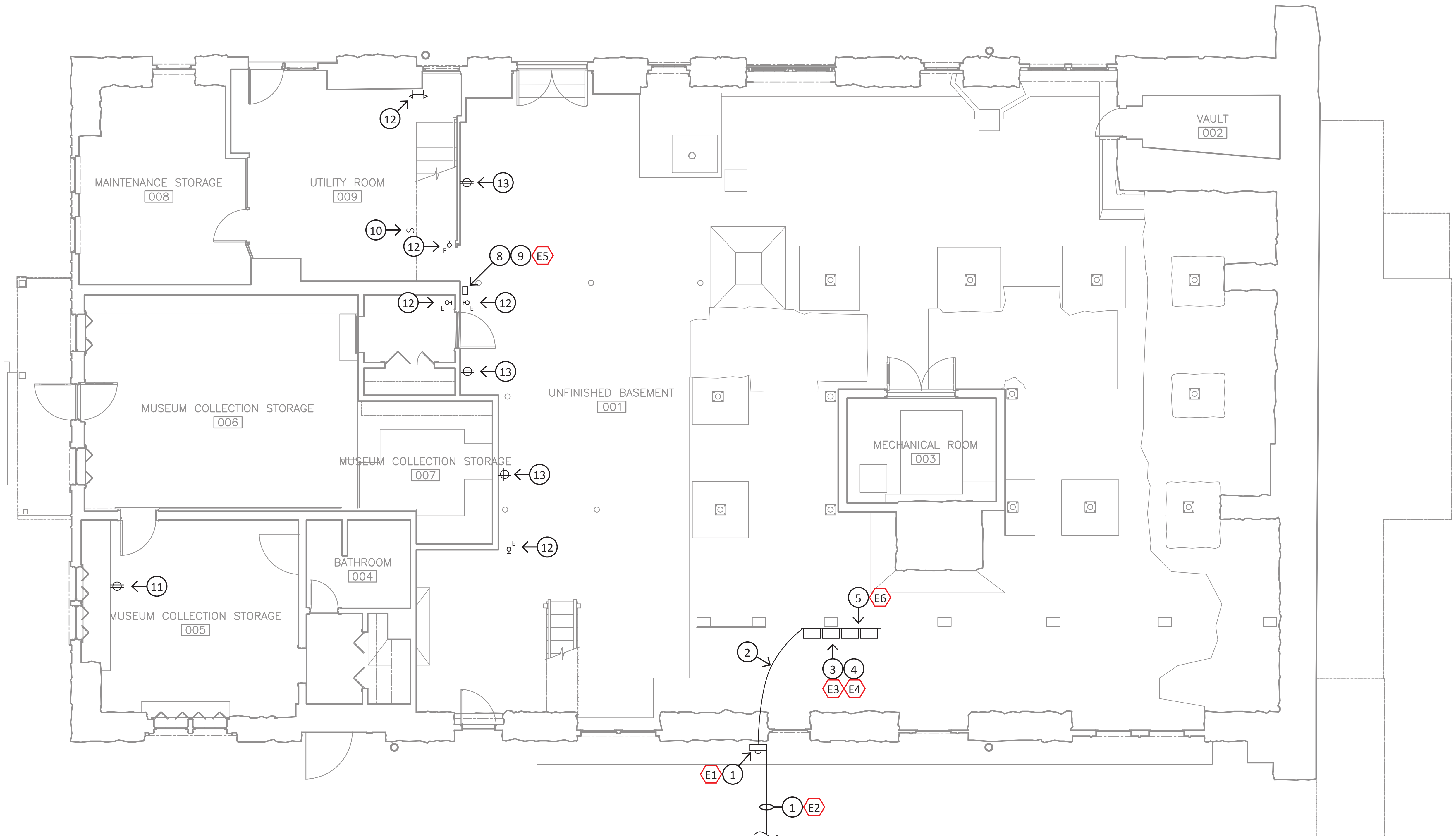
3. Several devices that were not securely mounted to the walls.

4. There is an old knob-and-tube wiring system on the third floor in the south storeroom. It appears to be abandoned.

5. Electrical outlets in unfinished basement area are non-GFGI which do not meet current code.

6. The existing electrical, telephone and data outlet layout and quantity were insufficient for a significant upgrade of the facility. The building is generally suitable for residential use. However, any upgrade to museum or office space use will require additional wiring as well as re-circuiting of existing outlets designed for increased power needs.

Plan does not show all existing electrical devices. Only devices associated with a deficiency are shown.



SPECIFIC NOTES

1. Electrical service capacity insufficient for future additional mechanical load and the change in usage of the building.
2. Service entrance cable is exposed and subject to physical damage
3. Service entrance conductors capacity is lower than the overcurrent devices at the service equipment
4. No surge protection devices
5. Insufficient grounding
6. Device not securely mounted
7. Obsolete knob-and-tube wiring
8. Telephone service entrance cable is exposed and unprotected
9. Telephone service entrance primary protection is obsolete and inadequate
10. ADA compliance violation - device mounted too high or too low
11. Receptacle located above baseboard heater
12. Emergency lighting and exit signage deficiencies
13. Non-GFCI receptacle located in unfinished basement

Figure 3.103 Electrical Existing Conditions Plan - Basement

Figure 3.104 Electrical service capacity insufficient for future additional mechanical load and the change in usage of the building E1

Figure 3.106 Service entrance cable is exposed and subject to physical damage E3

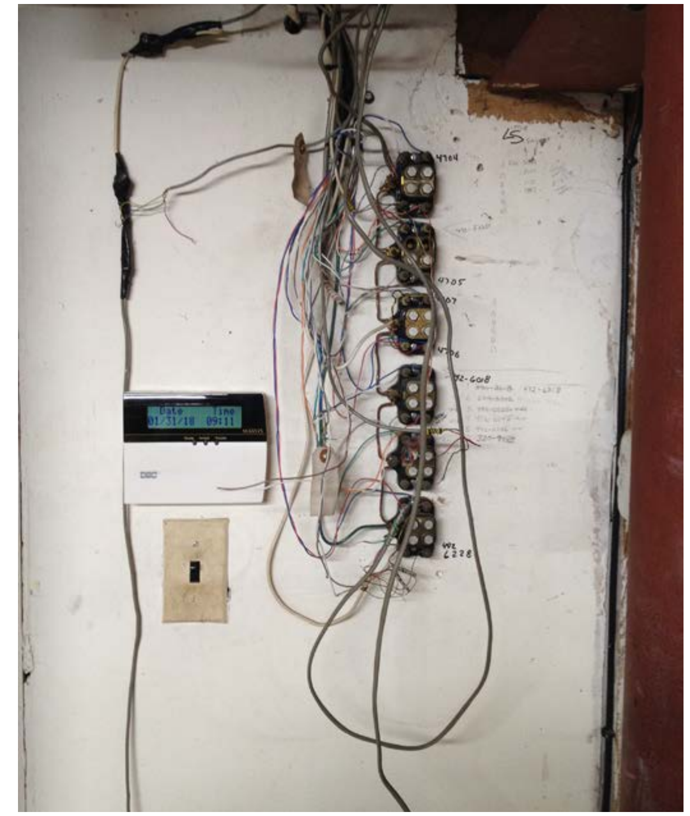


Figure 3.108 Telephone service entrance cable is exposed and unprotected; primary protection is obsolete and inadequate E5

Figure 3.105 Electrical service capacity insufficient E2

Figure 3.107 Service entrance conductors capacity is lower than the overcurrent devices at the service equipment; no surge protection devices E4

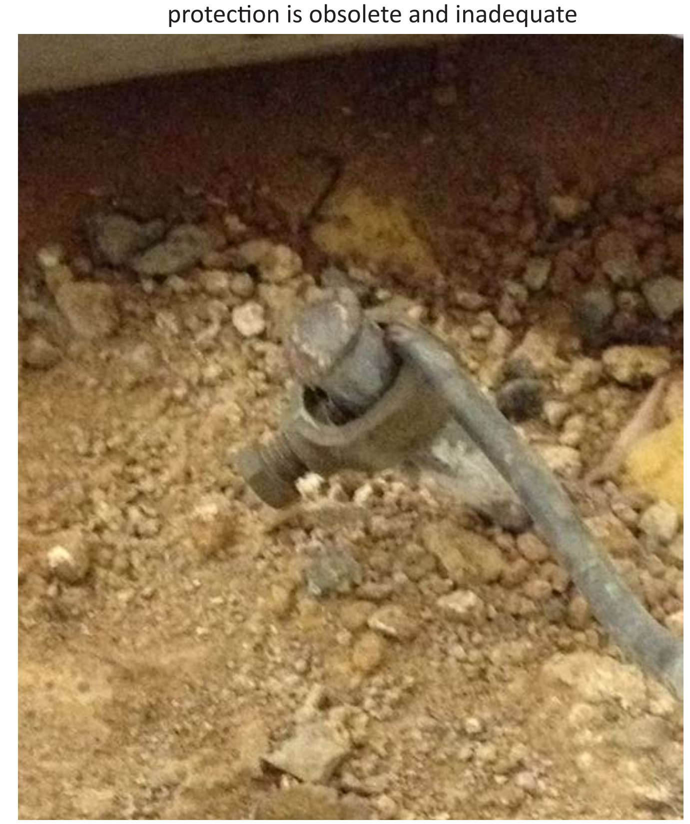
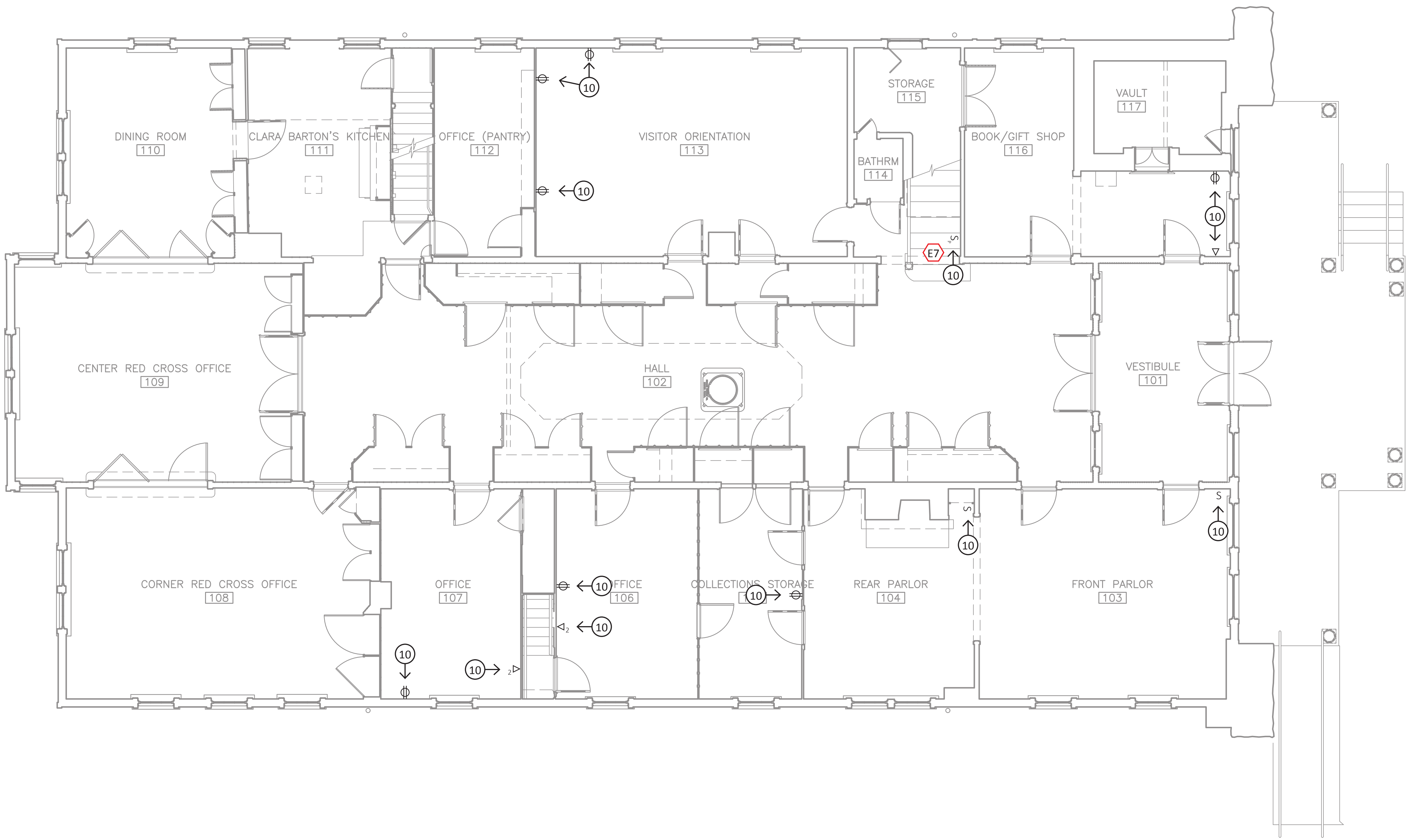


Figure 3.109 Insufficient grounding E6



Plan does not show all existing electrical devices. Only devices associated with a deficiency are shown.

SPECIFIC NOTES

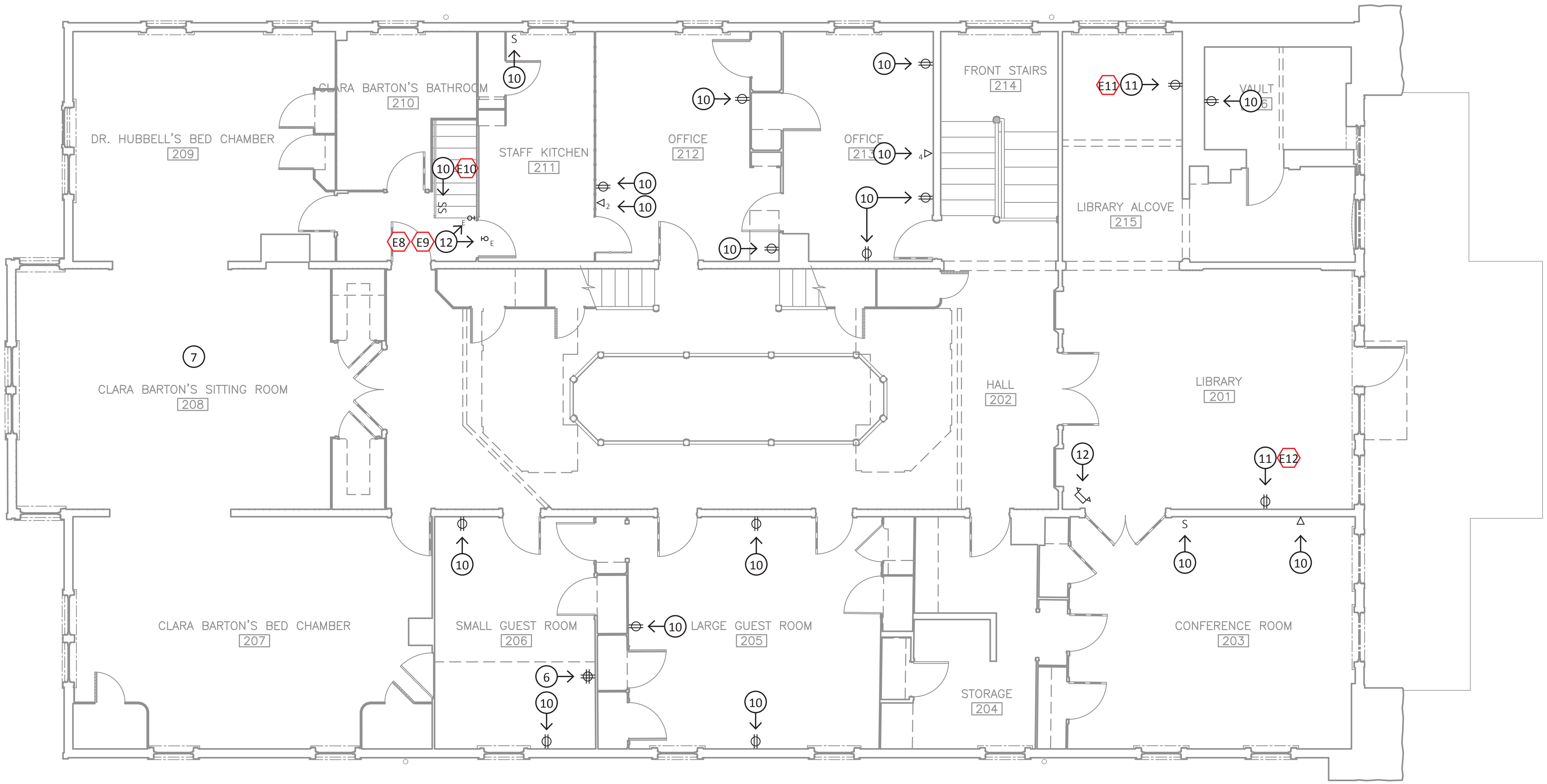
1. Electrical service capacity insufficient for future additional mechanical load and the change in usage of the building.
2. Service entrance cable is exposed and subject to physical damage
3. Service entrance conductors capacity is lower than the overcurrent devices at the service equipment
4. No surge protection devices
5. Insufficient grounding
6. Device not securely mounted
7. Obsolete knob-and-tube wiring
8. Telephone service entrance cable is exposed and unprotected
9. Telephone service entrance primary protection is obsolete and inadequate
10. ADA compliance violation - device mounted too high or too low
11. Receptacle located above baseboard heater
12. Emergency lighting and exit signage deficiencies
13. Non-GFCI receptacle located in unfinished basement

Figure 3.110 Electrical Existing Conditions Plan - First Floor

Figure 3.111 ADA compliance violation - device mounted too high E7

Figure 3.113 ADA compliance violation - device mounted too low

Figure 3.112 ADA compliance violation - device mounted too low



Plan does not show all existing electrical devices. Only devices associated with a deficiency are shown.

SPECIFIC NOTES

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5. Insufficient grounding
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7. Obsolete knob-and-tube wiring
8. Telephone service entrance cable is exposed and unprotected
9. Telephone service entrance primary protection is obsolete and inadequate
10. ADA compliance violation - device mounted too high or too low
11. Receptacle located above baseboard heater
12. Emergency lighting and exit signage deficiencies
13. Non-GFCI receptacle located in unfinished basement

Figure 3.114 Electrical Existing Conditions Plan - Second Floor

Figure 3.115 Emergency lighting and exit signage deficiencies E8

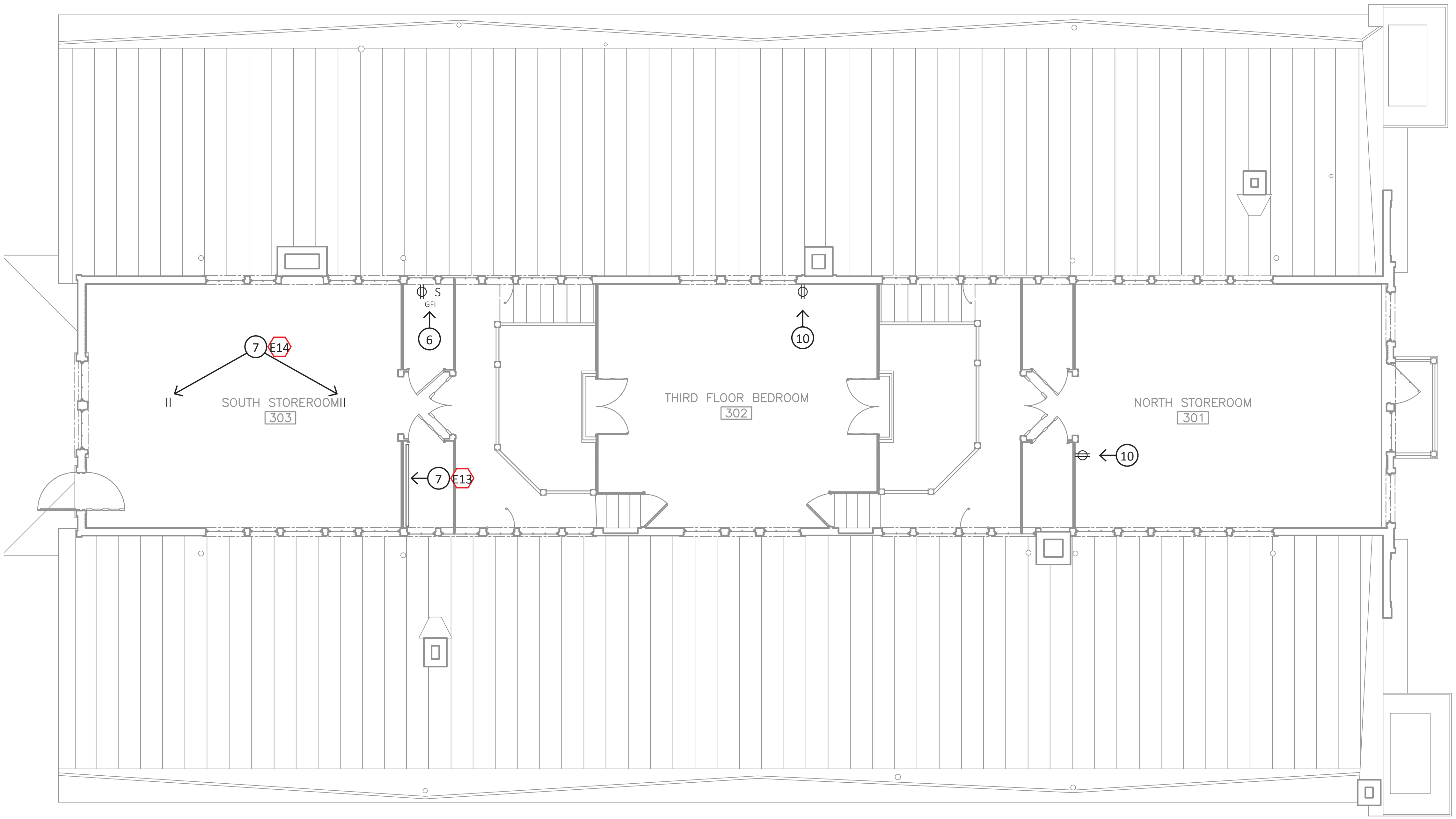
Figure 3.117 ADA compliance violation - device mounted too high or too low E10

Figure 3.119 Receptacle located above baseboard heater E12

Figure 3.116 Emergency lighting and exit signage deficiencies E9

Figure 3.118 Receptacle located above baseboard heater E11

Plan does not show all existing electrical devices. Only devices associated with a deficiency are shown.



SPECIFIC NOTES

1. Electrical service capacity insufficient for future additional mechanical load and the change in usage of the building.
2. Service entrance cable is exposed and subject to physical damage
3. Service entrance conductors capacity is lower than the overcurrent devices at the service equipment
4. No surge protection devices
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8. Telephone service entrance cable is exposed and unprotected
9. Telephone service entrance primary protection is obsolete and inadequate
10. ADA compliance violation - device mounted too high or too low
11. Receptacle located above baseboard heater
12. Emergency lighting and exit signage deficiencies
13. Non-GFCI receptacle located in unfinished basement

Figure 3.120 Electrical Existing Conditions Plan - Third Floor

Figure 3.121 Obsolete knob-and-tube wiring E13

Figure 3.122 Obsolete knob-and-tube wiring E14

AECOM

4.0 RECOMMENDATIONS

4.1 Architectural

4.1.1 Recommendation Priorities

Recommendations are labeled based on suggested priority.

Priority categories are as follows:

Immediate or Urgent Repair (bold text)

(1) High Priority

(2) Medium Priority

(3) Low Priority

4.1.2 Exterior Wood Cladding

The exterior cladding, trim at windows, corners, and other transition points are peeling. All wood siding and trim must be stripped, prepped, primed, caulked and properly painted. In many cases the wood should be replaced as rot has damaged the wood beyond repair. Exterior wood trim on the lower/basement level should be replaced with treated lumber or cement boards.

- Remove the exterior paint from the wood cladding and repaint. This may be a phased program. A Specialist in lead based paint removal should be engaged to develop a lead based paint removal technique. (1)

  A suggested outline specification for paint removal is as follows:

  Engage a qualified treatment specialist to perform preconstruction testing of the wood and metal materials to determine; cleaning materials, paint removers and compatibility of paint coatings and systems for each type of painted surface.

  Remove all exterior paint. Where cleaning methods have been attempted and further removal of the paint is required because of incompatible or unsatisfactory surfaces for repainting, remove paint to extent required by conditions. Apply paint removers according to paint-remover qualified treatment specialist's written instructions. Do not allow paint removers to remain on surface for periods longer than those indicated or recommended in writing by manufacturer.

  Repair wood defects including dents and gouges more than 1/4 inch in size and all holes and cracks by filling with wood-patching compound and sanding smooth. Reset or remove protruding fasteners. Where existing paint is allowed to remain, sand irregular buildup of paint, runs, and sags to achieve a uniformly smooth surface. Do not use torches, heat guns, or heat plates.

  In addition, paint removal should follow Historic Preservation Brief No. 9. Refer to Volume 2 Chapter 5.0 for Historic Preservation Briefs.

4.1.3 Windows and Doors

The windows on the third floor appear to be the oldest and show the worst deterioration. These windows should be a top priority for repair and wood replacement. Windows are to be repaired where possible, or replaced where necessary with treated lumber. They also require weather stripping as these older windows do not close properly and with deterioration between the window and frame, they no longer seal properly.

- Develop a phased window repair program involving removal, repair, renovation and replacement of windows based on severity of condition. (1)

  This program shall adhere to the guidelines established in NPS Historic Preservation Brief No. 9 which establishes categories as follows:

  - Routine Maintenance
  - Stabilization
  - Splices and Parts Replacement
  - Weatherization
  - Window Replacement

  This includes complete removal of each window unit to an offsite location for striping / repair and refinishing. A test window removal is recommended to allow assessment of sash counterweight operation, interior / exterior trim removal and general practicality. Refer to Table 4.15 for suggested priorities.

4.1.4 Basement

- Provide a concrete floor slab with vapor barrier at basement level. (2)
- The basement is currently unfinished. Consider general finishes upgrades including adding waterproofing at sub grade masonry, exterior wall insulation and general interior finishes. (3)

4.1.5 Roof

4.1.5.1 Upper Roof

The general condition of the upper roof is fair. However, the paint is peeling off and it is therefore recommended to remove loose paint, prime the surface and repaint the entire upper roof. A specialist in lead paint removal should be engaged. Downspouts from the upper roof should have diverters at the ends to help slow the flow of water over the lower roof. Alternatively, the discharge can be turned perpendicular to slope.

- **Flashing (and sealant) should be replaced at all masonry junctions. Downspout boots should be inspected and repaired and the eave soffits at the downspout penetrations should be inspected and repaired.**
- The entire roof should be refinished with all flashing replaced. ②
- All diverters should be replaced. ②

4.1.5.2 Lower Roof

The lower roof was replaced in 2015 with a painted copper standing seem roof with diverters that match the existing upper roof design. An expansion joint was added in the middle of the new roof at the eaves.

- **This expansion joint is leaking badly and needs to be sealed. The current design is inadequate and is allowing ponding water to flow directly into under the transition and into the wall below.**
- **This area also appears to be a low point. Refer to photos in section 3.1.11. The expansion joint should be a high point NOT a low point. This is a top priority repair. All downspouts need to be sealed as it appears water is leaking into eaves.**

4.1.5.3 Roof Drainage

The roof capacity calculation in section 3 demonstrates that the current roof design meets the code minimum drainage capacity. This is a theoretical calculation and does not account for the very low slope, diverter design or the very exposed site location.

- Increasing the drainage capacity of the roof. ②

  The following options should be considered:

  a. Adding an additional downspout to each or the main facades. (preferred). This option would require the reconfiguration and reconstruction of the existing lower roof diverters.

  b. Increasing the size of the existing downspouts (does not get water off the roof more quickly).

- Wire mesh should be added to any downspout that is unprotected. Regular maintenance shall included removal of leaves on an annual basis (minimum).

4.1.5.4 Moisture Meter / Water Detection

Use of a moisture meter is recommended to determine which leaks are still active and which leaks have been remedied by the lower roof work.

4.1.6 Chimneys

Chimneys are exposed and have suffered significant weathering. It is assumed that chimneys are not required to be functional.

- Repoint the tops of chimneys C1, C3, C4, C5 and C6. Refer to figure 3.11 for chimney assessment. ②
- Re-flash all upper roof chimneys. ②
- The chimney caps currently have slots allowing air movement. This is adequate but it is recommended to supplement this with stainless steel flashing to reduce water ingress from driven rain. ③

4.1.7 Masonry

- Masonry spot repointing at the basement walls, front porch and the chimney stacks to prevent water ingress and freeze-thaw damage. ①
- Construct masonry sills at basement door thresholds to prevent water ingress. A durable stone such as bluestone or granite set in a concrete bed is suggested. These sills are recommended to be 4 inches high and will prevent water from entering at the threshold and lift the bottom of the doors away from the grade. The doors will require adjustment to accommodate the new sill. ①
- **Seal joints between clapboard and masonry to prevent water ingress and minimize air leakage.**

4.1.8 Porch and Balcony

The front porch roof is severely deteriorated and requires a comprehensive repair. The low slope is causing severe water damage to windows above the roof on the second floor because water cannot drain properly, particularly during snow.

- Reconstruct the front porch. ①

  The following alternatives should be considered:

  a. A complete rebuilding, re-using the existing rubble stone plinth. The second floor balustrade may be rebuilt as long as the roof is designed for suitable loading.

  b. Re-framing of the porch roof only in order to reduce the window sill damage caused as result of the low slope and height relative to the window sills. Re-roofing with metal flashing at the sills. Elimination of the upper posts that pass through the roof.

- Removal, renovation and reconstruction of the third floor decorative balcony. ①

4.1.9 Site

- Vines should be removed from chimneys and masonry walls. No vegetation should be allowed to touch exterior sides of the building. ①
- Establish a vegetation block, approximately 24 inches wide, around the building perimeter. A continuous band of brick or concrete pavers would minimize erosion as a result of water dripping from the roof and mud from splashing onto the wood siding. ③
- Vegetation should be cut back along the South and West facade. This will allow better air flow and drying of exterior. ②
- Regrading should be performed around the perimeter so that surface water is encouraged to drain away from the facade. ①
- Conduct an accessibility study on the route form the parking lot up the main path and the ramp up to the front door. This study shall include grading (1:20 max slope not requiring a hand railing), ramp slope, width and railing design along with turning radii. ③

4.1.10 Exterior Envelope Upgrades

Envelope performance plays a critical role in the maintenance of interior environmental conditions. Exterior walls that are both uninsulated and leaky require a larger mechanical system (greater installation cost and energy consumption) to compensate. Conversely, an air tight and well insulated enclosure requires only a small mechanical system (and small amount of energy) to maintain the desired interior conditions.

4.1.10.1 Air Barrier

If an air barrier were to be added to the exterior envelope, this would be recommended to be a part of exterior cladding renovation program. The exterior cladding would have to be removed and the wall exposed down to either sheathing or wood studs. The exact specifications of the air barrier product would have to be researched however a sheet would probably be the most suitable. To be effective, an air barrier should engage all windows and doors, masonry walls and roof sheathing so as to maintain and airtight seal. All these elements would have to be exposed to allow the proper transition connections between the different materials. A vapor permeable barrier is suggested so that moisture is able to escape in both the heating and cooling seasons.

4.1.10.2 Walls and Insulation

Considerations for the addition of insulation include:

- Resilience to a wet dry cycle: regular batt insulation is not recommend as it sags over time and becomes ineffective. A rigid (or semi rigid) mineral wool provides thermal properties with fire resistance and an ability to get wet and not degrade. In addition, as an inorganic material, mineral wool has no cellulose to support mold growth.
- Continuous vs cavity: continuous insulation on the exterior (on top of the wood framing and behind the cladding) is the most effective placement location.
- Installation: level disruption to interior or exterior finished and any long term aesthetic compromises.
- Insulation type: a long term solution that does not compromise the historic structure and is reversible.
- Provision of and air and/or vapor barrier

Refer to section 5.5 for further discussion on envelope considerations.

Table 4.1 Window Priority of Renovation Matrix

SOUTH FAÇADE

		Flaking Paint	Deteriorated Sill / Threshold	Deteriorated Frame	Missing Sealant	Deteriorated Mullion	Broken Glass Panes (ref. elevations)	Glazing Compound missing	Double Hung Sash Cord broken	Weather stripping Interfers with operation	Air infiltration	Water ingress	Inoperable
2	W0.1	X	X		X							X	X
2	W0.2	X			X			X			X	X	X
2	W0.3	X			X		X	X				X	X
2	W0.4	X		X	X			X				X	X
2	W0.5	X						X				X	X
2	W0.6	X						X				X	X
3	W1.1	X											
3	W1.2	X											
1	W1.3	X					X				X		
1	W1.4	X			X		X				X		
2	W1.5	X			X						X		
1	W1.6	X			X		X				X		
2	W1.7	X					X						
2	W1.8	X					X						
1	W1.9	X	X	X	X			X					
3	W1.11	X			X		X						
3	W2.1	X											
2	W2.2	X					X						
2	W2.3	X					X		X				
2	W2.4	X					X		X				
3	W2.5	X											
3	W2.6	X											
2	W2.7	X					X						
3	W2.8	X							X				
3	W2.10	X		X									
1	W3.1	X					X	X					
1	W3.2	X					X	X					
1	W3.3	X		X			X	X					
1	W3.4	X					X	X					
1	W3.5	X					X	X					
1	D0.1	X	X	X	X							X	
1	D0.2	X	X	X	X							X	

NORTH FAÇADE

		Flaking Paint	Deteriorated Sill / Threshold	Deteriorated Frame	Missing Sealant	Deteriorated Mullion	Broken Glass Panes (ref. elevations)	Glazing Compound missing	Double Hung Sash Cord broken	Weather stripping Interfers with operation	Air infiltration	Water ingress	Inoperable
1	W0.12	X			X		X	X				X	X
3	W0.13	X					X						X
3	W0.14	X			X								X
3	W0.15				X								X
3	W0.16				X								X
3	W0.17						X						X
3	W1.13	X	X										
3	W1.15	X											
2	W1.16	X						X					
2	W1.17	X			X			X				X	
2	W1.18	X						X					
1	W1.19	X									X		
2	W1.20	X						X					
2	W1.21	X			X			X				X	
3	W1.22	X											
3	W2.12	X		X									
3	W2.14	X											
3	W2.15	X											
2	W2.16	X					X	X					
2	W2.17	X						X					
2	W2.18	X					X	X					
3	W2.19	X						X					
3	W2.20	X						X					
2	W2.21	X					X	X					
2	W3.7	X					X	X					
2	W3.8	X					X	X					
2	W3.9	X		X			X	X					
2	W3.10	X					X	X					
2	W3.11	X					X	X					
1	D0.4	X	X	X	X							X	
1	D0.5	X	X	X	X							X	

EAST FAÇADE

		Flaking Paint	Deteriorated Sill / Threshold	Deteriorated Frame	Missing Sealant	Deteriorated Mullion	Broken Glass Panes (ref. elevations)	Glazing Compound missing	Double Hung Sash Cord broken	Weather stripping Interfers with operation	Air infiltration	Water ingress	Inoperable
3	W1.23	X			X			X				X	
3	W1.24	X			X			X				X	
2	W1.25	X					X						
2	W1.26	X			X		X	X				X	
3	W1.27	X			X			X					
3	W1.28	X			X			X					
2	W2.22	X						X					
2	W2.23	X						X					
2	W2.24	X					X	X					
2	W2.25	X						X					
2	W2.26	X						X					
1	W2.27	X					X	X					
3	W2.28	X						X					
3	W3.12	X			X								
2	W2.13	X					X				X		
1	W3.14	X			X			X					
3	D1.1	X	X										
1	D2.1	X	X								X	X	
1	D3.2	X	X								X	X	

WEST FAÇADE

		Flaking Paint	Deteriorated Sill / Threshold	Deteriorated Frame	Missing Sealant	Deteriorated Mullion	Broken Glass Panes (ref. elevations)	Glazing Compound missing	Double Hung Sash Cord broken	Weather stripping Interfers with operation	Air infiltration	Water ingress	Inoperable
3	W0.7	X						X					
1	W0.8	X					X	X			X		
2	W0.9	X						X					
2	W0.10	X					X	X					X
3	W0.11	X											X
3	W1.10	X											
2	W1.12	X					X	X					
2	W1.14	X			X			X					
2	W2.9	X						X	X				
3	W2.11	X											
1	W2.13	X			X			X				X	
2	W3.6	X					X	X					
3	D0.3	X											
2	D3.2	X											X

4.2 Structural

4.2.1 Overview

In addition to providing the available live load capacities of the floors, we have also identified potential areas to increase the floor capacity to meet NPS needs where rooms fall below code minimums for their use.

The goal of the structural portion of this report is to provide floor plans clearly delineating the available live load capacity of each room, corridor, hallway, and staircase. In addition, a separate plan has been provided showing the maximum number of people that can occupy each space. Plans address capacity while the museum is unfurnished as well as once it is filled with the museum's furnishings.

The dead loads used in the analysis of the floor capacities included the roof, existing walls, floor and ceiling coverings, planned items from the museum collections, and MEP systems. Incorporating these specific loads provided a more accurate analysis of live load capacity.

In locations of low live load capacity, we coordinated with the architect, CLBA, and NPS to develop proposed room layouts. These proposed layouts identify areas that are off limits to visitors, and more importantly, where visitors can be strategically located. This allowed for a more accurate analysis of the floor structure and provided more flexibility for NPS and CLBA as they begin to plan for visitors and new tours of the property.

4.2.2 Applicable Codes

- 2015 International Building Code (IBC)
- ASCE/SEI 7-10; Minimum Design Loads for Buildings and Other Structures
- ANSI/AWC NDS – 2015; National Design Specification (NDS) for Wood Construction with 2012 Supplement
- Secretary of Interior's Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings

4.2.3 Design Criteria

The existing floor systems were analyzed to determine the available live load capacities and those capacities were compared to the code-required live loads for Residential areas, Office, Assembly areas, Balconies, Corridors, Libraries, and Stairs.

Proposed strengthening options are addressed where the capacity of the existing floor framing is less than the building code and NPS requirements.

4.2.4 Material Properties

Based on the HSR, there was some discrepancy on the wood species used to construct the CLBA. Because of this, wood samples were taken from (8) locations within the CLBA and were sent out for species identification to determine the type of wood used to construct the CLBA.

4.2.5 Species Identification Summary

Of the eight samples taken, the species identification concluded that six (Samples 1, 2, 3, 4, 6, & 7) of the samples were of the genera Tsuga canadenis, commonly referred to as Eastern Hemlock. Sample 5 was preliminarily identified as a Southern Yellow Pine, specifically Pinus virginiana, commonly referred to as Virginia Pine.

Of note, the Sample 8 was significantly more difficult to obtain as access was limited. Due to these limitations, the sample required the removal of a smaller diameter core that resulted in a shear fracture during extraction. As such, this sample was difficult to prepare for examination and was therefore excluded.

The final species identification report has been summarized below and the findings were incorporated into the structural analysis of the floor structure.

The Design Values, obtained from the NDS 2015, for the identified species are provided below.

- Samples 1, 2, 3, 4, 6, & 7 (Table 4A, No. 1 Eastern Hemlock):
  - Fb = 775 psi
  - Fv = 170 psi
  - E = 1,100,000 psi
- Samples 5 (Table 4B, No. 1 Southern Pine):
  - Fb = 1,350 psi
  - Fv = 175 psi
  - E = 1,600,000 psi

4.2.6 Structural System Analysis

The NDS-required adjustment factors have been included in the member design and analysis where applicable and include the repetitive use factor and size factors.

The live load summaries in Figures 4.2,4.3, and 4.4 are based on the flexural and shear strength of the existing framing. The allowable live load capacities were not reduced based on an allowable deflection limit. Therefore, the capacities of the floors will be reduced if a maximum deflection, in inches or as a ratio of the span length, is required by NPS.

4.2.7 Design Summary

4.2.7.1 Removal of Existing Shoring

Based on a memo prepared by Valor Construction, dated January 15, 2016, with engineering design included, that was prepared during the roof replacement project, we understand that the shoring was installed for two reasons. First, for the safety of the workers on the roof while the work was in progress and secondly, to reduce the potential of loosening of interior ceiling plaster as a result of the repairs.

Based on this understanding, discussion with NPS, and the locations of the remaining sections of shoring it is our recommendation that the shoring can be removed from Rooms 209, 106, 104, and 001.

The removal of these elements in the basement is limited to the temporary shoring and does not include the removal of the existing concrete footings, steel post columns, and steel beams that were installed as a part of the 1981 Sheladia reinforcing of the First Floor.

4.2.7.2 First Floor

As-built drawings prepared by Sheladia and dated December 31, 1981 indicate a design live load for the First Floor of 60 psf. Based on these drawings, and our survey that verified that floor joists were added, we can infer that the First Floor has a live load floor capacity of 60 PSF.

Although a number of the existing First Floor joists (those painted white) have areas with a significant number of drill holes, the newer wood joists (unpainted), installed per the 1981 Sheladia drawings, have very few. Based on the drawings and our survey, we can reason that the Sheladia design accounted for these holes when determining the size and spacing of the supplemental wood joists. Therefore, although noticeable, we would conclude that the First Floor would retain the 60 psf live load capacity as designed in 1981. Refer to Figure 4.2.

4.2.7.3 Second and Third Floors

Based on our analysis, we have determined that the available live load capacity of the Second and Third Floors falls significantly below 40 psf. This is the minimum required design live load for residential areas with similar use as the majority of the CLBA. The minimum design live loads required by the IBC, for other occupancies, are all greater than this value.

Although the floor framing was consistent across each of the three main segments of the house, the live load capacity of the rooms varied, primarily due to the ceiling finishes hanging from below. The existing ceilings were generally comprised of either muslin or a plaster on lath ceiling. Refer to Figures 4.3 and 4.4 for the live load capacities of the Second and Third Floors.

Additionally, based on these capacities, we have determined the maximum number of people that can occupy each of the rooms and have shown them graphically on plan.

The loading plans represent the capacity of each room in an unfurnished state. Refer to Figures 4.5, 4.6, and 4.7.

We also reviewed the NPS furniture layout plans to determine the allowable number of people that can occupy certain public spaces. The NPS has also identified the areas that will be roped off to restrict public access into a given space. Based on this information, we have provided an occupied capacity plan that will assist the NPS in developing their tour program. Refer to Figures 4.8, 4.9, and 4.10.

Based on conversation with NPS, they have identified areas of the Second and Third Floors where strengthening is most critical to address the Clara Barton House tour functionality. These areas include the Library [Room 201], the Library Alcove [Room 215], and the stairs up to the third floor. Of note, the strengthening of the stairs to the Third Floor will require extensive exploratory work and design efforts to determine a historically sensitive solution.

The extent of the demo area is shown with a hatch pattern for clarity. Refer to Figures 4.9 and 4.10.

4.2.7.4 Decorative Balcony

The extent of the exterior survey was limited to a visual inspection from the ground. Based on this inspection, there is significant deterioration to the base of one of the corner newel posts, significantly weakening the railing's ability to resist a code-required loading. As the existing framing and connections to the side of the house were not accessible, a determination of structural integrity is not possible at this time, but based on the architectural observations provided earlier in this report the balcony should not be accessed.

4.2.7.5 Existing flagpole

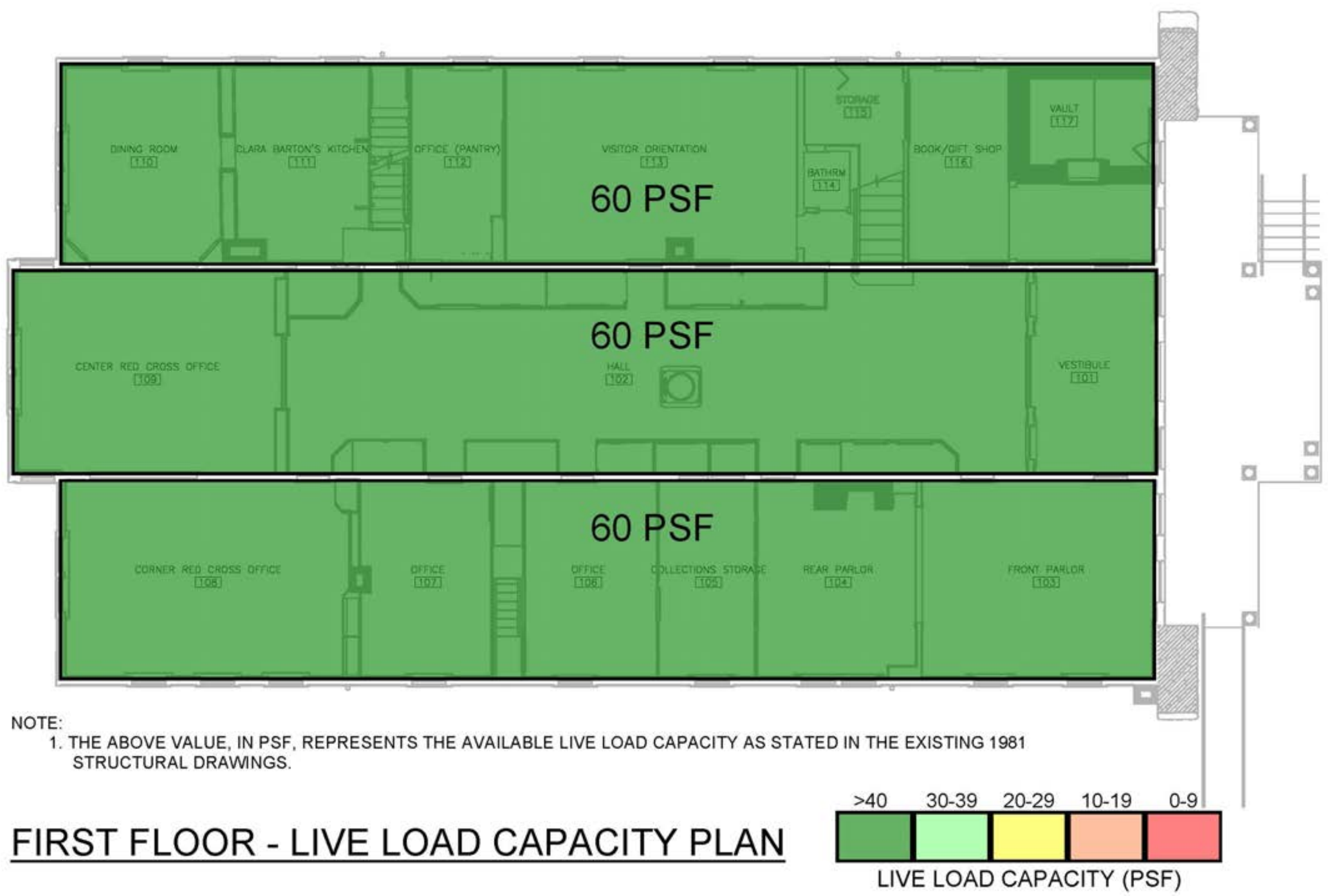
The existing flagpole, centered above Room 302, Third Floor Bedroom, extends up from the central peak of the roof. As indicated in Section 3.1, movement of the flagpole has damaged the roof membrane. We weren't able to observe any structural failures of the original flagpole support structure but were informed that the previous NPS structural engineer "was always concerned about the design of the flagpole and the stress it puts on the roof". Knowing this concern and the damage to the roof membrane, structural stiffening of the flagpole support is recommended that would require a more in depth study and exploration of the ceiling structure behind the muslin ceiling covering. The installation of a shorter flagpole should also be considered to reduce the forces, and thus, movement of the support.

4.2.8 Reinforcing of the Second and Third Floors

After review of final furniture layout plans and areas identified as off-limits to the public, a solution for increasing the live load capacity of certain areas of the CLBA involves adding additional wood joists between the existing joists. These joists will bear on the existing bearing walls.

As indicated in Section 3 of the report, the existing framing member sizes and configuration are based on the structural sketches in the HSR. The accuracy of the prior report was limited and therefore upon removal of the ceiling coverings may result in a modification of the proposed solution.

Figure 4.1 First Floor Joists (Painted White - Original; Unpainted - 1981 Strengthening)



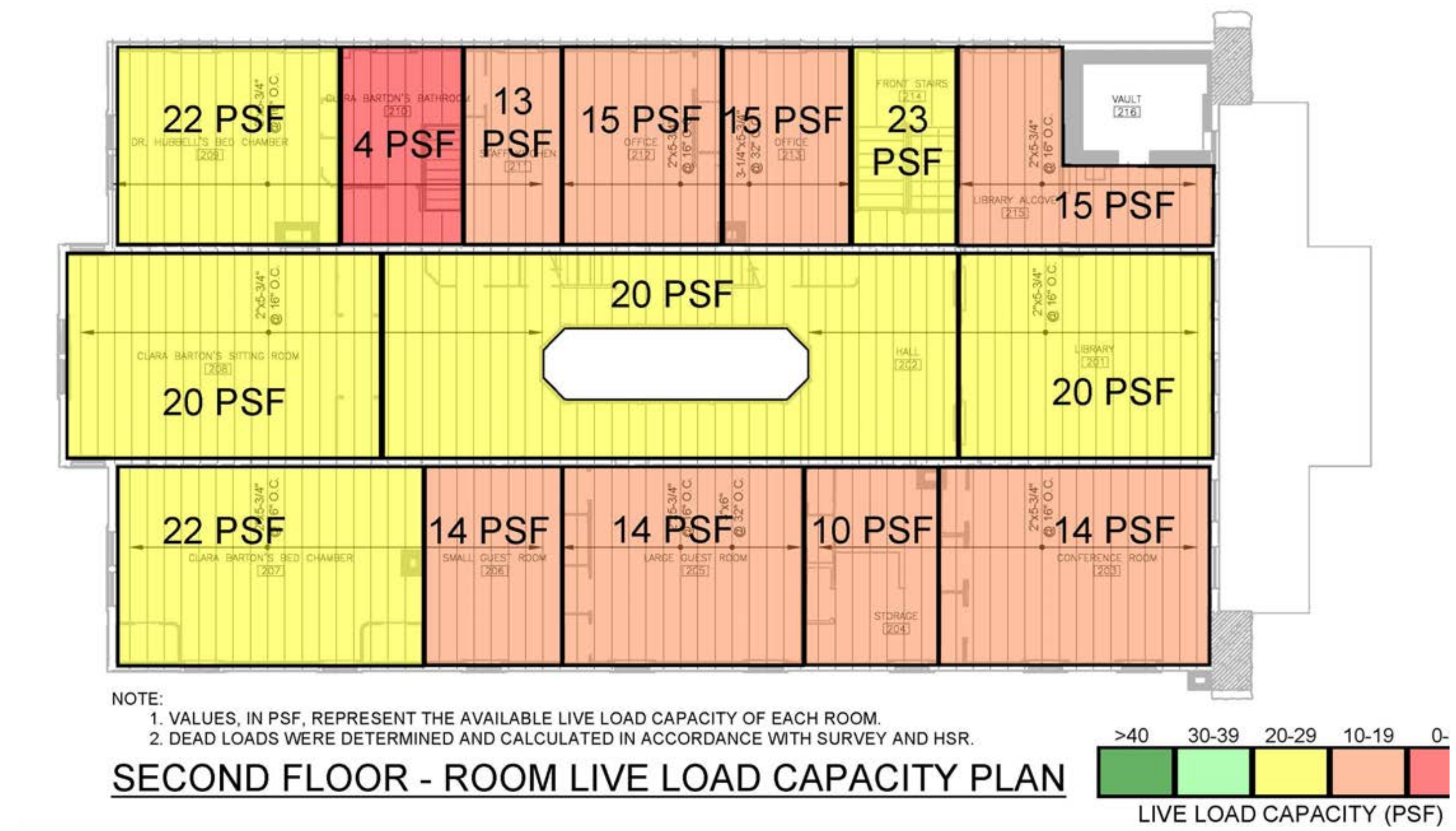


Figure 4.2 Live Load Capacity Plan - First Floor

Figure 4.3 Live Load Capacity Plan - Second Floor

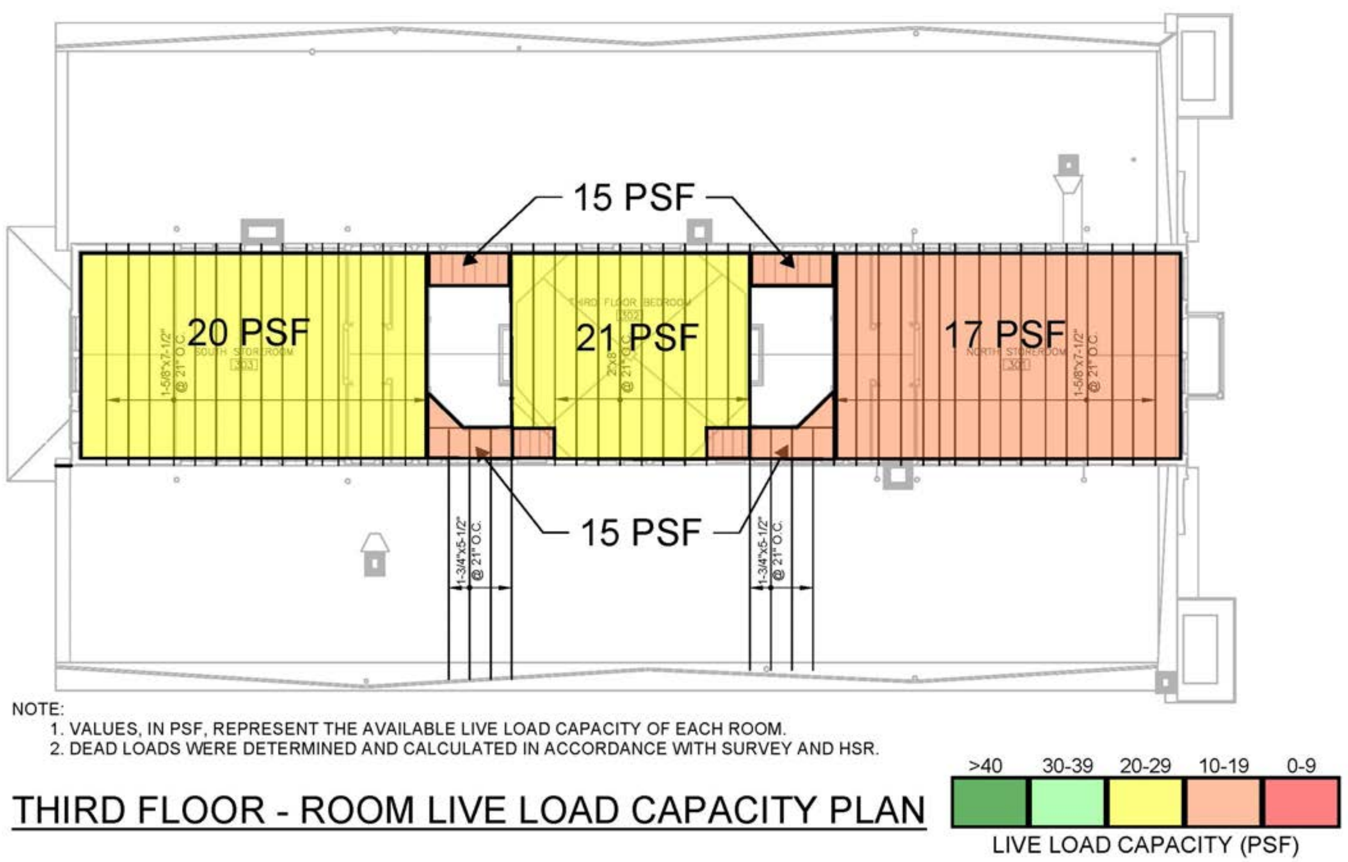


Figure 4.4 Live Load Capacity Plan - Third Floor

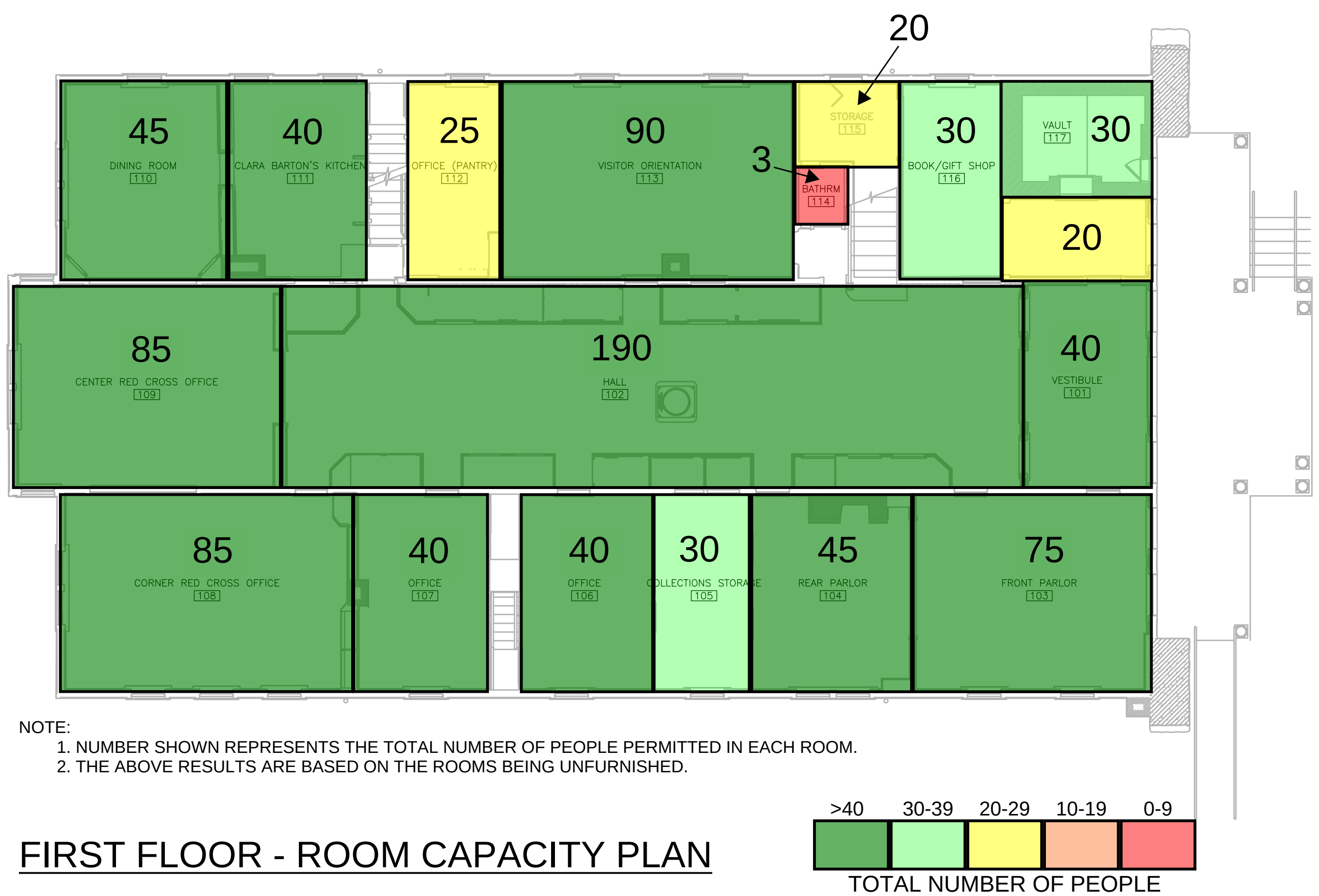


Figure 4.5 Unfurnished Room Capacity Plan - First Floor

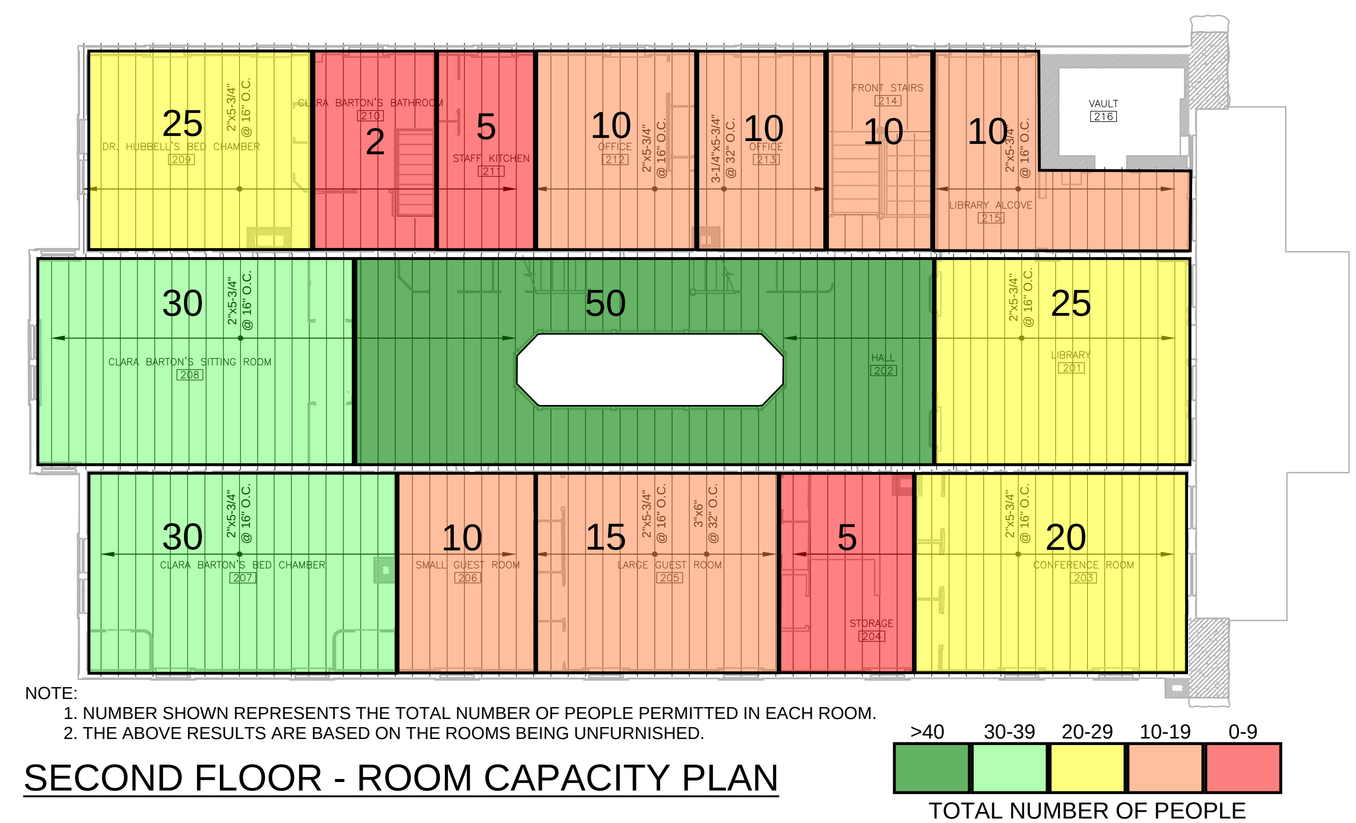


Figure 4.6 Unfurnished Room Capacity Plan - Second Floor

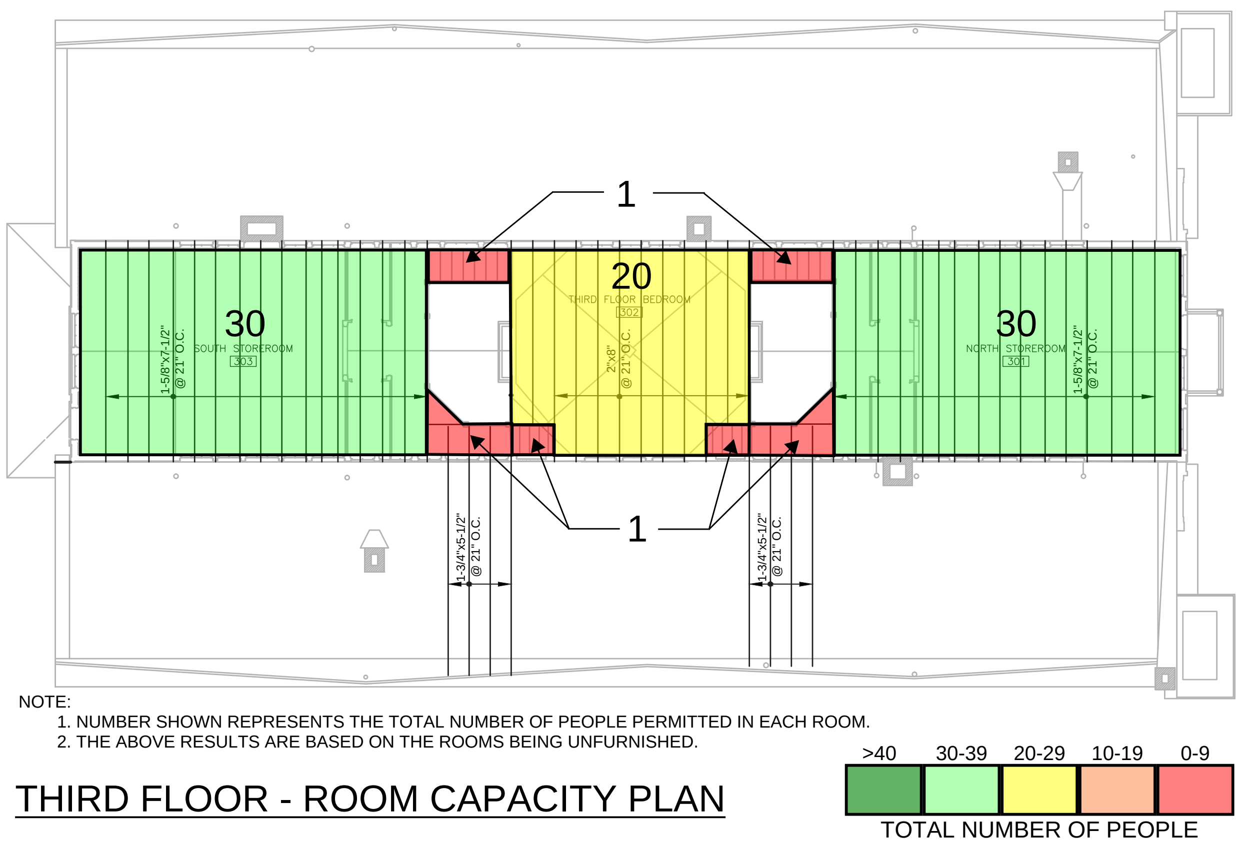


Figure 4.7 Unfurnished Room Capacity Plan - Third Floor

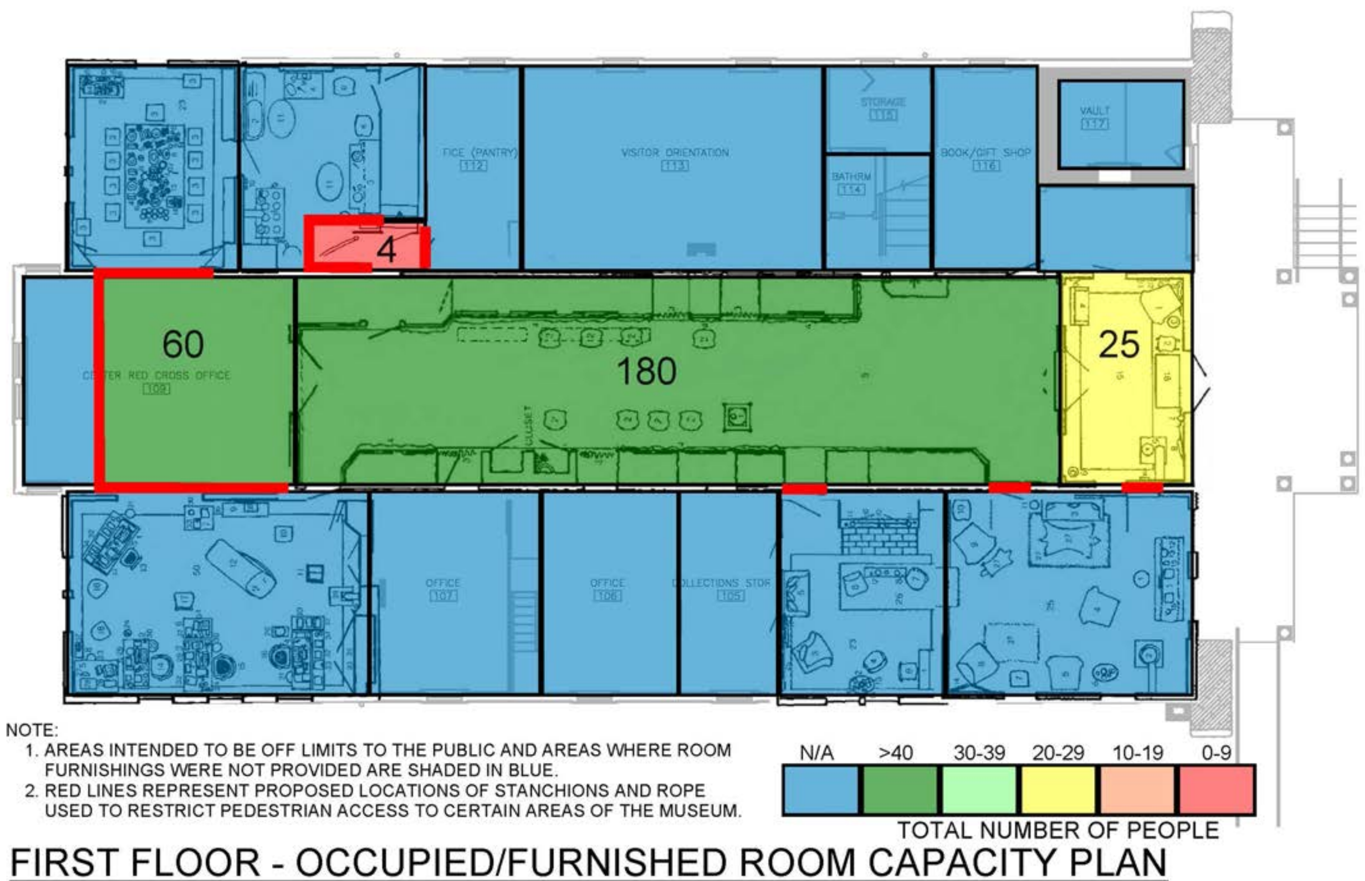


Figure 4.8 Furnished Room Capacity Plan - First Floor

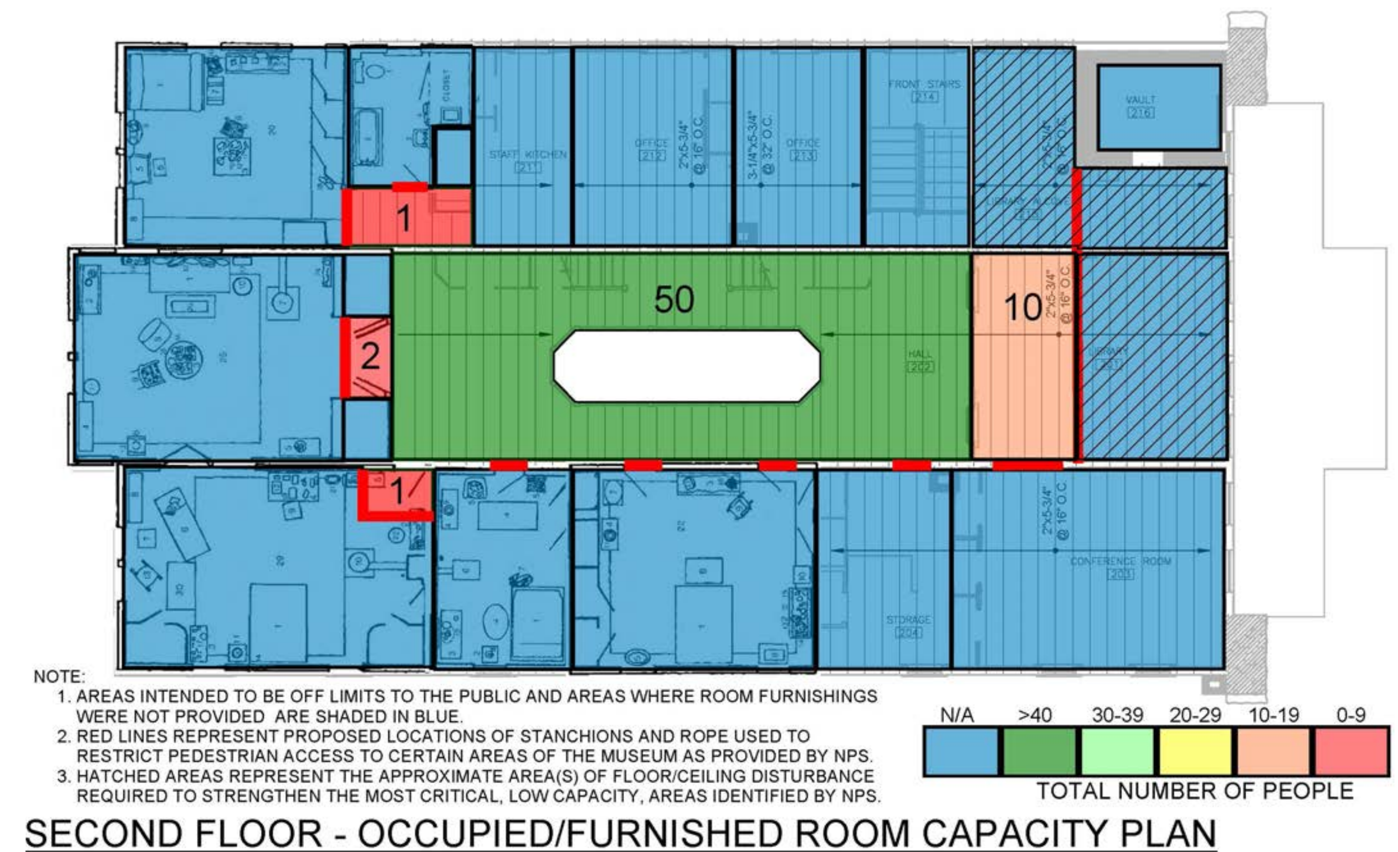
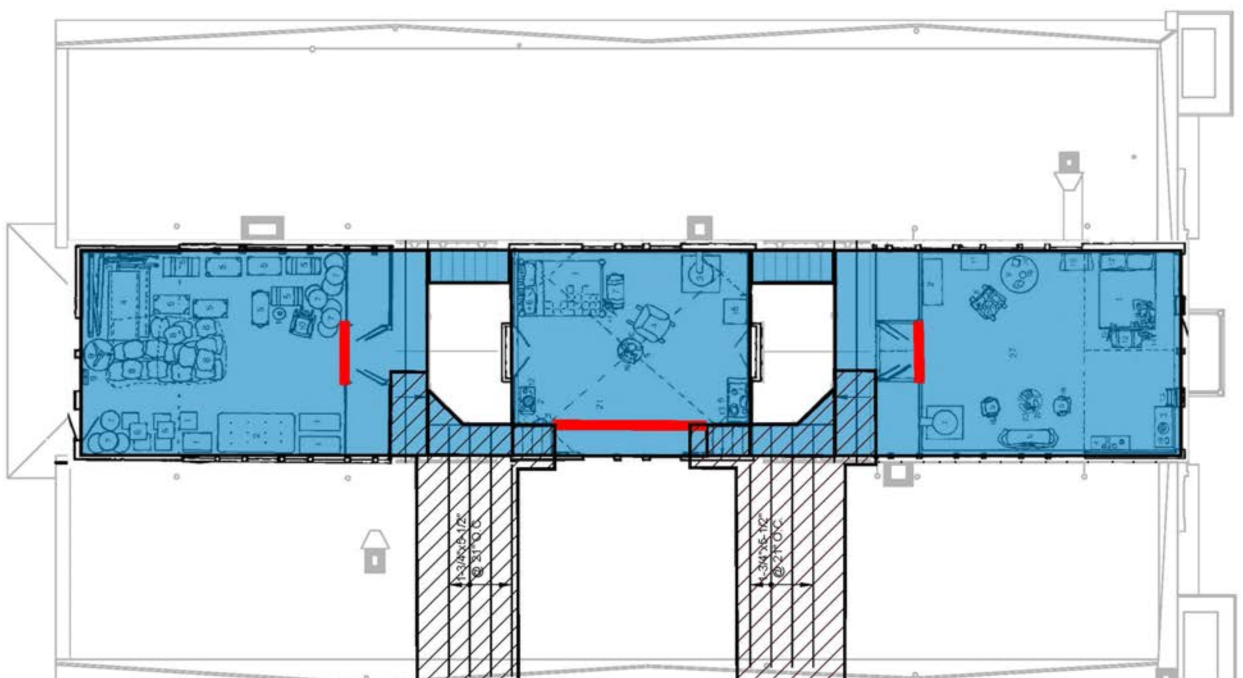


Figure 4.9 Furnished Room Capacity Plan - Second Floor



NOTE:
1. AREAS INTENDED TO BE OFF LIMITS TO THE PUBLIC AND AREAS WHERE ROOM FURNISHINGS WERE NOT PROVIDED ARE SHADED IN BLUE.
2. RED LINES REPRESENT PROPOSED LOCATIONS OF STANCHIONS AND ROPE USED TO RESTRICT PEDESTRIAN ACCESS TO CERTAIN AREAS OF THE MUSEUM AS PROVIDED BY NPS.
3. HATCHED AREAS REPRESENT THE APPROXIMATE AREA(S) OF FLOOR/CEILING DISTURBANCE REQUIRED TO STRENGTHEN THE MOST CRITICAL, LOW CAPACITY, AREAS IDENTIFIED BY NPS.

N/A	>40	30-39	20-29	10-19	0-9

TOTAL NUMBER OF PEOPLE

THIRD FLOOR - OCCUPIED/FURNISHED ROOM CAPACITY PLAN

Figure 4.10 Furnished Room Capacity Plan - Third Floor

4.3 Mechanical

By not addressing existing envelope deficiencies, it will be difficult and costly to maintain proper temperature and humidity set-points throughout the building all year around. New HVAC equipment quantities and sizes can be significantly reduced, if the existing envelope is improved. Additionally, yearly energy consumption costs will be lower with an improved building envelope.

4.3.1 Space Cooling, Heating, and Relative Humidity Set-points

Recommended temperature and humidity set-points throughout the Clara Barton House are based upon historical importance of a space and whether or not the space is anticipated to be occupied. Additionally, these recommendations take into consideration the potential impact these set-points will have on existing and potentially new equipment quantities and sizes. National Park Service (NPS) guidelines recommend room temperature set-points in the range of 72 deg. F to 75 deg. F and relative humidity set-points of no more than 60% RH for public, office, and living spaces. The Clara Barton House; however, does not necessarily fit into any of these categories. Rather, since the House contains historical collections, its primary use is that of museum. As such, museum space temperature and humidity set-points shall be based on the recommendations listed in Chapter 4 of the 2016 NPS Museum Handbook. Refer to Table 4.2 for recommended room temperature and humidity set-points per space type.

Table 4.2 Recommended Room Temperature and Humidity Set-Points

SPACE TYPE	SUMMER		WINTER	
	TEMP.	RH	TEMP.	RH
Museum	75	50	68	40
Critical Storage	77	50	68	40
Office / Admin	77	50	68	N/A
Storage / Utility	80	N/A	55	N/A
Unfinished Basement	N/A	N/A	55	N/A

4.3.2 Calculations

A preliminary load calculation was performed using Trane Trace 700 v6.3.3 with the estimate envelope thermal performance (see section 3.3.2) and the recommended temperature and humidity set-points described above. Additionally, the following assumptions were incorporated into the calculation.

4.3.2.1 Outdoor Design Conditions

Outdoor design conditions are specified conditions, such as temperature, required to be produced and maintained by a system and under which the system must operate.

Summer (2013 ASHRAE 90.1 0.4% dry bulb & wet bulb):

- Dry-Bulb Temperature = 94.5°F
- Wet-Bulb Temperature = 75.7°F

Winter (2013 ASHRAE 90.4 99.6% dry bulb):

- Dry-Bulb Temperature = 17.3°F

4.3.2.2 Occupancy Assumptions

- Offices = 1 person per office
- Conference Room = 20 SF/person
- Break Room = 40 SF/person
- Visitor Orientation Room = 20 max.
- Museum = 3 max.
- It is noted that a maximum of 20 visitors at any given time are anticipated in the building.
- Occupant Activity Levels: 250 Btu/h sensible; 200 Btu/h latent

4.3.2.3 Internal Cooling Load Assumptions

Internal cooling loads are the amount of heat energy that would need to be removed from a space (via cooling) to maintain the space temperature within an acceptable range. The rates below pertain to the amount of heat generated within the listed space by miscellaneous equipment such as computers or cooking appliances.

- Museum & Storage areas = 0 w/sf
- Office & Admin areas = 0.5 w/sf
- Break Room = 1500 W

4.3.2.4 Lighting Density Assumptions

- Museum areas = 1.0 W/SF
- Office & Admin areas = 1.0 W/SF
- Storage areas = 0.5 W/SF

4.3.2.5 Air Infiltration Assumptions

- 2.5 air change per hour (loose construction based on ASHRAE Fundamentals)

The results of the load calculation showed that the approximate cooling load for the building is 46 tons, while the heating load, including the load required for humidification, is approximately 721 MBH. The humidification load by itself is approximately 77 MBH. The following recommendations will be based on the calculated cooling, heating, and humidification requirements.

4.3.3 Cooling

As discussed in section 3.3.2 and 3.3.3, lack of cooling is one of the most critical deficiencies in the Clara Barton House. Per preliminary load calculations, approximately 50 tons of cooling are required, if no enhancements are made to the exterior envelope of the building. The cooling load is based on maintaining the space cooling set-points in the table above.

Therefore, it is strongly recommended that a new 50-ton air-cooled chiller be installed to accommodate all of the Clara Barton House's cooling needs. The unit will replace the existing split chiller and should be placed in the vicinity of the existing air-cooled condenser, adjacent the Southeast façade of the building. A unit of this capacity will have an approximate footprint of 10'x 8' and approximate height of 7'. The unit can be furnished with a pumping package rated for exterior operation. It is worth noting that 3 phase power will be required to operate this unit, which is currently not available, but strongly recommended as an upgrade. See the Electrical Recommendations portion of this report for more detail.

New chilled water piping can be run underground from the new chiller to new air handling equipment located in the unfinished basement level of the Clara Barton House. Vertical chilled water piping would be limited to serving new fan coil units replacing existing ones and new high wall fan coil units serving remaining office/admin spaces.

4.3.4 Heating

As discussed in section 3.3.3 and 3.3.4, the heating capacity of the existing gas-fired boiler serving the Clara Barton House can accommodate approximately 90% of the peak heating requirements of the building, if no enhancements are made to the exterior envelope of the building. Assuming some level of diversity; however, in that not all spaces in the building will demand peak heating capacities at the exact same time, the boiler should be able to maintain the space heating set-points shown in the table above for most, if not all of the heating season. Heating season typically includes the winter months (December through March); however, heating mode can be engaged during any time that temperatures fall below indoor heating temperature set-points (see table 4.2), likely to also occur in the Spring and Fall.

The existing boiler will not be able to accommodate the required humidification load that Museum and Critical Storage spaces will require. It is thus recommended that a source of humidification be provided. Electric humidifiers would be the simplest to implement.

4.3.5 Air-side Systems

As previously mentioned, not all rooms in the Clara Barton House are currently conditioned. Most of the unconditioned rooms are museum type spaces. It is assumed that the preferred solution to providing these spaces with heating and cooling would involve a non-intrusive approach that would limit the amount of ductwork and/or piping entering/exiting these spaces. Additionally, no HVAC equipment should be installed within these spaces to maintain the historic aesthetic of these rooms. With these limitations, it is therefore recommended that new high velocity small duct air handling systems be provided to serve these spaces. This new HVAC system can provide adequate cooling, heating, and humidity control while minimizing the impact on the existing architecture, as suggested in Preservation Brief 24- Heating, Ventilating, and Cooling Historic Buildings- Problems and Recommended Approaches.

The new air handlers would all be located in the basement level and would be modular type furnished with hot water heating coils, chilled water cooling coils, a fan section, and return air section with filters. Associated ductwork will be fairly small and the majority will be routed at the basement level. Space in existing chases, closets, and shafts will be used as much as possible to route new distribution ductwork, in accordance with Preservation Brief 24- Heating, Ventilating, and Cooling Historic Buildings- Problems and Recommended Approaches. Round supply air tubing will be routed vertically, terminating in floor-mounted air outlets not larger than 2.5” in diameter. For the entire first floor, these air outlets would be the only visible portion of the new system from within the room. On the 2nd level, however, visible ductwork cannot be avoided in Clara Barton’s Sitting Room and Clara Barton’s Bed Chamber because these spaces are located directly above Museum spaces on the floor below. The new ductwork can be run overhead tight against the existing ceiling and painted to match. Similarly, the South Storeroom and Third Floor Bedroom on the 3rd level will have some exposed ductwork. Because all museum spaces will contain historically important artifacts, humidity control will be important. The new air handlers will have the ability to dehumidify the supply air during summer months; however, new humidifiers will be needed to maintain minimum space humidity levels in winter months. It is recommended that new electric humidifiers be provided in the main branch ductwork off of the air handlers at the basement level to provide humidification to all museum spaces. Unico is one manufacturer that can provide high velocity small duct air-side systems with the features described above. Below is a list of pros and cons of the Unico’s high velocity / small duct system.

Pros:

- Best option for maintaining the aesthetic of the CLBA without extensive renovation or intrusive ductwork.
- Low noise levels.
- Allows for zoning of similar spaces
- Provides draft-free, even temperatures.
- Removes humidity effectively allowing for higher temperature set-points and lower energy costs.
- Air handlers are small enough to be strategically placed in confined areas.

Cons:

- Each air handler is limited to 4 tons; approximately 8 air handlers will be needed.
- Each room served will require multiple air outlets; 6-12 outlets per room.
- Maintenance of several pieces of equipment is required.
- The majority of the air handlers will have to be located in the unfinished basement, thereby limiting space for future growth.
- Requires separate fan (located in the basement) to bring in outside air.

4.3.6 Alternate System Considered

A ground source geothermal system was previously considered by NPS; however, this option was not supported and not pursued further. Such a system would eliminate the need of a large condensing unit located outside the house. This system would be able to provide heating and cooling while providing energy savings due to higher system efficiencies. The existing boiler would serve as a source of supplemental heat or back-up heat. Most of the indoor components would be similar to those described for the high velocity duct system; however, additional space would be required for 4 water to water heat pumps and an additional pump to circulate water between the geothermal field and the heat pumps.

A ground source loop taking up a significant amount of land outside the house would be required. For this application, a vertical system is recommended to limit the amount of area required for installation. Soil type affects the required field size, as different types of soil have different abilities to absorb energy. Ideal soils types are denser, while drier, sandier soils will require a larger loop field area. To be able to meet the 50-ton cooling load requirement of the Clara Barton House, approximately 15,000 SF of land will be required for installation of the vertical loop system. Approximately 50 bores would have to be drilled into the ground outside the Clara Barton House. These bores would have to be 150 to 200 feet deep and would need to located 20 feet apart to maximize heat transfer.

While ground source heat pump systems are more energy efficient than traditional air-cooled systems, the installation cost of a geothermal system can be up to several times that of an air source system of similar heating and cooling capacity. Since the geothermal system is more efficient; however, typical payback periods can be as short as 5 to 10 years. Maintenance of outdoor geothermal components is minimal, as most of these components are buried; however, if an issue, such as a leak, were to occur, it would be difficult to gauge the exact location of the problem without extensive digging. Assuming proper installation, typical indoor heat pump equipment lifespan is approximately 25 years, while the outdoor components making up the ground source loop can last approximately 50 years.

Due to the higher first costs of a geothermal system, the amount of land area required for the ground source loop, and the additional area required for 5 additional pieces of HVAC equipment, it is strongly recommended that this option not be pursued. The aforementioned descriptions are meant to provide NPS a brief understanding of the difficulties of installing a geothermal system at the Clara Barton House historical site.

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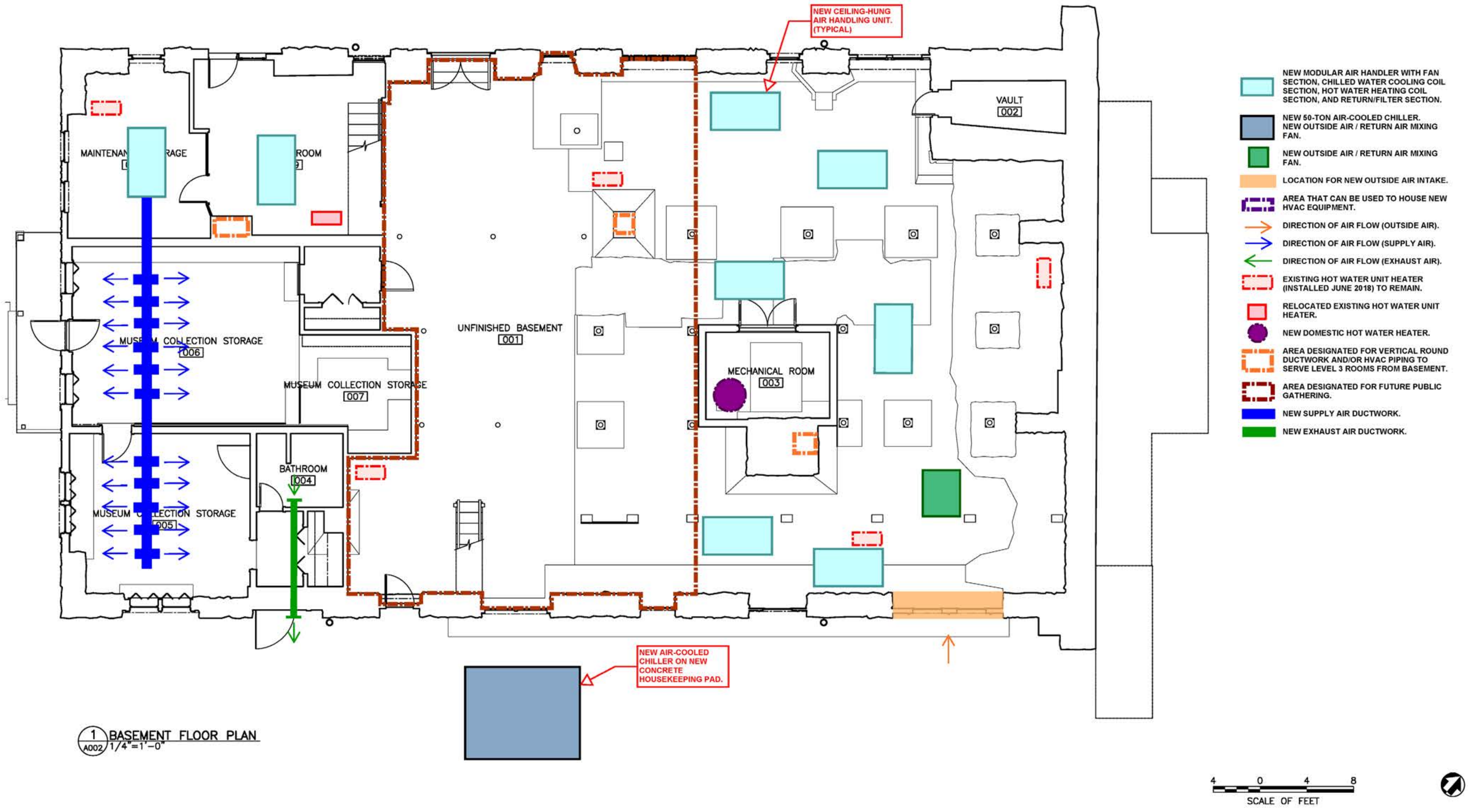

Figure 4.11 Mechanical Recommendations - Basement

4.3.7 Room-by-Room Recommendations

4.3.7.1 Basement

- Provide a new hot water unit heater to serve the Utility Room. Unit should be sized to accommodate a 55 deg F. heating set-point in the space. ①

- Remove the existing fan coil unit in the Museum Collection Storage 006. Remove the finned tube radiators in the Museum Collection Storage 005. Provide a new small duct/ high velocity heating and cooling system to serve these 2 rooms and the adjacent Museum Collection Storage 007. The associated air handler can be installed in the adjacent Maintenance Storage 008. ②

  NOTE: If work associated with installing the recommended small duct / high velocity heating and cooling systems cannot be performed, at minimum, replace the existing fan coil unit in the Museum Collection Storage 006 with a brand new unit of similar capacity. Similarly, replace the existing finned tube radiators in the Museum Collection storage 005. This recommendation should be considered a Top Priority.

- Provide a new fan and ductwork to exhaust air from Bathroom 004 directly to the outdoors to meet code requirements. The fan and exhaust grille can be installed in the bathroom and associated exhaust ductwork can be routed directly outdoors across the adjacent room. ①

- Replace all heating hot water and chilled water piping in the basement or at minimum, replace portions of piping visibly damaged, deteriorated, or with large amounts of rust. ①

- Replace all HVAC piping insulation or at minimum, replace all portions of insulation with apparent water damage, all portions of torn insulation, and portions of insulation not meeting minimum thicknesses and/or materials. Insulate all bare spans of piping and/or fittings not currently insulated. ①

- Install all air handlers to serve upper level museum type spaces. A new fan will be required to mix return air with the minimum amount of outside air required by the International Mechanical Code and ASHRAE 62.1. An outside air intake louver and plenum can be installed at any of the existing windows. ②

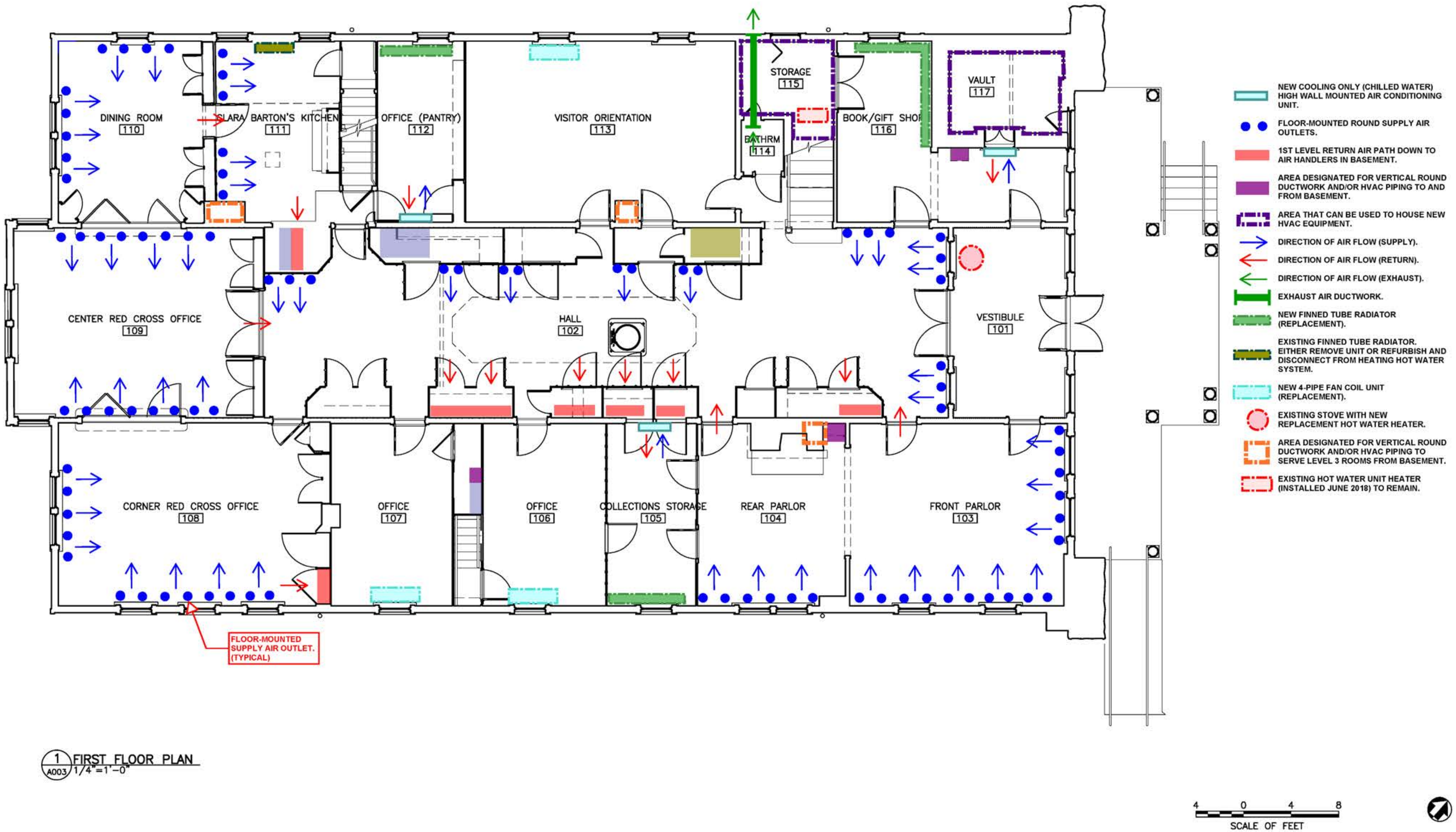

Figure 4.12 Mechanical Recommendations - First Floor

4.3.7.2 First Floor

Offices 106, Office 107, Visitor Orientation 113:

- Replace existing floor-mounted fan coil units with new 4-pipe floor-mounted fan coil units. Replace all associated exposed portions of chilled water and heating hot water piping with new piping and insulation. Replace existing valving and accessories in kind. Fan coils shall have built-in integral thermostats. Chilled water to these units shall be provided by new air-cooled chiller. ①

Collections Storage 105, Office (Pantry) 112, and Book/Gift Shop 116:

- Replace existing floor-mounted finned tube radiators and associated valving and accessories with new finned tube radiators and associated valving and accessories. All new finned tube radiators shall have integral thermostats. ①
- Provide high wall air conditioning units (cooling only). Refer to colored mechanical plans for proposed locations. New high wall AC units shall use chilled water as the cooling source. These indoor units shall be connected to the new air-cooled chiller to be located on the southeast side of the Clara Barton House. ②
- Replace water damaged insulation on vertical chilled water and heating hot water risers in Office Pantry 112. ①

Dining Room 110, Clara Barton's Kitchen 111, Center Red Cross Office 109, Corner Red Cross Office 108, Front Parlor 103, Rear Parlor 104, and Hall 102:

- Remove existing baseboard finned tube radiators and provide new small duct / high velocity heating and cooling systems to serve these rooms, which are all classified as Museum spaces on this floor. These units can be installed in the Basement Level of the Clara Barton House. The museum spaces shall be served via floor-mounted supply air outlets no larger than 2.5" in diameter. Air outlets materials and finishes can be made to match existing flooring in the spaces they are installed in to minimize the aesthetic impact of the new HVAC systems. Return air from these spaces will be brought back to the air handler units in the basement. ②
- Since heating to the Clara Barton's Kitchen 111 will be provided by the new HVAC system described above, the existing hot water radiator will no longer be needed. It can either be removed and all associated piping connections can be capped at the floor or it can be refurbished / repainted to be a non-functioning artifact and maintain the existing room aesthetic. ②

  NOTE: New hot water baseboard finned tube radiators were installed in the Front Parlor (103), Rear Parlor (104), Corner Red Cross Office (108), and Dining Room (110) as part of the 2018 Fire Suppression project. These heaters were sized to prevent the new fire protection piping from freezing and not to provide comfort heating. As described above, it is recommended that these existing heaters be removed and the heating source be via new small duct / high velocity systems that can properly maintain heating and humidity set-points adequate to museum type spaces.

- Replace custom built heater in stove located in Vestibule 101 with new hot water heater. As per the current installation, associated thermostat should be accessible via stove access panel. ①
- Provide a new fan and ductwork to exhaust air from Bathroom 114 directly to the outdoors to meet code requirements. The fan and exhaust grille can be installed in the bathroom and associated exhaust ductwork can be routed directly outdoors across the adjacent Storage room 115. ①
- Vault 117 will remain unconditioned. If installing a new chiller is not an option, the space can be used as a location to house new HVAC equipment.

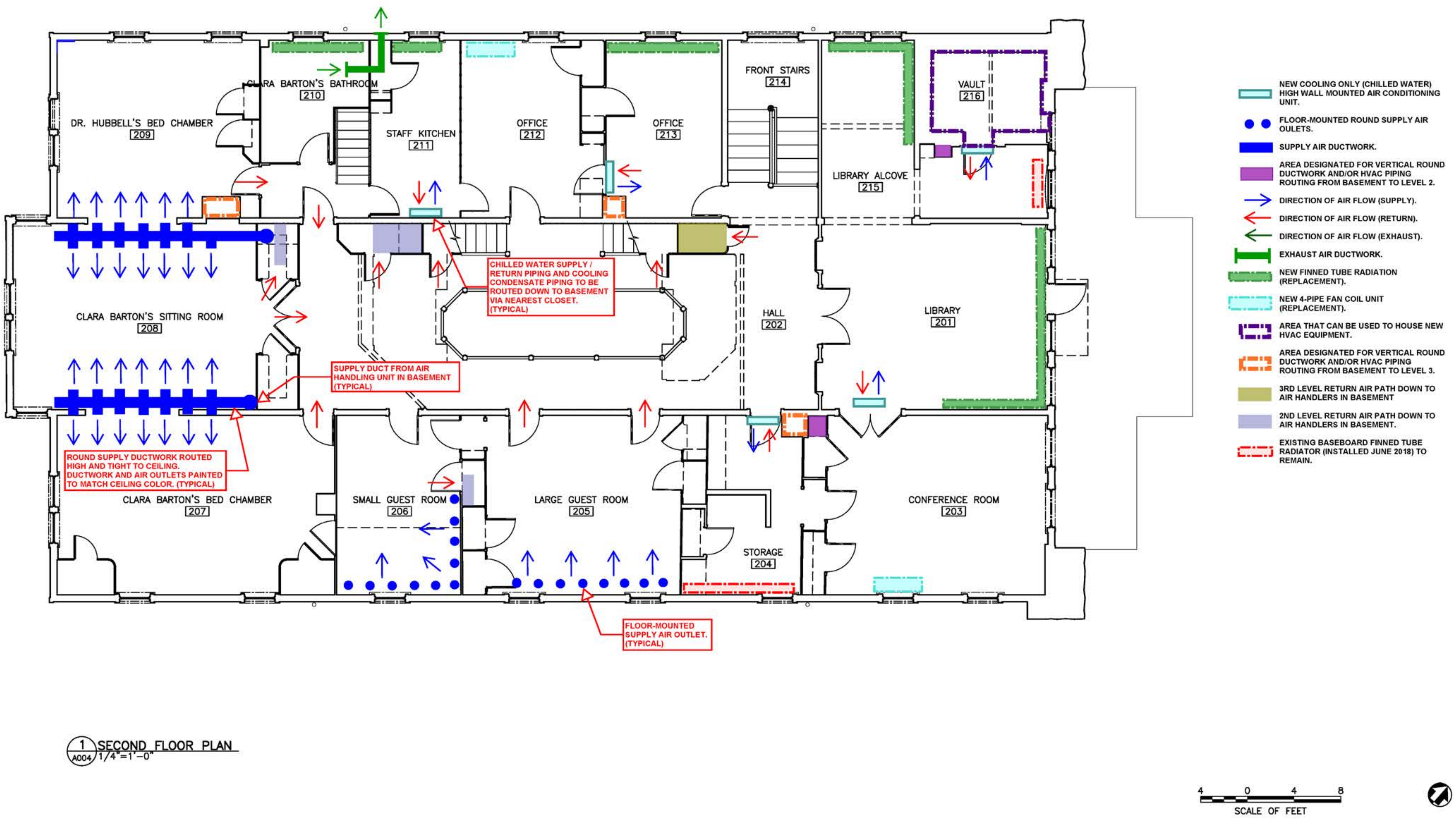

Figure 4.13 Mechanical Recommendations - Second Floor

4.3.7.3 Second Floor

Office 212 and Conference Room 203:

- Replace existing floor-mounted fan coil units with new 4-pipe floor-mounted fan coil units. Replace all associated exposed portions of chilled water and heating hot water piping with new piping and insulation. Replace existing valving and accessories in kind. Fan coils shall have built-in integral thermostats. Chilled water to these units shall be provided by new air-cooled chiller. (1)
- Replace water damaged insulation on vertical chilled water and heating hot water risers in Conference Room 203 closet. (1)

Storage 204, Clara Barton's Bathroom 210, Staff Kitchen 211, Office 213, Library 201 and Library Alcove 215:

- The existing baseboard finned tube radiators (installed June 2018) serving Storage 204 and Library Alcove 215 shall remain. Replace all other existing floor-mounted finned tube radiators and associated valving and accessories with new finned tube radiators and associated valving and accessories. All new finned tube radiators shall have integral thermostats. (1)
- Provide high wall air conditioning units (cooling only). Refer to colored mechanical plans for proposed locations. New high wall AC units shall use chilled water as the cooling source. These indoor units shall be connected to the new air-cooled chiller to be located on the southeast side of the Clara Barton House. (2)
- Insulate vertical chilled water and heating hot water piping in Staff Kitchen 211. (1)

Dr. Hubbell's Bed Chamber 209, Clara Barton's Sitting Room 208, Clara Barton's Bed Chamber 207, Small Guest Room 206 and Large Guest Room 205:

- Remove existing baseboard finned tube radiators and provide new small duct / high velocity heating and cooling systems to serve these rooms, which are all classified as Museum spaces on this floor. These units can be installed in the Basement Level of the Clara Barton House. (2)
- Small Guest Room 206 and Large Guest Room 205 can be served via floor-mounted supply air outlets no larger than 2.5" in diameter to minimize the intrusion of ductwork into the space. Associated ductwork can be routed high and tight to the ceiling across the office spaces directly below these rooms on the first floor. (2)
- Dr. Hubbell's Bed Chamber 209, Clara Barton's Sitting Room 208, and Clara Barton's Bed Chamber 207 cannot be provided with floor air outlets because the spaces directly below them are Museum spaces. Therefore, these three rooms will be served from overhead supply ducts with multiple air outlets. Because the three rooms are open to each other, only two branch ducts will be needed. Ducts can be high and tight to the existing ceiling or within a soffit. Air outlets will be no larger than 2.5" in diameter each, and their materials and finishes can be made to match the existing flooring/ceiling of the spaces they are installed in. Return air from these spaces will be brought back to a centralized return air location in Hall 102. (2)

NOTE: New hot water baseboard finned tube radiators were installed in all of these rooms as part of the 2018 Fire Suppression project. These heaters were sized to prevent the new fire protection piping from freezing and not to provide comfort heating. As described above, it is recommended that these existing heaters be removed and the heating source be via new small duct / high velocity systems that can properly maintain heating and humidity set-points adequate to museum type spaces.

- Provide a new fan and ductwork to exhaust air from Clara Barton's Bathroom 210 directly to the outdoors to meet code requirements. The fan and ductwork can be installed in the small closet in the adjacent room (Staff Kitchen 211) to hide it from view. (2)
- Vault 216 will remain unconditioned. If installing a new chiller is not an option, the space can be used as a location to house new HVAC equipment. (3)

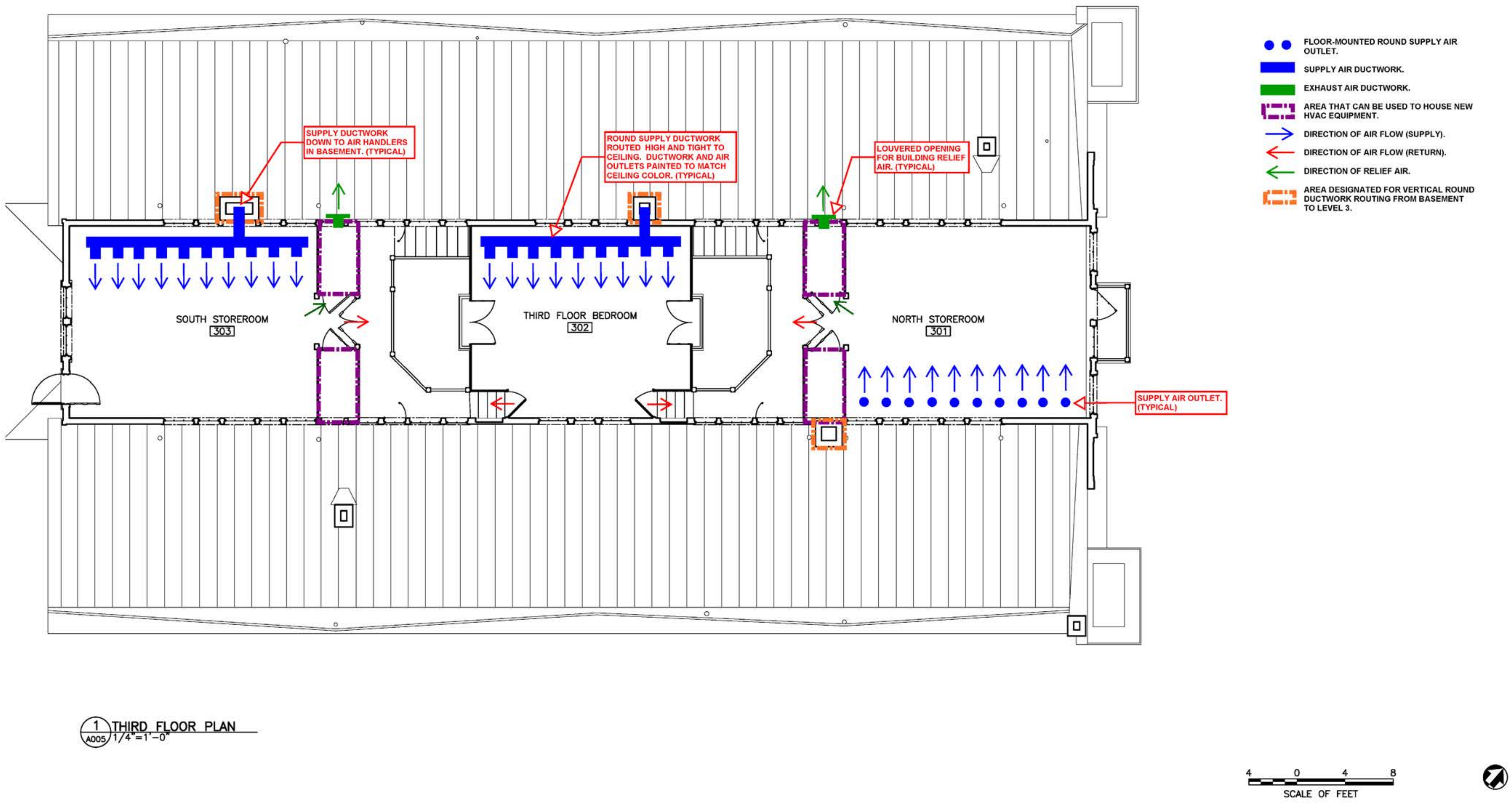

Figure 4.14 Mechanical Recommendations - Third Floor

4.3.7.4 Third Floor

- North Storeroom 301, Third Floor Bedroom 302, and South Storeroom 303 are all classified as Museum spaces on this floor; therefore, they require heating and cooling to maintain reasonable space temperatures throughout the year and humidity levels within an acceptable range to be able to house historically important documents and artifacts. The North Storeroom 301 and the Third Floor Bedroom 302 cannot be provided with floor air outlets because the spaces directly below them are Museum spaces. Therefore, these rooms will be served from overhead supply ducts, similarly to Rooms 207, 208, and 209 on the 2nd Floor. Air outlets will be no larger than 2.5" in diameter each and their materials and finishes can be made to match the existing flooring/ceiling of the spaces they are installed in. Return air from these spaces will be brought back to a centralized return air location in Hall 102. (2)

  NOTE: New hot water baseboard finned tube radiators were installed in North Storeroom 301 and South Storeroom 303 as part of the 2018 Fire Suppression project. These heaters were sized to prevent the new fire protection piping from freezing and not to provide comfort heating. As described above, it is recommended that these existing heaters be removed and the heating source be via new small duct / high velocity systems that can properly maintain heating and humidity set-points adequate to museum type spaces.

- Provide a means of relief of excess air in the Clara Barton House. Since fresh air will be provided to the building, a means of exhausting this additional airflow will need to be provided. The best option would be to place gravity relief vents on the roof above the 3rd floor rooms; preferably above the North Store Room 301 and the South Store Room 303. If installing these on the roof is not an option, louvered relief vent wall openings can be provided in one of the closets in Rooms 301 and 303. Each louvered relief vent will be approximately 2' x 2', or equivalent area. Refer to Figure 4.133 for approximate locations. (2)

- If installing a new chiller is not an option, there are 4 closets on the 3rd level that can be used to house new HVAC equipment such as air-cooled air conditioners. Some window area within the closets would have be allocated to allow excess heat off of the equipment to exit outdoors.

4.3.8 Envelope Improvements

As previously discussed, the Clara Barton House envelope has a significant impact on its required cooling and heating loads. The building is for the most part uninsulated and has very loose construction contributing to large amounts of conditioned air leakage in the summer and cold air infiltration during the winter. By not addressing existing envelope deficiencies, it will be difficult and costly to maintain proper temperature and humidity set-points throughout the building all year around. New HVAC equipment quantities and sizes can be significantly reduced, if the existing envelope is improved. Envelope improvements can also decrease required relief vent sizes. Additionally, yearly energy consumption costs will be lower with an improved building envelope. The following analysis was performed to assess the impact of improving separate components of the building's existing thermal envelope.

The initial load calculation discussed in section 4.3.1, which estimates the heating, cooling, and humidification loads of the Clara Barton House with no improvements made to the existing building envelope, will be referenced as Alternative 1. This alternative will serve as the baseline for this analysis. Three more load calculations were performed to gauge the effects of upgrading the building envelope on the HVAC requirements for the building. Refer to Table 4.3 for a summary of all 4 alternatives.

Table 4.3 Alternatives Summaries

ALTERNATIVES	COOLING (TONS)	% SAVINGS	SPACE HEATING (MBH)	% SAVINGS	HUMIDIFICATION (MBH)	% SAVINGS
Alt. 1 (Baseline)- No Improvements	45.8	-	721	-	77	-
Alt. 2- Roof Insulation	35.9	22%	580	20%	77	0%
Alt. 3- Air Barrier	40.8	11%	524	27%	40	48%
Alt. 4- Add Air Barrier + Roof Insulation	31.1	32%	383	47%	40	48%

It is worth noting that the envelope improvements and associated calculations described below are not meant to strive towards a certain standard, but rather are provided to educate NPS on the cooling and heating energy and cost savings expected when improving certain aspects of the current building envelope. It is worth noting that improving energy efficiency in existing buildings by adding insulation and vapor barriers to existing buildings is in accordance with Preservation Brief 24- Heating, Ventilating, and Cooling Historic Buildings- Problems and Recommended Approaches. Refer to table 3.7 for building envelope thermal performance requirements needed to meet current International Energy Conservation Code standards.

Alternative 1 (Baseline) – No improvements made to exterior envelope.

Alternative 2 – Insulate all roof areas with batt insulation (R-10)

Insulating the roof reduces the cooling load by approximately 22% and heating load by approximately 20%. It does not have an effect on the humidification load, as insulating the roof only affects the sensible heating load, while the former is a latent load.

A 20% reduction in cooling may decrease the sizes of cooling equipment such as the air cooled chiller and air handlers. A relief vent area decrease of approximately 20% can also be expected.

Alternative 3 – Add an air barrier to the entire building envelope

This calculation is based on the assumption that an air barrier can be installed at all exterior walls and that all window frames are sealed such that the overall air infiltration in the winter (worst case) can be decrease from 2.5 air changes per hour (leaky, loose construction) to 0.6 air changes per hour, which is equivalent to a medium tightness, average construction building. Adding an air barrier to the CLBA envelope reduces the cooling load by approximately 11% and reduces the total heating load by approximately 27%. The humidification load is reduced by approximately 48%.

The air cooled chiller and air handlers should decrease by approximately 10% in cooling capacity; however, equipment sizes may not be much different. Humidifier capacities and sizes can be expected to decrease by nearly 50%. A relief vent area decrease of approximately 10% can also be expected.

Alternative 4 – Insulate all roof areas with batt insulation and add an air barrier to the entire building envelope (Essentially a combination of Alt. 2 and Alt. 3 improvements).

This final alternative combines the envelope improvements assumed in Alternative 2 and Alternative 3 to assess their combined effectiveness, which equates to a reduction of the cooling load by approximately 32% and a reduction in the total heating load by 47%. As expected, there was no additional reduction in humidification load from Alternative 3.

The 30% reduction in cooling will decrease the size of the air handlers and air cooled chiller. A relief vent area decrease of approximately 30% can also be expected.

4.4 Plumbing

4.4.1 Basement

- Replace the electric domestic water heater with a new unit of similar size and storage capacity. ①
- Replace all domestic hot water and cold water piping in the basement or at minimum, replace portions of piping visibly damaged, deteriorated, or with large amounts of rust. Check that valves and fittings are in adequate condition and that no leaks occur in each system. ②
- Replace all domestic water piping insulation or at a minimum, replace all portions of insulation with apparent water damage, all portions of torn insulation, and portions of insulation not meeting minimum thicknesses and/or materials. Insulate all bare spans of piping and/or fittings not currently insulated. ②
- Replace existing chilled water make-up backflow preventer. ②
- Replace sanitary piping or at minimum, replace the portions of piping that are visibly rusty and/or damaged. Check that valves and fittings are in adequate condition and that no leaks occur in each system. ②

4.4.2 First Floor

- Replace water damaged insulation/jacketing on sanitary piping in Clara Barton's Kitchen 111. ②

4.4.3 Second Floor

- **Remove all lead domestic water piping in Clara Barton's Bathroom 210 and replace with new copper piping.**
- **Remove all lead domestic water piping in Staff Kitchen 211 and replace with new copper piping.**
- Replace rusted floor drain grate. ②

4.4.4 Roof (Third Floor)

- Remove peeling paint off of metal downspouts and re-paint. Replace portions of downspout that are damaged/ deteriorated. ②

4.4.5 Fire Suppression System

A new, complete automatic sprinkler system was installed throughout the Clara Barton House in June 2018. There are no recommendations in regards to this system.

4.5 Electrical

4.5.1 Electrical Service Entrance

The following corrective action is recommended:

- Place service disconnects on the basement wall nearest the point of entry into the building to reduce the exposure of unprotected service entrance cables traversing through the unfinished basement. ①
- Upgrade the utility transformer service from single-phase to a three-phase service and upgrade the incoming service entrance cable to a size that will equal to or exceed the sum of the amp ratings of the service entrance protective devices. A 150 to 225 kVA utility service size is likely to be needed, but this will need to be verified during the design of the upgraded facility. ①
- Provide Surge Protection as recommended by IEEE C62.72. Surge protection devices should be added to the service entrance panels as well as the distribution panels.
- Provide a set of three ground rods in a grounding triad configuration and connect this to the service entrance ground. The new grounding triad is to be installed outside the building and beyond the drip line of the eaves to ensure sufficient moisture in the soil to provide a low resistance to ground. Also, all metallic piping entering the building needs to be bonded to the ground system. Lastly, connect the telecommunications ground to the main electrical ground in accordance with TIA-607-B recommended practices for telecommunications systems.

4.5.2 Telecommunications Service Entrance

The following corrective action is recommended:

- Replace the existing copper telephone cables with sufficient capacity as required for the newly renovated building. Replace the existing primary protector and relocate it to the exterior wall. The protectors should be mounted on the inside face of the exterior wall or outside the building where the cable enters the building. This work is to be coordinated with the telecommunications service provider since sometimes telephone service is delivered via fiber optic cable based on the type of data and voice package purchased by the end-user.

4.5.3 Emergency Lighting System

The emergency lighting in the building should be upgraded as follows:

- Replace the existing emergency lighting system with a new system that is coordinated with the life safety egress plan.
- Provide illuminated emergency exit signage. The new system must be equipped with a minimum of 90-minute backup power to meet NFPA 101 requirements.

4.5.4 Outlet and Wiring Issues

The following deficiencies should be addressed:

- Remove or relocate existing outlets that do not meet ADA accessibility requirements.
- Remove or relocate existing outlets located above the baseboard heaters. ①
- Repair or replace improperly mounted devices throughout the facility.
- Remove the knob and tube wiring system on the third floor south storeroom.
- The electrical outlet layout and quantity should be updated based on building renovation requirements and change in usage of existing spaces. The existing electrical outlet layout and capacity appears to be only suitable for residential housing usage. A ninefold increase in power capacity is recommended for the entire building. To address the new usage as administrative and museum space will entail the need to upgrade receptacle quantity and circuits as needed to accommodate the increased receptacle power density for these new usage requirements."
- Upgrade the data and phone outlet layout and quantity according to the new room usage requirements in the renovated spaces.
- Provide GFCI protection for electrical outlets in the unfinished basement. Also all bathrooms, exterior receptacles and similar wet areas are to be provided with GFCI protection.
- Modify existing exposed MC Cabling systems in user spaces by removing the cables, concealing them in the walls or running them in exposed Architecturally finished raceway systems (wiremold) to avoid physical damage.

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5.0 CONCLUSIONS

5.1 Architectural

5.1.1 Exterior Envelope

The exterior envelope suffers from inadequate maintenance and fundamental thermal and humidity performance issues. Many windows and doors are leaking, rotting and have peeling paint further exposing the substrate to accelerating degradation with water leaks damaging the interior finishes. The majority of the facade requires repainting.

These issues, however, can be addressed by a maintenance program targeting the windows and doors and the exterior cladding, sealing up any gaps and addressing and correcting leaks. Given the exposed location of this building, a painting and exterior maintenance program following a 5 year cycle is recommended.

Key envelope design issues however are more difficult to address:

- Air infiltration and exfiltration
- Thermal insulation

Sealing leaks and repairing windows will reduce, but not eliminate, air movement through the envelope. Unrestricted air movement taxes the mechanical systems for both heating and cooling and for humidity control. Lack of thermal insulation is also a significant deficiency.

Considerations for the addition of insulation include:

- **Resilience to a wet dry cycle:** regular batt insulation is not recommend as it sags over time and becomes ineffective.
- **Continuous vs cavity:** continuous insulation on the exterior (on top of the wood framing and behind the cladding) is the most effective placement location.
- **Installation:** level of disruption to interior or exterior finishes and any long term aesthetic compromises. For example, the application of a continuous layer of 2" mineral wool insulation would require the removal and re-attachment of all the existing cladding resulting in a thicker exterior wall and changing, however slightly, the visual appearance and character of the building.
- **Insulation type:** a long term solution that does not compromise the historic structure and is reversible.
- **Provision of and air and/or vapor barrier**

5.1.2 Roof

The lower roof has been replaced but continues to have some leaking and performance issues. The added expansion joint is leaking, cracking has been observed at the flashing and the roof drainage slopes appear not to function effectively. The upper roof appears fundamentally sound but needs the be repainted, re-caulked with all flashing and diverters replaced (or repaired at a minimum).

5.1.3 Porch and Balcony

The front porch has a poor roof design (low slope) that results in deterioration of the adjacent window sills and should be re-framed. An added improvement is to add metal cladding (or similar durable material) to the window sills to protect against decay caused by standing water. The porch columns are rotten at the base and should be renovated.

The second floor decorative balcony is unsafe and should not be used until structural repairs are made or the balcony is rebuilt.

5.1.4 Site

Site issues are modest. Some basic re-grading will allow more effective water shedding away from the envelope. Vegetation should be cut back allowing better air movement around the perimeter.

5.1.5 Phasing

Two basic phasing alternatives can be considered.

1. Façade. In this scenario, each façade (N,S E W) would be addressed as a whole with the entire façade renovated in each phase including:
   - Windows and doors
   - Abatement and removal of lead based paint surface preparation and painting
   - Air barrier installation (if desired)
   - Landscape improvements
2. Category. In this scenario, each component is addressed in the entire building regardless of location.
   - All windows
   - All wood / repainting
   - Porch and balcony rebuilding
   - Landscape improvements
   - Roof

Or some combination of the two. Each of the above should consider the roof and roof clerestory windows as being one phase.

5.2 Structural

Considering the age of the structure, we believe the structural systems of the building are in good condition. However, during our evaluations, we found the floor framing to be deficient for the proposed functions as the available live load capacity of the 2nd and 3rd floor floors are significantly under designed relative to the current building code. The low floor capacities are a result of two major factors: shallow member depth, relative to the spans, and a wood species with a low flexural capacity. As a result, restrictions on the number of people permitted in each room have been provided. To achieve a higher live load capacity, the floors, or areas of the floors, will require reinforcing, likely with additional wood joists, similar to the existing, previously installed, First Floor reinforcing.

In summary, the floor framing should be reinforced or the available live load capacities and maximum occupancy numbers should be noted and posted.

Deficiencies on ancillary structural elements include the decorative balcony, existing flagpole, and the main porch.

5.3 Mechanical

Heating and cooling the interior spaces to maintain museum grade conditions is challenging and requires significant energy consumption because of poor exterior envelope performance in both air movement and thermal insulation. A leaky envelope also makes humidity control very challenging.

Major envelope enhancements are achievable (insulation/ air barrier) but the cost may be outweighed by the benefits. There may also be unintended consequences in changing the thermal dynamic of a building that has stood for over 100 years.

5.3.6 Mechanical Phasing Considerations

The mechanical recommendations made in section 4.3 can be phased in a manner that will make subsequent improvements easier to incorporate. It is noted that new electrical upgrades will likely need to be in place in order to accommodate the majority of these mechanical upgrades. The following list represents the recommended order in which mechanical improvements could be made:

1. Where recommended, replace existing four-pipe fan coil units with new fan coil units. Valving, accessories, and associated piping (if damaged) should be replaced. These fan coil units serve Office and Administrative areas on the 1st and 2nd floors.

2. Where recommended, replace existing finned tube radiators with new baseboard finned tube radiators. Valving, accessories, and associated piping (if damaged) should be replaced. These finned tube radiators serve Office and Administrative areas on the 1st and 2nd floors. Replace existing stove unit heater serving Vestibule 101.

3. Replace existing chiller with new 50 ton chiller. Work should include upgrading associated pump, expansion tank, and all necessary accessories. At this time, the chilled water piping mains should be upgraded to accommodate higher flows associated with the additional capacity of the new chiller. The work will be limited to the basement.

4. Install new outside air intake and outside air / return air mixing fan in basement. Install new small duct, high velocity air handlers and provide new chilled water and heating hot water connections. Install new supply, return, and outside air ductwork to and from air handlers. Note that not every single air handler shown in Figure 4.130 needs to be installed at once. These systems can be installed in the order that NPS deems appropriate. Note that one air handler can serve multiple rooms. Refer to the Load & Airflow Summary Report in Volume 2 for recommended zoning of all museum spaces.

5. Install new cooling only high wall mounted air conditioning units to serve Office and Administrative areas on the 1st and 2nd floors. Install associated chilled water and condensate piping to be routed via nearby vertical shaft and void areas.

6. New exhaust fans and associated ductwork serving toilet rooms can be installed at any time.

5.4 Electrical

The CBH systems are antiquated and require upgrade to meet ADA, life safety, general lighting and modern building load requirements. In addition, any upgrade to the mechanical equipment will add significantly to the building overall building load possibly resulting in an increased incoming service size and main electrical panel.

5.5 Holistic Building Design

T = E x M

The above equation is intended to illustrate the relationship between the three key variables:

Interior Environmental Conditions (T): thermal and humidity requirements set over 4 seasons

Envelope Improvements (E): Envelope performance; air tightness and thermal insulation

Mechanical Systems (M): equipment sizing, performance and controls

As the requirements for T become more stringent (INCREASE) with narrower temperature and humidity set points, the M and the E portions of the equation need to increase to balance out the T requirements. As the T requirements become less stringent (REDUCE) then the M and the E can consequently adjust. In either scenario, the M portion may be the only adjustment (however energy inefficient), the E part is included to illustrate that a tight and well insulated envelope plays an important part in an overall system performance.

For example, achieving precise temperature and humidity conditions over the entirety of four seasons will necessitate both significant mechanical and envelope upgrades. Relaxation of some requirements will significantly reduce infrastructure, envelope and operational costs – but at the expense of the consistency of the interior temperature and humidity environment.

A leaky wall (windows, doors and the wall itself) allows significant air movement between the inside and outside. Air that infiltrates the building can carry moisture and heat in the summer (or vice versa in the winter) and has to be treated as a part of the system. More energy is lost through air movement in a typical building than through either convection or conduction (both more reliant on thermal insulation). The humidity component is worthy of special note. Humidity extraction (required during summer conditions when there is unrestricted humid air movement) consumes a disproportionate amount of energy as compared to simply changing the temperature of dry air.

Consequently, in a building such as this, the most value in envelope remediation is in improving air tightness (over adding insulation).

If wall insulation is to be added, a non combustible insulation type is recommended. The addition of an air barrier and thermal insulation at the exterior walls are necessary for the building to maintain suitable museum level interior environmental conditions. Without these elements, the mechanical system is unable to adequately respond to, and compensate for annual swings in temperature and humidity.

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6.0 APPENDIX

LIST OF FIGURES

LIST OF TABLES

6.1 Deficiencies

Table 6.1 Mechanical Condition Assessment and Deficiencies

Clara Barton House - Mechanical Condition Assessment and Deficiencies

Area / Level	ID	Equipment & Model / Serial No.	Serial No.	Room Location	Approximate Capacity	Manuf. Date	Age	ASHRAE Life Exp.	Remaining Life	Visible Condition	Photo (Y/N)	Deficiency	Recommendation
BASEMENT [Refer to Dwg. MD00]	M1	Packless Coil (COCX-2501-J-13-178)	N/A	Unfinished Basement	5 Tons	July 2011	7	20	13	Good	Y	Chiller evaporator coil lacks the capacity to cool the entire house. The cooling capacity is approximately 5 Tons, but approximately 50 Tons are needed.	Replace with packaged 50-ton air-cooled chiller.
	M2	B&G Inline Pump (Motor - MRP58JV-758)	N/A	Unfinished Basement	Approx. 10 GPM @ 8' Head	NA	7 (estimated)	10	3	Good	Y	The pump is in good condition and should be able to last another 10 years; however, if the chiller is replaced to accommodate a larger unit, the pump will also need to be replaced to accommodate the greater water flow required.	Replace if existing chiller is replaced with larger chiller.
	M3	Airtrol Fitting (ATF-12)	N/A	Unfinished Basement	N/A	NA	N/A	N/A	N/A	Fair	Y		
	M4	Little Giant Condensate Pump (VCMA-2OULS)	AJM24971066	Unfinished Basement	1/2 gallon tank; 1/30 HP	January 2001	17	15	0	Poor	Y	The condensate pump is near the end of its useful life.	While no visual evidence of malfunction was observed, it is recommended that the pump be replaced. If a new chiller is to be installed, the new condensate pump may need to be larger.
	M5	Wood Ind. Prod. Co Expansion Tank	N/A	Unfinished Basement	15 gallon?	1981	37	20	0	Poor	Y	The expansion tank is nearing 40 years of age and has reached the end of its useful life.	Replace with new expansion tank. If a new chiller is installed, the expansion may need to be larger.
	M6	Hot Water Unit Heater	N/A	Maintenance Storage 008	22 MBH	June 2018	<1	20	19	Excellent	N	N/A	N/A
	M7	Thermal Zone Condenser (TZAA-348-2A757)	N/A	Outside Basement (Southeast)	48 MBH nominal	November 2010	8	20	12	Fair	Y	Chiller condensing unit lacks the capacity to cool the entire house. The cooling capacity is approximately 4 Tons, but approximately 50 Tons are needed.	Replace with packaged 50-ton air-cooled chiller.
	M8	Hot Water Unit Heater	N/A	Unfinished Basement	22 MBH	June 2018	<1	20	19	Excellent	N	N/A	N/A
	M9	Honeywell Chronotherm (T8082)	N/A	Museum Collect Storage 006	N/A	1977	41	16	0	Poor	Y	The thermostat is over 30 years old and is antiquated.	Replace with new thermostat and interlock with fan coil unit operation.
	M10	FCU (4-pipe)	N/A	Museum Collect Storage 006	CLG/HTG: 13.1 MBH / 38.2 MBH	June 1981	30+	20	0	Poor	Y	The fan coil unit is well beyond its useful service life. Both the casing and associated piping show several amounts of rust throughout. The unit does not provide humidity control, which is critical to the preservation of museum artifacts.	The Museum Collection Storage 006 is a critical storage space and will house several historically important artifacts. It is recommended that the space be heated and cooled by a new modular air handler to be located in the adjacent unfinished basement. A duct mounted humidifier is recommended for additional humidity control.
	M11	Finned Tube Radiators	N/A	Museum Collect Storage 005	12.1 MBH - 690 BTU/FT	1980's	30+	25	0	Poor	Y	Although the finned tube radiator looks to be in fair condition, it looks aged and beyond its useful service life. The space requires cooling and some level of humidity control to be able to preserve museum artifacts.	The Museum Collection Storage 005 is a critical storage space and will house several historically important artifacts. Replacing the finned tube radiator is not a viable option, since the space will also need cooling. It is recommended that the space be heated and cooled by a new modular air handler to be located in the adjacent unfinished basement. A duct mounted humidifier is recommended for additional humidity control.
	M37	Piping - Heating Hot Water	N/A	Unfinished Basement	N/A	N/A	30+	25	0	Poor	Y	Heating hot water piping throughout is over 30 years old and is beyond its serviceable life.	It is recommended that the full extent of heating hot water piping be replaced, given its age. At minimum, the portions that are visibly in poorest condition should be replaced. Fittings and joints should also be checked to ensure leaks are not an issue.
	M38	Piping - Chilled Water	N/A	Unfinished Basement	N/A	N/A	30+	25	0	Poor	Y	Chilled water piping throughout is over 30 years old and is beyond its serviceable life. There are several piping portions exhibiting calcium build-up and rust.	It is recommended that the full extent of chilled water piping be replaced, given its age. At minimum, the portions that are visibly in poorest condition should be replaced. Fittings and joints should also be checked to ensure leaks are not an issue.
	M39	HVAC Piping Insulation	N/A	Unfinished Basement	N/A	N/A	30+	24	0	Poor	Y	Heating hot water and chilled water piping insulation is in poor condition throughout. Water damage can be observed on several sections of insulation. Additionally, several portions of HVAC piping are not insulated.	It is recommended that all HVAC insulation be replaced, given its age. At minimum, replace all visibly damaged portions of insulation. Ensure all insulation is of the same type and thickness. Provide insulation on currently bare piping, including fittings.

Table 6.2 Mechanical Condition Assessment and Deficiencies

Clara Barton House - Mechanical Condition Assessment and Deficiencies

Area / Level	ID	Equipment & Model / Serial No.	Serial No.	Room Location	Approximate Capacity	Manuf. Date	Age	ASHRAE Life Exp.	Remaining Life	Visible Condition	Photo (Y/N)	Deficiency	Recommendation
BASEMENT	P1	Electric Water Heater (Ruud PE52-2)	RU 029188486	Mech Room 003	4500 Watts / 50 Gallon	Feb. 1991	27	15	0	Fair	Y	The domestic water heater is well beyond its useful service life.	Replace the domestic heater with new unit similar in size/capacity.
[Refer to Dwg. MD00]	P2	Piping - Domestic Water (hot & cold)	N/A	Unfinished Basement	N/A	N/A	30+	25	0	Poor	Y	Domestic hot and cold water piping throughout is over 30 years old and is beyond its serviceable life. Most of this piping is uninsulated. Several portions of piping were observed with rust and/or calcium build-up.	It is recommended that the entire piping system be replaced, given its age. At minimum, potions of piping in the worst conditions should be replaced. Existing fittings and joints should also be checked to ensure leaks are not an issue.
	P3	Piping - Sanitary	N/A	Unfinished Basement	N/A	N/A	30+	25	0	Poor	Y	Sanitary piping throughout is over 30 years old and is beyond its serviceable life. Rust can be observed on several portions of piping.	It is recommended that sanitary piping be replaced, given its age. At minimum replace the portions of piping that are visibly rusty and/or damaged. Check that valves and fittings are in adequate condition and that no leaks occur in each system.
	P4	CHW Make-up water backflow preventer	N/A	Unfinished Basement	N/A	N/A	30+	20	0	Poor	Y	The backflow preventer valving assembly appears aged. The bottom plug is missing on one of the dual valves. Additionally, rust is exhibited on both the valve bodies and associated piping.	Replace backflow preventer valve assembly. If upgrading to a larger chiller, ensure new backflow preventer can accommodate new make-up water requirements.

Table 6.3 Mechanical Condition Assessment and Deficiencies

Clara Barton House - Mechanical Condition Assessment and Deficiencies

Area / Level	ID	Equipment & Model / Serial No.	Serial No.	Room Location	Approximate Capacity	Manuf. Date	Age	ASHRAE Life Exp.	Remaining Life	Visible Condition	Photo (Y/N)	Deficiency	Recommendation
BOILER SHED [Refer to Dwg. MD00]	M12	Smith Cast Iron Boiler (PGB300)	PGB300-8-I-080236	Boiler Shed	571 MBH	2008	10	25	15	Good	Y	Boiler appears in good condition	Routinely maintain unit to prolong its useful life.
	M13	Inline Pump (B&G RUK 56C17D5662E)	N/A	Boiler Shed	N/A	2009	9	10	1	Good	Y	Pump appears in good condition	Although ASHRAE indicated inline pumps usually last 10 years, recent data suggests these pumps can last 15-20 years if properly maintained.
	M14	Flexcon Expansion Tank (H2Pro XHT60)	SXHT6000516	Boiler Shed	33 gallons	January 2009	9	20	11	Good	Y	Expansion tank appears in good condition	Routinely maintain unit to prolong its useful life.
	M15	Ventilation Damper / Belimo TF-24 Actuator	N/A	Boiler Shed	N/A	January 2009	9	16	7	Good	Y	Damper and Actuator appear in good condition / good working order. Some rust is starting to develop on actuator and its mounting screws to the damper casing.	Ensure boiler shed doors are closed to protect equipment, including damper and actuator, from weather elements. Apply corrosion protectant to rusted areas.
	M16	Electronic Metering Pump (LE02S1)	9904100352	Boiler Shed	6 GPD	N/A	10 (estimated)	10	0	Poor	Y	The pump appears at the end of its useful life. It is very dirty and does not appear to be routinely maintained.	Replace metering pump with new unit of similar capacity.
	M16a	Watts 1156F pressure regulator	N/A	Boiler Shed	N/A	N/A	10 (estimated)	20	10	Good	N	N/A	N/A
	M17	Fisher Regulator (R622H-JGK)	N/A	Outside Boiler Shed	N/A	N/A	10 (estimated)	20	10	Fair	Y	Regulator appears in fair condition and midway its expected service life.	Regulator manufacturer recommends replacement of the unit every 20 years. Ensure maintenance per manufacturer's recommendations is performed on a regular basis.

Table 6.4 Mechanical Condition Assessment and Deficiencies

Clara Barton House - Mechanical Condition Assessment and Deficiencies

Area / Level	ID	Equipment & Model / Serial No.	Serial No.	Room Location	Approximate Capacity	Manuf. Date	Age	ASHRAE Life Exp.	Remaining Life	Visible Condition	Photo (Y/N)	Deficiency	Recommendation
1ST FLOOR [Refer to Dwg. MD01]	M18	Fan Coil Unit (Trane B12AL02)	S81F-11316	Office 106	CLG/HTG: 6.6 MBH / 21 MBH	June 1981	37	20	0	Poor	Y	The fan coil unit is well beyond its useful service life. Both the casing and associated piping show several amounts of rust throughout.	Replace unit with a new 4-pipe fan coil unit. Replace associated valving in kind.
	M19	Fan Coil Unit (Trane L12AL04)	S81F-11320	Visitor Orientation 113	CLG/HTG: 12.3 MBH / 32.2 MBH	June 1981	37	20	0	Poor	Y	The fan coil unit is well beyond its useful service life. Both the casing and associated piping show several amounts of rust throughout.	Replace unit with a new 4-pipe fan coil unit. Replace associated valving in kind.
	M20	Fan Coil Unit (Trane - model # unknown)	N/A	Office 107	CLG/HTG: 6.6 MBH / 21 MBH	June 1981 (?)	37	20	0	Poor	Y	The fan coil unit is well beyond its useful service life. Both the casing and associated piping show several amounts of rust throughout.	Replace unit with a new 4-pipe fan coil unit. Replace associated valving in kind.
	M21	Finned Tube Radiator	N/A	Collection Storage 105	4.1 MBH (6' x 690 BTU/FT)	1980's	30+	25	0	Poor	Y	The finned tube radiator is in poor condition, with some of the internal piping and fins exhibiting significant amounts of rust. The unit is beyond its useful service life.	Replace the finned tube radiator and associated valving in kind. Provide a high wall air conditioner to provide cooling to the space.
	M22	Radiator	N/A	Clara Barton's Kitchen 111	N/A	1980's	30+	25	0	Poor	Y	Although the finned tube radiator looks to be in fair condition, it looks aged and beyond its useful service life.	Replace the finned tube radiator and associated valving in kind. Provide a high wall air conditioner to provide cooling to the space.
	M23	Finned Tube Radiator	N/A	Office 112	4.5 MBH (6.5' x 690 BTU/FT)	1980's	30+	25	0	Poor	Y	The finned tube radiator is in poor condition, with some of the internal piping and fins exhibiting significant amounts of rust. The unit is beyond its useful service life.	Replace the finned tube radiator and associated valving in kind. Provide a high wall air conditioner to provide cooling to the space.
	M40	Finned Tube Radiator	N/A	Book/Gift Shop 116	11.4 MBH (16.5' x 690 BTU/FT)	1980's	30+	25	0	Poor	Y	Although the finned tube radiator looks to be in fair condition, it looks aged and beyond its useful service life.	Replace the finned tube radiator and associated valving in kind. Provide a high wall air conditioner to provide cooling to the space.
	M24	Heating HW and CHW Vertical Piping/Insulation	N/A	Office 112 / Rear Parlor 104	N/A	N/A	30+	25	0	Poor	Y	Visible water damage on insulation. There also appears to be some mold growth on the insulation jacketing.	Replace damaged insulation.
	M25	Stove Custom Heater (Pot Belly) (Modine)	N/A	Hall 102	N/A	N/A	30+	20	0	Poor	Y	Custom unit heater and associated thermostat are beyond their useful lives. Associated piping is old and has signs of rust. Additionally, this piping is not insulated.	The Hall 102 is a museum space that needs to be heated and cooled. It is recommended that the space be heated and cooled by a new modular air handler to be located in the unfinished basement. A duct mounted humidifier is recommended for additional humidity control. The custom heater will therefore be no longer needed and can be turned off permanently.
	M26	Stove Custom Heater (Modine)	N/A	Vest 101	N/A	N/A	30+	20	0	Poor	Y	Custom unit heater and associated thermostat are beyond their useful lives. Associated piping is old and has signs of rust. Additionally, this piping is not insulated. The custom hot water heater does not currently function due to an electrical problem.	Replace custom unit heater and provide a new up-to-date thermostat. Replace all associated valving/accessories in kind. Insulated associated heating hot water piping.
	M27	Stove Custom Heater	N/A	Center Red Cross Office 109	N/A	N/A	30+	20	0	Poor	Y	Custom unit heater and associated thermostat are beyond their useful lives. Associated piping is old and has signs of rust. Additionally, this piping is not insulated.	The Center Red Cross Office 109 is a museum space that needs to be heated and cooled. It is recommended that the space be heated and cooled by a new modular air handler to be located in the unfinished basement. A duct mounted humidifier is recommended for additional humidity control. The custom heater will therefore be no longer needed and can be turned off permanently.
	M41	Hot Water Unit Heater	N/A	Storage 115	22 MBH	June 2018	<1	20	19	Excellent	N	N/A	N/A
	M42	Hot Water Baseboard Unit	N/A	Front Parlor 103, Rear Parlor 104, Corner Red Cross Office 108, Dining Room 110	500-600 BTU/FT	June 2018	<1	20	19	Excellent	N	N/A	N/A
	P5	Piping Insulation - Sanitary	N/A	Clara Barton's Kitchen 111	N/A	N/A	30+	24	0	Poor	Y	Visible water damage on insulation and its jacketing.	Replace damaged insulation.

Table 6.5 Mechanical Condition Assessment and Deficiencies

Clara Barton House - Mechanical Condition Assessment and Deficiencies

Area / Level	ID	Equipment & Model / Serial No.	Serial No.	Room Location	Approximate Capacity	Manuf. Date	Age	ASHRAE Life Exp.	Remaining Life	Visible Condition	Photo (Y/N)	Deficiency	Recommendation
2ND FLOOR [Refer to Dwg. MD02]	M28	Fan Coil Unit (Trane B12AL04)	S81F-11318	Conference 203	CLG/HTG: 12.3 MBH / 32.2 MBH (estimated)	June 1981	37	20	0	Poor	Y	The fan coil unit is well beyond its useful service life. Both the casing and associated piping show several amounts of rust throughout.	Replace unit with a new 4-pipe fan coil unit. Replace associated valving in kind.
	M29	Honeywell Chronotherm (T882A)	N/A	Library 201	N/A	Circa 1970's	40+	16	0	Poor	Y	The thermostat is over 40 years old and is antiquated.	Replace with new thermostat and interlock with finned tube radiator operation.
	M30	Fan Coil Unit (Trane B12LA03)	S81F-11319	Office 212	CLG/HTG: 19 MBH / 26 MBH (estimated)	June 1981	37	20	0	Poor	Y	The fan coil unit is well beyond its useful service life. Both the casing and associated piping show several amounts of rust throughout.	Replace unit with a new 4-pipe fan coil unit. Replace associated valving in kind.
	M31	Finned Tube Radiator	N/A	CB Bathroom 210	5.2 MBH (7.5' x 690 BTU/FT)	1980's	30+	25	0	Poor	Y	The finned tube radiator is in poor condition, with some of the internal piping and fins exhibiting significant amounts of rust. The unit is beyond its useful service life.	Replace the finned tube radiator and associated valving in kind. Provide a high wall air conditioner to provide cooling to the space.
	M32	Finned Tube Radiator	N/A	Staff Kitchen 211	3.5 MBH (5' x 690 BTU/FT)	1980's	30+	25	0	Poor	Y	The finned tube radiator is in poor condition, with some of the internal piping and fins exhibiting significant amounts of rust. The unit is beyond its useful service life.	Replace the finned tube radiator and associated valving in kind. Provide a high wall air conditioner to provide cooling to the space.
	M33	Finned Tube Radiator	N/A	Office 213	6.2 MBH (9' x 690 BTU/FT)	1980's	30+	25	0	Poor	Y	The finned tube radiator is in poor condition, with some of the internal piping and fins exhibiting significant amounts of rust. The unit is beyond its useful service life.	Replace the finned tube radiator and associated valving in kind. Provide a high wall air conditioner to provide cooling to the space.
	M34	Finned Tube Radiator	N/A	Library Alcove 215	11.4 MBH (16.5' x 690 BTU/FT)	1980's	30+	25	0	Poor	Y	The finned tube radiator is in poor condition, with some of the internal piping and fins exhibiting significant amounts of rust. The unit is beyond its useful service life.	Replace the finned tube radiator and associated valving in kind. Provide a high wall air conditioner to provide cooling to the space.
	M35	Finned Tube Radiator	N/A	Library 201	17.3 MBH (25' x 690 BTU/FT)	1980's	30+	25	0	Poor	Y	Although the finned tube radiator looks to be in fair condition, it looks aged and beyond its useful service life.	Replace the finned tube radiator and associated valving in kind. Provide a high wall air conditioner to provide cooling to the space.
	M36	Hot Water Baseboard Unit	N/A	Storage 204	500-600 BTU/FT	June 2018	<1	20	19	Excellent	N	N/A	N/A
	M44	Hot Water Baseboard Unit	N/A	Large Guest Rm. 205, Small Guest Rm. 206, Clara Barton's Sitting Rm.. 208, Clara Barton's Bed Chamber 207, Dr. Hubbell's Bed Chamber 209, Library Alcove 215	500-600 BTU/FT	June 2018	<1	20	19	Excellent	N	N/A	N/A
	P6	Piping - Domestic Water (hot & cold)	N/A	Clara Barton's Bathroom 210	N/A	N/A	30+	25	0	Poor	Y	The domestic water piping serving CB Bathroom 210 is visibly rusty and in poor condition. Additionally, this piping material appears to be lead.	It is strongly recommended that all lead piping be removed and replaced with an alternate material such as copper.

Table 6.6 Mechanical Condition Assessment and Deficiencies

Clara Barton House - Mechanical Condition Assessment and Deficiencies

Area / Level	ID	Equipment & Model / Serial No.	Serial No.	Room Location	Approximate Capacity	Manuf. Date	Age	ASHRAE Life Exp.	Remaining Life	Visible Condition	Photo (Y/N)	Deficiency	Recommendation
3RD FLOOR [Refer to Dwg. MD03]	M44	Hot Water Baseboard Unit	N/A	South Storeroom 303	500-600 BTU/FT	June 2018	<1	20	19	Excellent	N	N/A	N/A
	M46	Hot Water Baseboard Unit	N/A	North Storeroom 301	500-600 BTU/FT	June 2018	<1	20	19	Excellent	N	N/A	N/A
	P7	Metal Downspouts	N/A	Roof (3rd level)	N/A	N/A	N/A	30	N/A	Fair	Y	Paint is peeling off of the metal. There may be some rust developing	Replace gutter if metal is damaged. Provide new coat of weather resistant paint.

Table 6.7 Electrical Deficiencies

ELECTRICAL DEFICIENCIES SCHEDULE		
ID	DESCRIPTION	LOCATION
E1	THE ELECTRICAL SERVICE CAPACITY IS INSUFFICIENT FOR SIGNIFICANT RENOVATIONS.	BASEMENT
E2	SERVICE ENTRANCE CABLE IS EXPOSED FROM THE ENTRY POINT TO THE SERVICE DISCONNECT AND SUBJECT TO PHYSICAL DAMAGE.	
E3	THE SERVICE ENTRANCE CONDUCTORS AMPACITY IS LOWER THAN THE OVERCURRENT DEVICES AT THE SERVICE EQUIPMENT.	
E4	NO SURGE PROTECTION DEVICES.	
E5	INSUFFICIENT GROUNDING.	
E6	DEVICE NOT SECURELY MOUNTED AND EXPOSED MC CABLING WIRING SYSTEM.	VARIOUS LOCATIONS
E7	OBSOLETE KNOB-AND-TUBE WIRING	THIRD FLOOR
E8	TELEPHONE SERVICE ENTRANCE CABLE IS EXPOSED AND UNPROTECTED.	BASEMENT
E9	TELEPHONE SERVICE ENTRANCE PRIMARY PROTECTION IS OBSOLETE AND INADEQUATE.	BASEMENT
E10	ADA COMPLIANCE VIOLATION- DEVICE MOUNTED TOO HIGH OR TOO LOW. MOST ELECTRICAL RECEPTICALS ALSO HAVE EXPOSED SURFACE MOUNTED MC CABLING SYSTEMS.	VARIOUS LOCATIONS
E11	RECEPTACLE LOCATED ABOVE BASEBOARD HEATER.	VARIOUS LOCATIONS
E12	EMERGENCY LIGHTING AND EXIT SIGNAGE DEFICIENCIES	VARIOUS LOCATIONS
E13	NEC CODE COMPLIANCE ISSUE- NON-GFCI RECEPTACLE LOCATED IN UNFINISHED BASEMENT.	VARIOUS LOCATIONS

Table 6.8 Window and Door Deficiencies

	SOUTH FAÇADE											
	Flaking Paint	Deteriorated Sill / Threshold	Deteriorated Frame	Missing Sealant	Deteriorated Mullion	Broken Glass Panes (ref. elevations)	Glazing Compound missing	Double Hung Sash Cord broken	Weather stripping Interfers with operation	Air infiltration	Water ingress	Inoperable
W0.1	X	X		X							X	X
W0.2	X			X			X			X	X	X
W0.3	X			X		X	X				X	X
W0.4	X		X	X			X				X	X
W0.5	X						X				X	X
W0.6	X						X				X	X
W1.1	X											
W1.2	X											
W1.3	X					X				X		
W1.4	X			X		X				X		
W1.5	X			X						X		
W1.6	X			X		X				X		
W1.7	X					X						
W1.8	X					X						
W1.9	X	X	X	X			X					
W1.11	X			X		X						
W2.1	X											
W2.2	X					X						
W2.3	X					X		X				
W2.4	X					X		X				
W2.5	X											
W2.6	X											
W2.7	X					X						
W2.8	X							X				
W2.10	X		X									
W3.1	X					X	X					
W3.2	X					X	X					
W3.3	X		X			X	X					
W3.4	X					X	X					
W3.5	X					X	X					
D0.1	X	X	X	X							X	
D0.2	X	X	X	X							X	

	WEST FAÇADE											
	Flaking Paint	Deteriorated Sill / Threshold	Deteriorated Frame	Missing Sealant	Deteriorated Mullion	Broken Glass Panes (ref. elevations)	Glazing Compound missing	Double Hung Sash Cord broken	Weather stripping Interfers with operation	Air infiltration	Water ingress	Inoperable
W0.7	X						X					
W0.8	X					X	X			X		
W0.9	X						X					
W0.10	X					X	X					X
W0.11	X											X
W1.10	X											
W1.12	X					X	X					
W1.14	X			X			X					
W2.9	X						X	X				
W2.11	X											
W2.13	X			X			X				X	
W3.6	X					X	X					
D0.3	X											
D3.2	X											X

	NORTH FAÇADE											
	Flaking Paint	Deteriorated Sill / Threshold	Deteriorated Frame	Missing Sealant	Deteriorated Mullion	Broken Glass Panes (ref. elevations)	Glazing Compound missing	Double Hung Sash Cord broken	Weather stripping Interfers with operation	Air infiltration	Water ingress	Inoperable
W0.12	X			X		X	X				X	X
W0.13	X					X						X
W0.14	X			X								X
W0.15				X								X
W0.16				X								X
W0.17						X						X
W1.13	X	X										
W1.15	X											
W1.16	X						X					
W1.17	X			X			X				X	
W1.18	X						X					
W1.19	X									X		
W1.20	X						X					
W1.21	X			X			X				X	
W1.22	X											
W2.12	X		X									
W2.14	X											
W2.15	X											
W2.16	X					X	X					
W2.17	X						X					
W2.18	X					X	X					
W2.19	X						X					
W2.20	X						X					
W2.21	X					X	X					
W3.7	X					X	X					
W3.8	X					X	X					
W3.9	X		X			X	X					
W3.10	X					X	X					
W3.11	X					X	X					
D0.4	X	X	X	X							X	
D0.5	X	X	X	X							X	

	EAST FAÇADE											
	Flaking Paint	Deteriorated Sill / Threshold	Deteriorated Frame	Missing Sealant	Deteriorated Mullion	Broken Glass Panes (ref. elevations)	Glazing Compound missing	Double Hung Sash Cord broken	Weather stripping Interfers with operation	Air infiltration	Water ingress	Inoperable
W1.23	X			X			X				X	
W1.24	X			X			X				X	
W1.25	X					X						
W1.26	X			X		X	X				X	
W1.27	X			X			X					
W1.28	X			X			X					
W2.22	X						X					
W2.23	X						X					
W2.24	X					X	X					
W2.25	X						X					
W2.26	X						X					
W2.27	X					X	X					
W2.28	X						X					
W3.12	X			X								
W2.13	X					X				X		
W3.14	X			X			X					
D1.1	X	X										
D2.1	X	X								X	X	
D3.2	X	X								X	X	

6.2 Topographic Survey

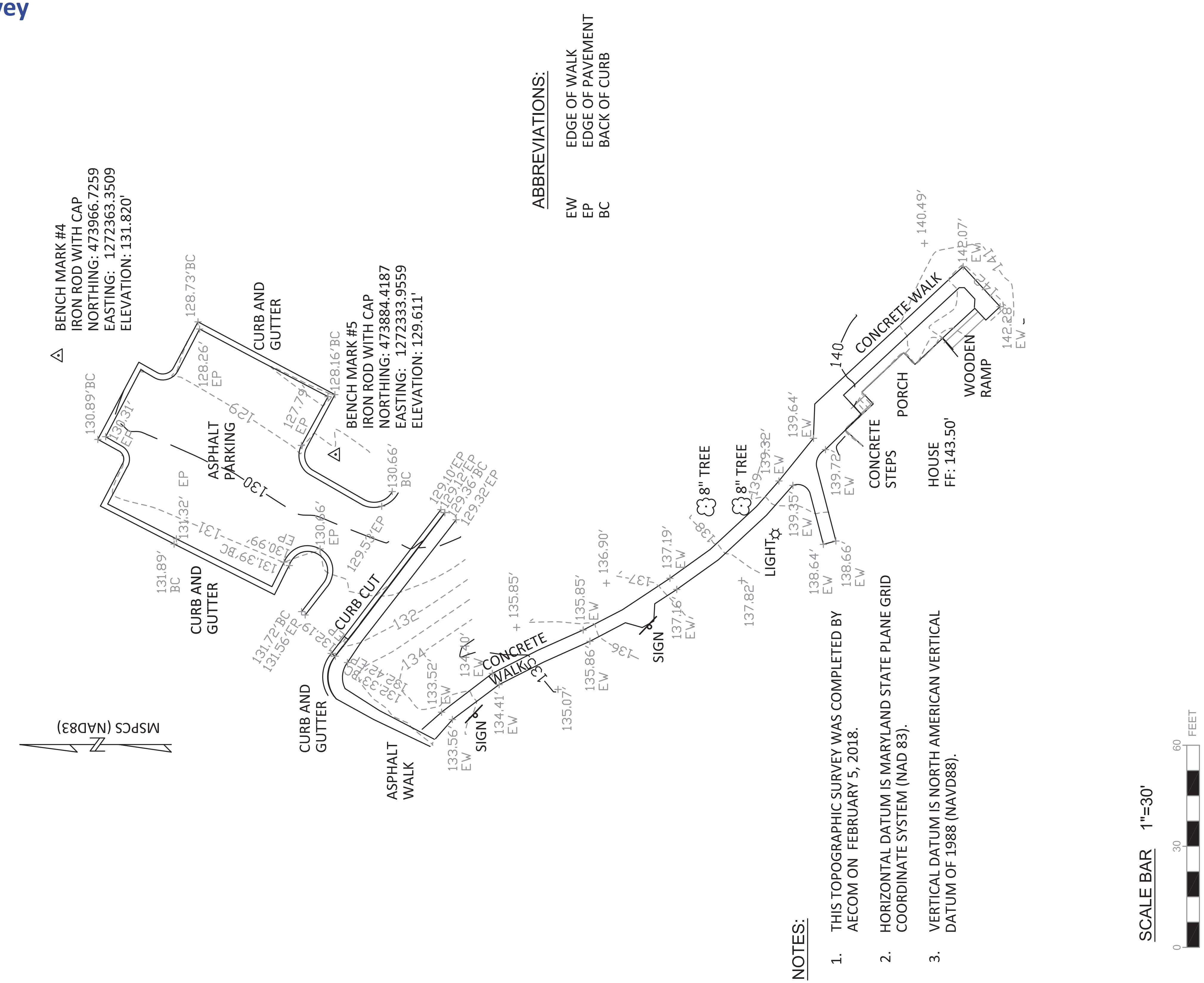

Figure 6.1 Topographic Survey

6.3 Diagrams

Figure 6.2 Enlarged Water Damage Diagram

AECOM